OPTIMIZATION OF IMPLEMENTATION PROCEDURES FOR RES ELECTRICITY GENERATION INFRASTRUCTURE PROJECTS IN THE BALTIC STATES, NO. EM 2021/19

Analysis of the implementation processes of RES electricity generation infrastructure projects in Finland, Norway and Sweden

2021

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***Analysis of the implementation processes of RES electricity generation infrastructure projects in Finland, Norway and Sweden*, 2021, 138 p.**

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TABLE OF CONTENTS

INTRODUCTION

Environmental benefits of renewables include less pollution, socio-economic benefits, and increased credibility for renewable energy as ideas are implemented locally and create new work opportunities. Renewable energy, new technological innovations and efficient energy use are the way to meet climate targets set in Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (European Parliament and the European Council, 2018).

Fig.A shows the data about solar power in Finland, Sweden and Norway. Sweden has the fastest growth of solar power, leaving Finland and Norway behind.

At the end of 2019, Finland could only meet 0.2% of its energy demand with solar power. Still, with the growth of solar power worldwide, it is projected that in 2035 Finland's total solar power capacity could reach 20TWh and cover 25% of its total energy demand (Tampere Universities magazine, 2020). Sweden's solar power is growing; it is expected to grow from 400 GWh in 2018 to 1.7 TWh by 2022 (PV magazine, 2020). In 2020, approximately 40 MW of new solar power was installed in Norway, equivalent to 350 solar panels installed every day 2020 (Energifakta Norge, n.d.-a).

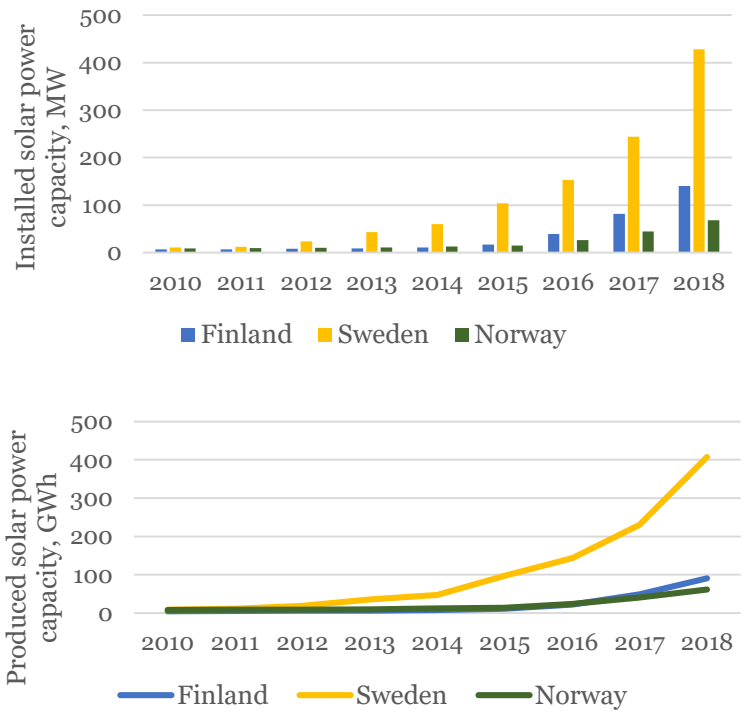

Fig.A Installed solar power capacity and produced solar power from 2010 to 2018 (IRENA, n.d.-a)

Fig.B shows data about wind energy in Finland, Sweden, and Norway. There has been an increase in wind power in all the three countries, but the fastest growth can be seen in Sweden; Finland has also increased wind power, but the growth is not as fast, while Norway's growth in power capacities during the period of 2010-2018 can be viewed as minimal compared to Sweden and Finland.

The amount of power generated by wind power is increasing, and it can be seen by looking at the installed wind power capacity and the produced extent of electricity. Finland had 821 wind turbines installed by the end of 2020, of which 67 turbines with a total capacity of 302 MW were established in 2020. Wind power accounted for 10% of Finland's electricity consumption and 12% of entire electricity generation in 2020 (Suomen Tuulivoimayhdistys, n.d.). Sweden has more than 4,000 wind turbines installed, and the amount of electricity generated by wind power has increased rapidly in recent years from 0.5 TWh in 2000 to 27.6 TWh in 2020. (Sweden.se, n.d.). At the beginning of 2021, Norway had 53 wind farms, with more than 610 wind turbines, with an installed capacity of 3 977 MW. In 2020 6.4% of total electricity production was from wind power (Energifakta Norge, n.d.-b).

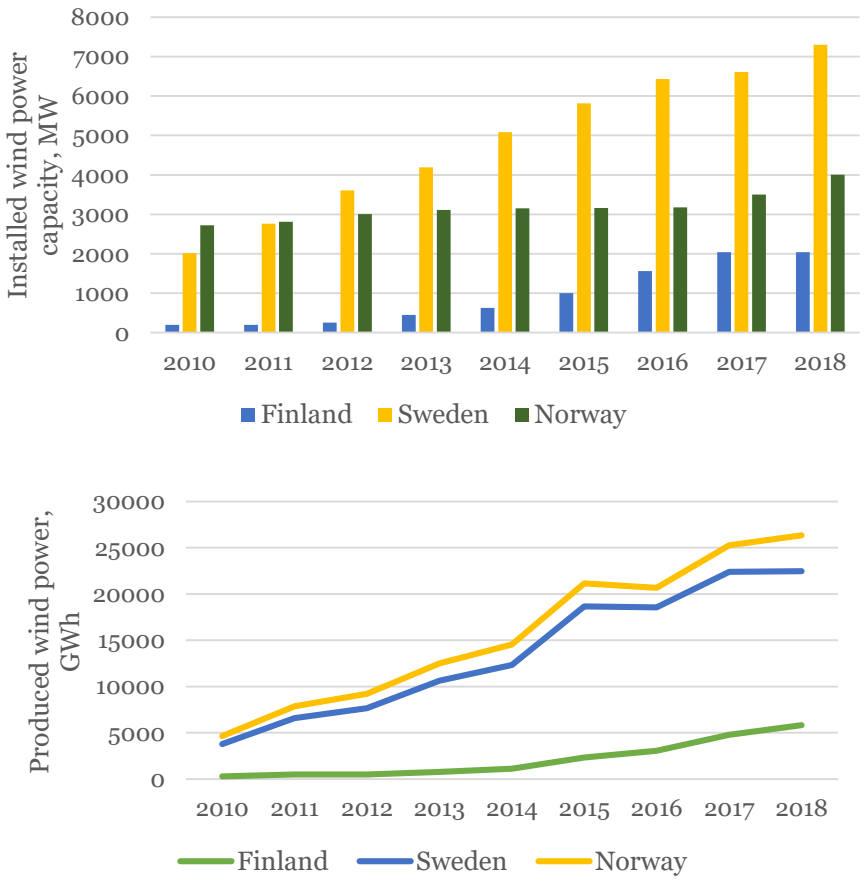

Fig.B Installed wind power capacity and electricity generated 2010-2018 (IRENA, n.d.-b)

1. FINLAND

Finland's electricity mix consists of several energy sources and does not have a single leader in providing electricity (IEA, n.d.-a). In 2020, 67.46 TWh of electricity was generated in Finland (Our World in Data, n.d.-a). The most significant share of electricity was generated at nuclear power plants, 23.23 TWh or 34.44% of the total electricity produced (Our World in Data, n.d.-b). This is followed by hydropower plants, which had 15.19 TWh of electricity or 22.52% of the total amount (Our World in Data, n.d.-b). The third place is occupied by other renewable technologies, such as biofuels, wave energy, etc. (IEA, n.d.-b). The development of wind energy has grown rapidly in Finland since 2013, producing 7.67 TWh of electricity or 11.37% of the total energy in 2020 (Our World in Data, n.d.-b). In 2020, solar energy produced 0.09 TWh or 0.13% of the total amount of energy produced in the country (Our World in Data, n.d.-b).

Finland financially supports energy generation development from renewable energy sources through various mechanisms. For example, in 2013, the Finnish Government introduced a training and certification programme to train people to install renewable energy technologies (Wikberg, 2019a). In the construction sector, Finland adopted legislation in 2015 to regulate energy efficiency requirements for new buildings. The state supports research and development in energy generated from renewable sources through various grants and investment subsidies (Wikberg, 2019b).

Production equipment with a maximum capacity of **2 MVA** is considered Small-scale electricity production. It is more common with technologies that use solar energy, wind power and hydropower to generate electricity (The VSV Group, n.d.). Currently, the fastest growth in terms of installed equipment and capacity is in solar PV microgeneration. Microgeneration refers to electricity generation equipment connected to a place of electricity use, the primary purpose of generating electricity for self-consumption. The power limit of a micro-production plant is generally considered **100 kVA**. Typically, the equipment's power is from a few kilowatts to a few tens of kilowatts (The VSV Group, n.d.).

Anyone has the right to become a producer of electricity. The task of the network operator is to provide a reliable network and guarantee operation security of electricity distribution to all network users (The VSV Group, n.d.). Electricity generated and not used for self-consumption can be transferred to the electricity seller of the customer's choice.

Developers planning to connect a power production plant to the electricity grid must check the obligations and instructions from the local network company regarding the

connection of the production plant to the grid. The electrical network connection and electrical properties of production facilities must meet the requirements of electrical safety and electromagnetic compatibility standards (Eduskunta, n.d.). Equipment by the standards ensures no risk to life for installers working in the electricity network. The network voltage quality remains good enough for the producer and the neighbours (Eduskunta, n.d.). **A certified electrician may only carry out installation work on the production plant.**

Before connecting a power plant to the electricity grid, the producer must agree with the network company for the connection process and the use of the power plant to generate electricity. The **producer must also verify with the municipal building control authority whether the plant's location on the site requires a building or operating permit**. Construction and use of the environment or public areas require a permit from the municipal authority; in Finland, the electronic system Lupapiste communicate and obtain the necessary permits, thus speeding up the permitting process (*Lupapiste*, n.d.).

Before starting their economic activity in Finland, entities must obtain a permit to carry out certain activities related to their economic activity. One of the possible permits needed is Environmental permits to carry out activities that may lead to air pollution, water contamination,r soil contamination(Finnish Environment Institute, 2020). A water permit must be obtained for construction-related activities in the water or water supply(Finnish Environment Institute, 2020). Exceptionally, the construction of certain structures and changes in land use may also require planning permission (Finnish Environment Institute, 2020). Permits may be granted to individuals or legal entities. Advice on permit application procedures is available from 13 Centres for Economic Development, Transport and the Environment, the four Regional State Administrative Agencies, local environmental authorities or the Finnish Environment Institute SYKE (Finnish Environment Institute, 2020).

A one-stop digital service solution for managing the built environment Lupapiste was developed with the Ministry of the Environment and Finnish municipalities in the early 2010s (Cloudpermit, 2020). This service is implemented, and it allows municipalities to act according to the reform of the Land Use and Building Act. This service is scaled for the individual needs of municipalities, developers and others in the permitting procedure involved parties (Cloudpermit, 2020; *Lupapiste*, n.d.). Lupapiste is a tool for municipal building inspection, citizens, architects and other experts and operators of the building sector

(Cloudpermit, 2020; *Lupapiste*, n.d.). Service is available to all users and makes the permitting process efficient, saving considerable time and resources and making the permitting process more transparent (Cloudpermit, 2020; *Lupapiste*, n.d.). The service can be implemented in any Finnish municipality. 60% of Finnish municipalities can be reached through this service (*Lupapiste*, n.d.).

Lupapiste includes services and information management for building inspections, public areas and services for environmental authorities (Cloudpermit, 2020; *Lupapiste*, n.d.). Through the permit point, it is possible to apply for permits for any construction works and handle the related authority transactions electronically (City of Helsinki, 2019). Electronic application is an interactive workspace for all parties involved in the project - project information can be supplemented in any order, and a discussion with authority can occur through a project-specific discussion window (City of Helsinki, 2019). Information written on the application is saved automatically and can be modified until the authority submits the application or processing (City of Helsinki, 2019; *Lupapiste*, n.d.). Once a decision has been made on the application, the service electronically notifies all the parties involved in the project (City of Helsinki, 2019; Lupapiste, n.d.).

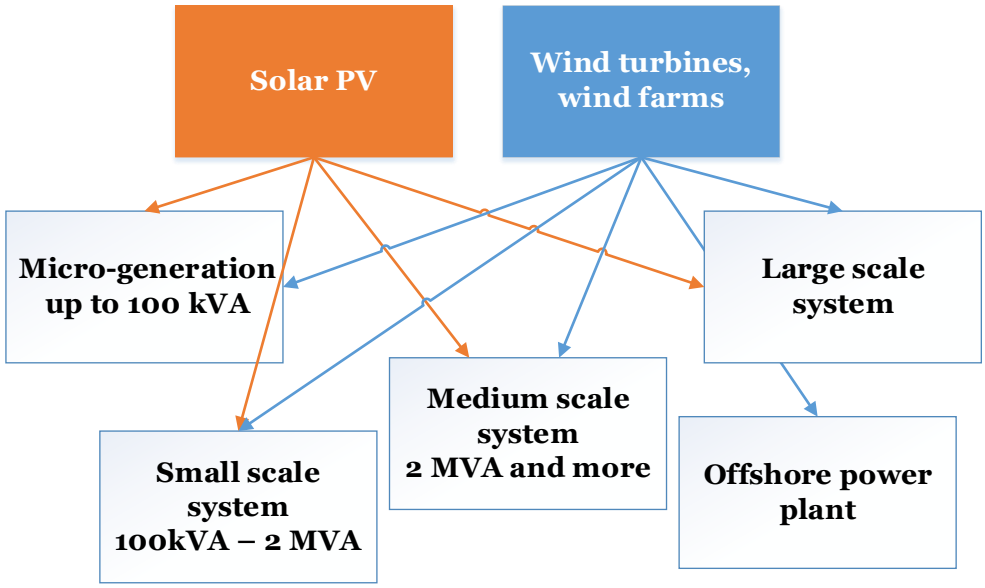

Fig.1.1. Distribution of solar PV and wind turbines, wind farms by installed capacity in Finland

Section 1.1. and Section 1.2. describe the general implementation process for Sweden's solar and wind power plants. While starting from Section 1.3, an in-depth legislation analysis

has been performed. The following sections briefly describe the main steps the solar PV or wind power plant project developer should undergo to implement the project.

1.1. Main steps for wind power plant implementation

A total of 754 wind turbines were in operation in 2019, generating 2,284 MW of power in Finland and wind power accounted for 7% of Finland's total electricity consumption in 2019 (Finnish Wind Power Association, n.d.-b). Currently, the giant wind turbines in Finland have a capacity of 5 MW, but by the year 2030, wind turbines are expected to have a capacity of more than 7 MW. Plans (by 2030) also include increasing the output of existing wind turbines to 30 TWh (Finnish Wind Power Association, n.d.-b).

Over the recent years, the Finnish Government has taken active measures to promote the development of wind parks by simplifying the administrative permit system for wind power projects (Bergmann, 2018). Permitting prerequisites were amended to permit building permits for wind parks even if the relevant spatial plan has not gained legal force due to pending appeals (Bergmann, 2018). **Municipalities can facilitate the development of wind power plants by adopting a wind power directing local master plan**. Most of the required environmental assessments have already been carried out (Bergmann, 2018). Environmental permit conditions were clarified by a Finnish Governmental Decree that sets down noise limits specifically for wind parks. In 2014, a new Environmental Protection Act was enacted, including several measures targeted at expedited and smoother environmental permit processing (Bergmann, 2018). **One of the biggest practical challenges in wind park development is no centralised permitting procedure. Developers have to go through many different permitting procedures that are subject to various preconditions and deadlines and result in several distinct appeal proceedings** (Bergmann, 2018).

The municipal building control authority decides whether an application for a building permit for a wind power plant is needed; the conditions for granting access are specified in the Land Use and Construction Act (Anni Mikkonen, 2019). For self-consumption, the limit is up to 2 MW for wind turbines. Wind turbines over this capacity are considered **industrial-sized** (Anni Mikkonen, 2019). If the generated electricity is to be fed into the grid, a grid inverter must be installed to be connected to the grid. However, a permit from the distribution system operator is required and must be installed and tested by a certified electrician (Kodin vihreä energia, 2011b). The distribution system operator must be consulted on the technical

specifications of the inventory and the best fit with the grid infrastructure before purchasing inventory for network connection (Kodin vihreä energia, 2011b).

The development of a wind power project usually takes **at least two years** (Fingrid, 2015). After that, it is to be decided whether a wind farm can be constructed at the site in question and whether or not the project is viable. **A wind farm refers to a project containing more than ten turbines** (Fingrid, 2015). Projects of this size require an EIA procedure under the legislation. Smaller projects generally do not need an EIA. Still, the permitting process for wind farm construction is similar (Fingrid, 2015).

➔Firstly, there is a **preliminary study of the general conditions** to build a wind farm. The location must be windy, and the land must be suitable for installing wind turbines (Fingrid, 2015). The impact on people, the environment, and other land uses must be considered (Fingrid, 2015). If necessary, it must be possible to build roads at a reasonable expense, and then there is the question of connectivity. There should be a suitable nearby connection point to Fingrid's grid or a regional or distribution network (Fingrid, 2015).

➔ After an initial study, it is decided whether it is economically viable and feasible to build the wind farm. If it is determined in favour of construction, the next step for a wind farm project with more than ten turbines is **the EIA procedure** (Fingrid, 2015).

➔ This measure overlaps with the plot's zoning and **compliance with the municipal spatial plans** (Fingrid, 2015). At the same time, wind conditions are measured, and technical analyses are carried out.

➔ If, after these procedures, the project is given the green light, actual construction work can commence. It is impossible to predict in advance which of the many wind power plant planned projects will be approved and implemented (Fingrid, 2015). Some projects are never completed, and the scope of many projects is reduced during the planning and approval process. **The planning of connections to the transmission network operator Fingrid** is based on equity. Despite this, more advanced projects and more likely to be realised will be agreed upon first, and the network will be constructed (Fingrid, 2015).

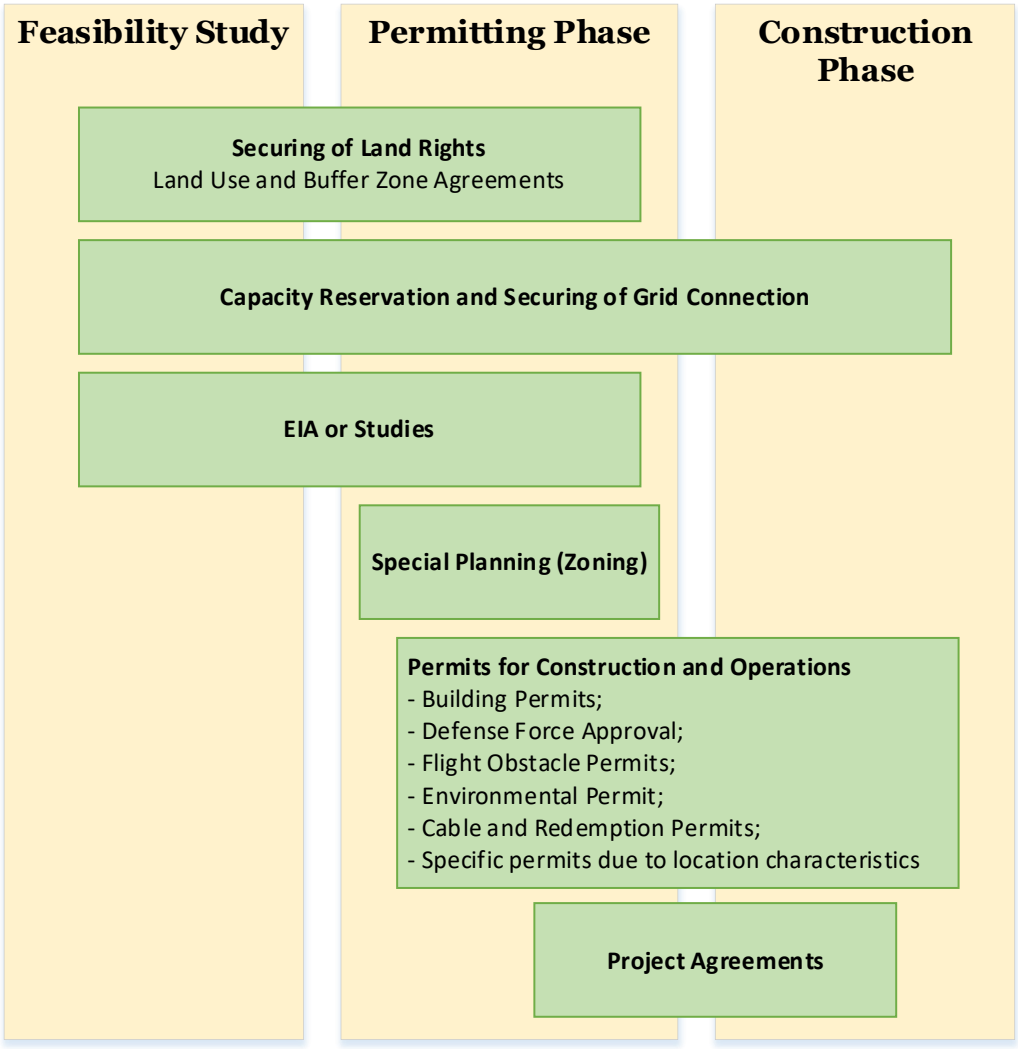

Fig.1.2. Steps to be taken for developing a wind power plant (Bergmann, 2018)

An electricity producer must notify the Finnish Energy Agency before putting a wind power plant into commercial operation. The Energy Agency then decides on the instalments and payment schedule of a wind power fee based on a notification made by the electricity producer (Energy Agency, n.d.-b). The purpose of wind power compensation is to enable the construction of wind power plants in wind power compensation areas so that Finnish regional control and military aviation are not disturbed (Energy Agency, n.d.-b). However, an electricity producer who operates a wind farm in the Bay of Bothnia is obliged to pay a wind power fee (the so-called radar compensation fee) (Energy Agency, n.d.-b).

Steps to develop a wind park project and an overall procedure are shown in Figure 1.2. and 1.3.

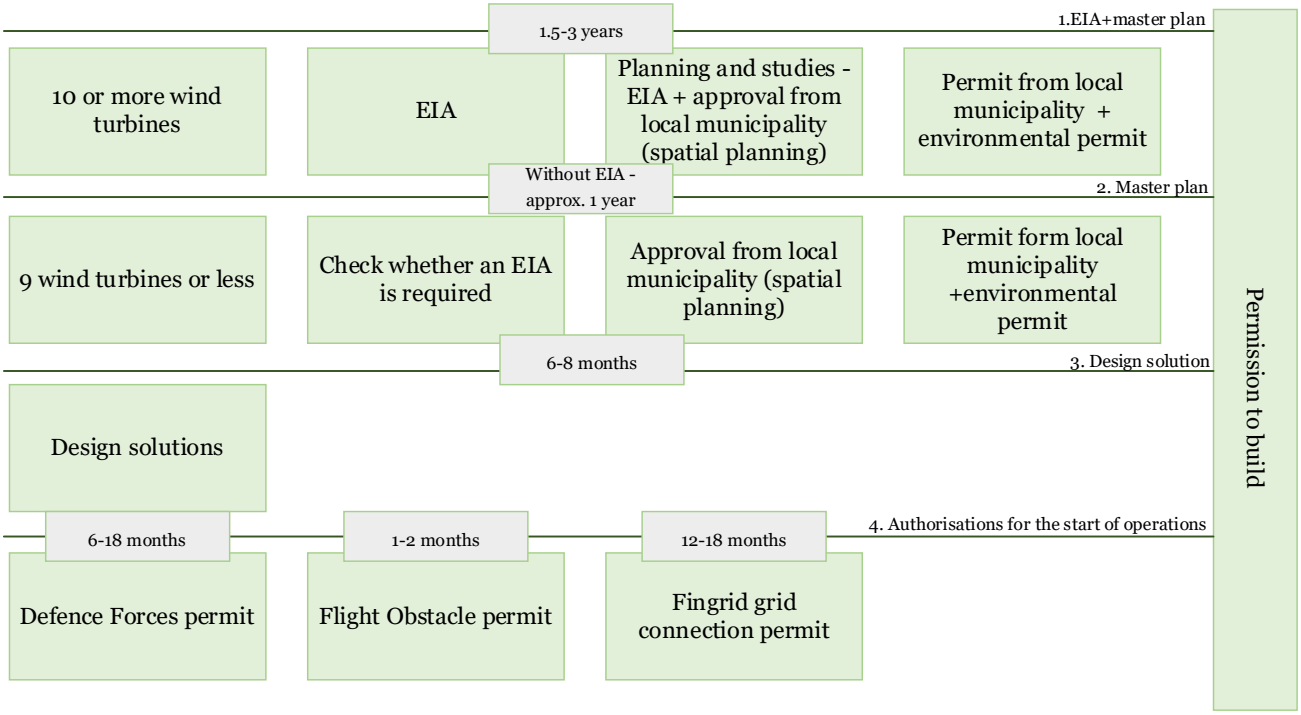

Fig.1.3. The overall process for wind farm project development in Finland (Suomen Tuulivoimayhdistys, 2019)

1.2. Main steps for solar power system implementation

In Finland, subsidies are eligible for a 50% refund if solar panels are installed for a household's consumption. For households for solar PV installations, permits or licenses are usually not required. However, before making a purchase, the municipal Construction Board should be asked for the opinion, whether a permit is needed or not (Suomen Aurinkoratkaisut Oy, n.d.-a). Suppose the produced electricity is transferred to the grid. In that case, solar PV installation and the capacity installed must be reported and an agreement signed with the local electricity distribution system operator. A certified electrician must do the connection process(Suomen Aurinkoratkaisut Oy, n.d.-b).

Permitting procedures for installing solar panels may vary depending on the type and location of the building in which the equipment is to be installed (*Permit Matters - Motiva*, n.d.). After the Land Use and Building Act amendment, only installing or constructing solar panel or collector that significantly impacts the urban landscape or the environment requires a building permit (*Permit Matters - Motiva*, n.d.). Exceptions include installations on buildings recognised as cultural heritage and large systems with a higher capacity (*Permit Matters - Motiva*, n.d.). Even on protected buildings or areas, solar PV installations are not

explicitly banned but are considered case-by-case basis. It is, therefore, possible that installation of a solar PV plant (*Permit Matters - Motiva*, n.d.):

- is wholly prohibited (the building is declared as cultural heritage);
- requires a building permit or the approval of an urban landscape architect;
- requires a notification to the local building authority;
- the local building authority involves nothing.

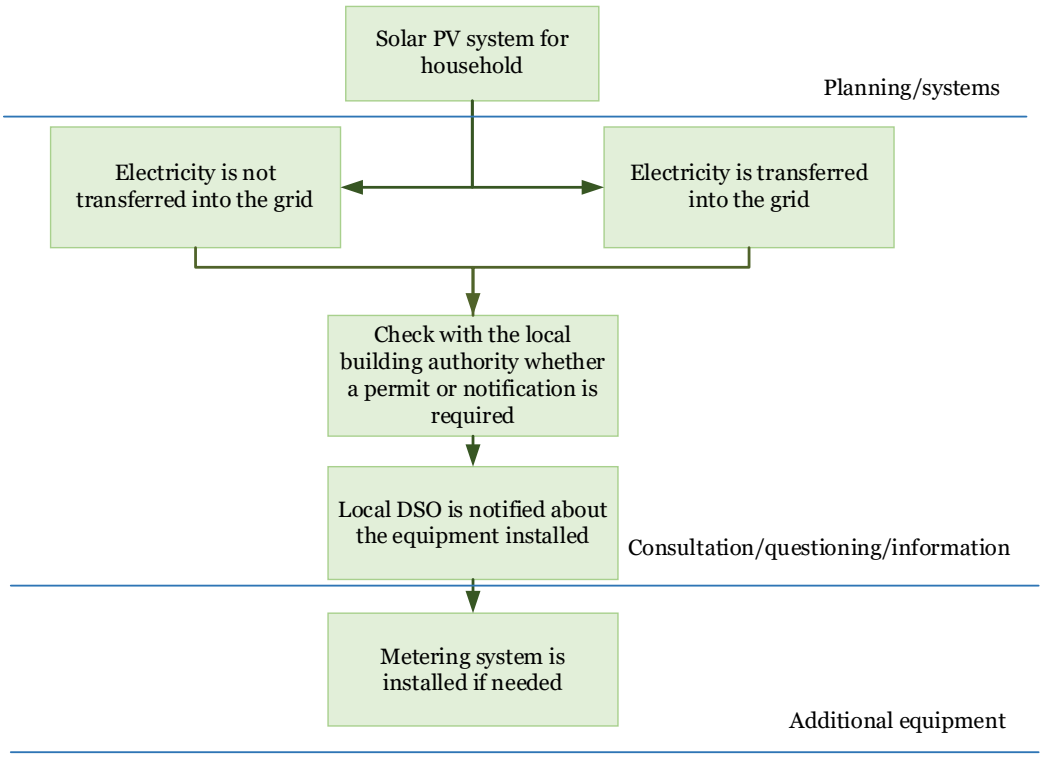

Fig.1.4. Steps for installing a solar PV system in a household

1.3. Territorial planning

The Ministry of the Environment shall organise monitoring of the state and development of land use and the built environment and maintain the necessary databases (*Land Use and Building Act 5.2.1999/ 132*, 1999). **The Regional Environmental Centre** promotes and manages the organisation of monitoring the state and development of land use and the built environment in its territory and helps organise the necessary monitoring (*Land Use and Building Act 5.2.1999/ 132*, 1999). Within their territories, **Regional Councils and local municipalities** shall see to the monitoring of the state and development of land use, the regional and community structure, the built environment and the cultural and natural

environment as required for regional planning and building (*Land Use and Building Act 5.2.1999/ 132*, 1999). The role of the **local building control authority** is to monitor compliance with plans, review permits for construction and other activities, and monitor the maintenance of the built environment and buildings as required by Law (*Land Use and Building Act 5.2.1999/ 132*, 1999).

Proposed building permits shall be made publicly available in the municipality for at least 30 days (*Land Use and Building Act 5.2.1999/ 132*, 1999). Community members and other interested parties have the right to submit objections to the proposed building permit (*Land Use and Building Act 5.2.1999/ 132*, 1999). Complaints shall be submitted to the local building control authority within the period of authorisation of the permit (*Land Use and Building Act 5.2.1999/ 132*, 1999). **The Regional Environmental Centre**, the **Regional Council and the local municipality** whose land use and development would be affected by the development consent are asked for their opinion on the proposed consent (*Land Use and Building Act 5.2.1999/ 132*, 1999).

The regional spatial plan defines how land is used in the region. T**he Local Master Plan lays down the land use objectives in the municipality** (Ministry of the Environment, n.d.-a). The local master plan sets out the overall development of the municipality and the use of the land area it covers, such as the location of residential areas, industrial zones and traffic routes (Ministry of the Environment, n.d.-a). It is possible to prepare a partial master plan for such areas as the coast or a beach, which may be more detailed than a local master plan (Ministry of the Environment, n.d.-a).

Each municipality is responsible for preparing a local master plan. The municipal council approves this plan. The Land Use and Building Act lays down content requirements for the local master plan, and it **is used as the basis for the preparation of local detailed plans** (Ministry of the Environment, n.d.-a). The local detailed development plan is the most complex of all land-use plans, guiding land use and development according to local conditions, urban and landscape requirements, good building practice and other agreed objectives (Ministry of the Environment, n.d.-a). The local detailed plan determines the organisation of land use and development in the municipality. It determines the future use of the area it covers: what will be preserved and what, where, and how can be built (Ministry of the Environment, n.d.-a). For example, it determines the location, size and purpose of buildings.

Municipalities can prepare a land policy programme to outline the principles of land use, land acquisition and the implementation of land use plans. Building permits are

monitored to comply with the spatial plan, which lays down rules and guidelines appropriate for local conditions (Ministry of the Environment, n.d.-a).

The Land Use and Building Act (Article 62a) provide that the **project implementation plan and the environmental impact assessment procedure may be carried out simultaneously, and the necessary consultations may be coordinated by Article 22 of the Environmental Impact Assessment Procedure Act** (*Land Use and Building Act 5.2.1999/ 132*, 1999).

The Land Use and Building Act (Chapter 10a, Article 77a) state that a building permit for a wind power plant may be issued if a legally binding master plan stipulates explicitly that the plan or part thereof is the basis for the building permit (*Land Use and Building Act 5.2.1999/ 132*, 1999). When drawing up a master plan that includes areas for the construction of wind farms, in addition to the other provisions of the master plan, it should be ensured that (*Land Use and Building Act 5.2.1999/ 132*, 1999):

1) the master plan sufficiently defines the pattern of development, and other land uses in the area;
2) the proposed wind energy development and other land uses are compatible with the landscape and the environment;
3) it is possible to organise the maintenance of the wind turbines and electricity transmission.

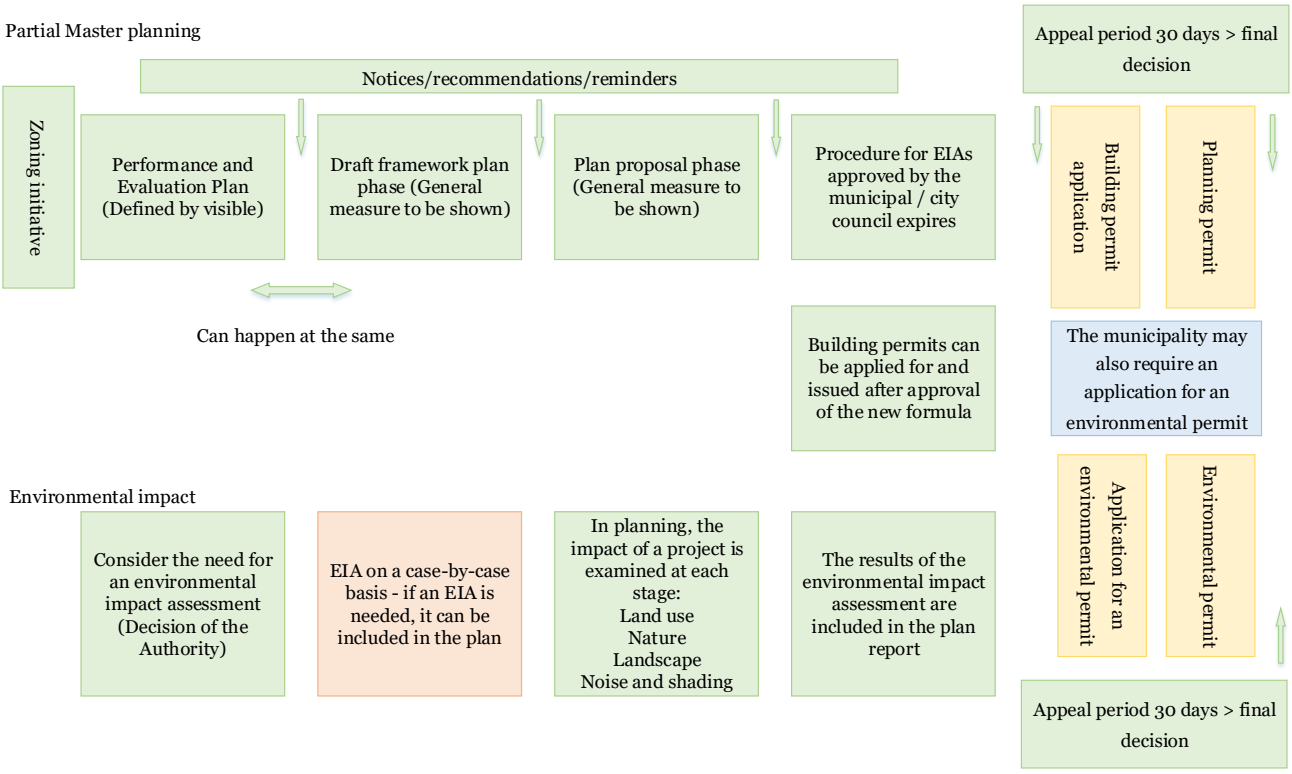

Fig.1.5. Master plan (about a year) (Suomen Tuulivoimayhdistys, 2019)

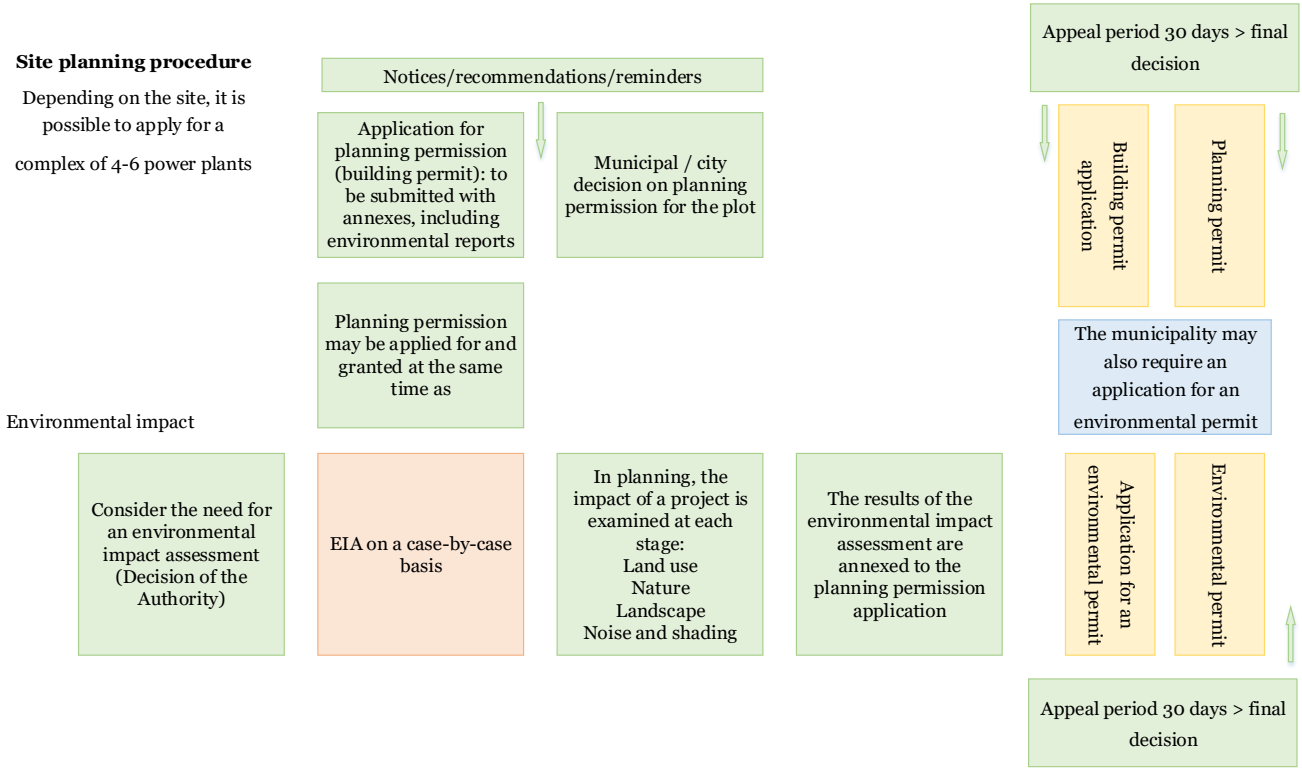

Fig.1.6. Parcel planning solution (6-8 months) (Suomen Tuulivoimayhdistys, 2019)

1.3.1. Permits related to land use and building

In Finland, construction and land development are controlled by the Land Use and Building Act, and more specific restrictive measures may be laid down in regulatory documents. The Finnish National Building Code contains comprehensive technical standards and guidelines (Ministry of the Environment, 2013a). Municipal building codes, subordinate to higher national legislation, have more specific provisions on local conditions.

Construction and land-use changes are controlled through official plans defined at various levels, including regional land use plans, local master plans and local detailed plans (Ministry of the Environment, 2013a). **All construction-related projects require building permits or operating permits** (Ministry of the Environment, 2013a). In some cases, it may be necessary to revise existing plans or decide on applications for special planning permission. New plans need to be made where land-use changes will entail the construction of new infrastructures such as roads or new arrangements for other areas (Ministry of the Environment, 2013a). The environmental impact of some construction developments may need to be formally assessed.

Local authorities can also designate specific areas to be covered by new plans. Where new spatial plans are to be drawn up, or existing plans are amended, more detailed requirements are often attached to planning permissions. Applications are dealt with more extensively than usual (Ministry of the Environment, 2013a). Decisions on building permits for areas to be covered by new plans are made in two phases - permit granting authority initially assesses whether the conditions are suitable for the development and can then decide whether to grant a specific building permit (Ministry of the Environment, 2013a).

Suppose a development is proposed and does not conform with current land use plans or other regulations or limitations defined under the Land Use and Building Act. In that case, special planning permission should be granted before an application for a building permit may be considered (Ministry of the Environment, 2013a). Exceptionally, planning permission cannot be given for development which would impede future planning, the implementation of existing plans, other designated land uses or conservation of the natural or built environment (Ministry of the Environment, 2013a). Applications for special planning permission are usually submitted to the municipal authorities; in some cases, such as areas not yet covered by local plans, decisions are made by Regional Environment Centres (Ministry of the Environment, 2013a). **Information on the initiation of such planning and permit procedures should also be provided to neighbouring property**

owners and posted on the site (Ministry of the Environment, 2013a). Decisions on applications for special planning permission are sent to the applicants, relevant authorities, and other persons who have requested information (Ministry of the Environment, 2013a).

1.3.2. Nature conservation permits

The Nature Conservation Act includes numerous prohibitions related to the conservation of nature reserves and species, the purpose of which is to preserve natural biodiversity (Ministry of the Environment, 2013b). Nature reserves typically prohibit all activities that affect natural habitats, as defined in their establishment provisions and decisions, altering protected natural habitat types; in particular, deterioration or destruction of species habitats is prohibited (Ministry of the Environment, 2013b).

It is prohibited to alter the habitat types or comparable habitats referred to in the Nature Conservation Act (section 29) in such a way as to jeopardise the preservation of the characteristic features of the area in question (Ministry of the Environment, 2018). **If the characteristic features of the habitat type are not jeopardised, no permit is needed** (Ministry of the Environment, 2018). The prohibition to alter shall take effect when an Economic Development, Transport and Environment Centre has set the boundaries of the natural habitat to be protected and has notified the site owners and holders of its decision.

➔Duration of the process	6-12 months
➔ Solar PV	applies
➔Windfarm	applies

1.4. Environmental Impact Assessment

Law on the Environmental Impact Assessment Procedure 5/5/2017/252, Article 3 "Scope of the law and application of the assessment procedure" states that the Environmental Impact Assessment Procedure applies to projects and their modifications that are likely to have significant environmental effects (*Law on the Environmental Impact Assessment Procedure 5/5/2017/252*, 2017). The projects to be assessed under the EIA procedure and modifications are listed in Annex 1. The factors on which the decision is based are set out in Annex 2 of this Law (*Law on the Environmental Impact Assessment Procedure 5/5/2017/252*, 2017).

Annexe 1 lists wind power projects with a minimum of **10 individual plants or a total capacity of at least 45 megawatts as activities for which EIA is automatically required** (*Law on the Environmental Impact Assessment Procedure 5/5/2017/252*, 2017). It should be noted that EIA may also be designated for smaller wind farm projects if they are potentially assessed to have an adverse environmental impact (*Law on the Environmental Impact Assessment Procedure 5/5/2017/252*, 2017). Fig.1.6. and Fig.1.7. show a schematic representation of the process for EIA assessment and changes to the spatial plan.

In the EIA procedure, the impact of a project is assessed at the preparatory stage, before any further decisions are taken on the implementation of the project, on the assumption that after the EIA has been carried out, it will be possible to influence the technical design of the project, if necessary. The project developer is responsible for carrying out the required environmental studies and preparing the scoping document and EIA report (Ministry of the Environment, 2020a). The procedure is supervised and controlled by the **Economic Development, Transport and Environment Centre**, which act as competent authorities (Ministry of the Environment, 2020a).

The public and the authorities affected by the project can participate in the EIA procedure. The nature of the procedure is participatory and open. Suppose the developer is not sure whether the project may have significant environmental impacts to be assessed. In that case, the local Economic Development, Transport and Environment Centre should be contacted for further action (Ministry of the Environment, 2020a).

Environmental impact assessment procedure includes (Chapter 3, Section 14) (*Law on the Environmental Impact Assessment Procedure 5/5/2017/252*, 2017):

1) preparation of the evaluation program and report;

2) information and consultation on the evaluation program and report;

3) the information provided in the assessment programme and review report of the authorities concerned, as well as the opinions and statements made in the context of the consultation;

4) the opinion of the authorities concerned on the evaluation program;

5) a reasoned conclusion of the authorities concerned on the significant environmental effects of the project;

6) the assessment report, the opinions and comments thereon and their incorporation in the assessment report.

Where the EIA procedure for a project and the preparation of a Master plan or changes in detailed plans for the project are being carried out simultaneously, the consultations may

be coordinated (Article 22) (*Law on the Environmental Impact Assessment Procedure 5/5/2017/252*, 2017). In such cases, consultation on the EIA programme and notification of the consultation and evaluation of plans under the Land Use and Building Act (132/1999), as well as consultation on the EIA report and the submission of opinions on the changes in spatial plans or, exceptional planning, the publication of the draft plan for public inspection may be organised in a joint procedure (*Land Use and Building Act 5.2.1999/ 132*, 1999; *Law on the Environmental Impact Assessment Procedure 5/5/2017/252*, 2017). The EIA of the project and the need for studies required to process the building permit application will be coordinated, where necessary, in the assessment programme, as well as the studies to be included in the assessment report and the building permit application may be prepared jointly (Section 22a)(*Law on the Environmental Impact Assessment Procedure 5/5/2017/252*, 2017).

➔ Duration of the process	1.5-3 years
➔ Solar PV	not applicable
➔ Windfarm	over ten turbines or 45 MW

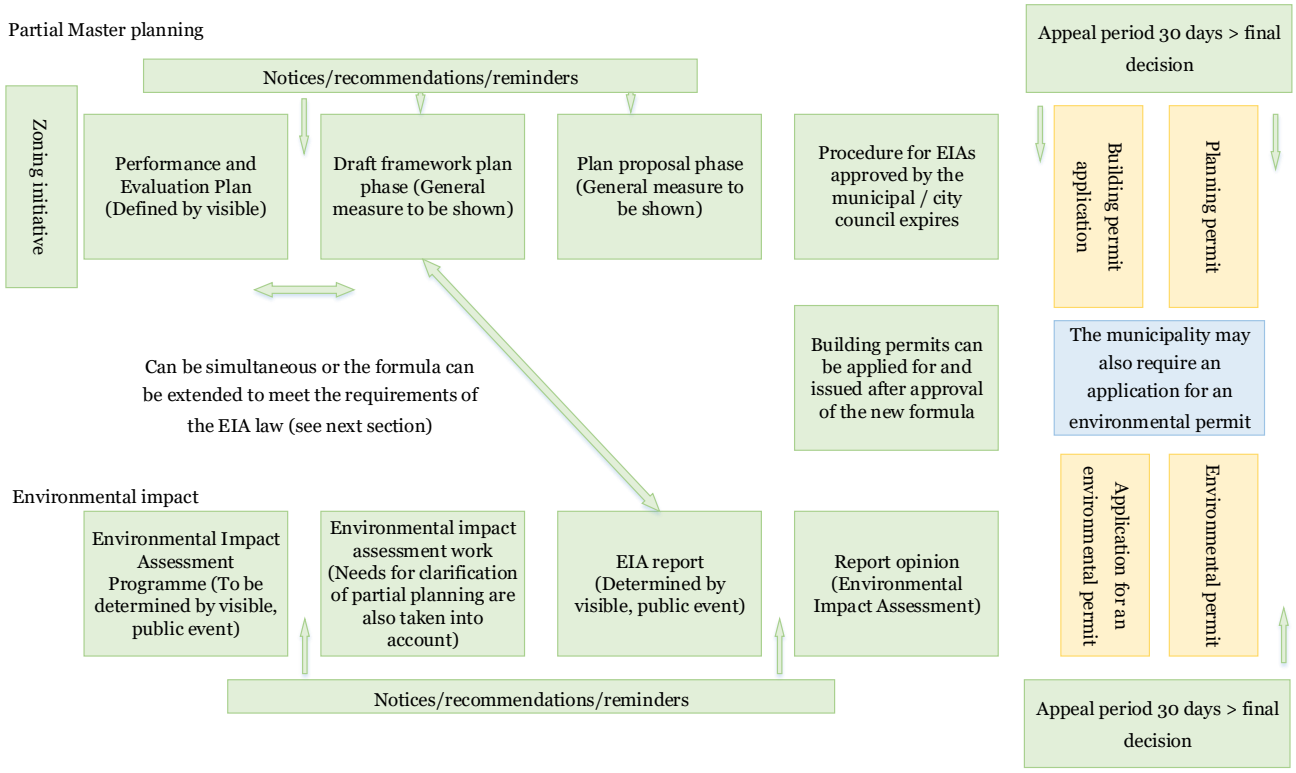

Fig.1.7. EIA + Master Plan (1a) 1.5-3 years (Suomen Tuulivoimayhdistys, 2019)

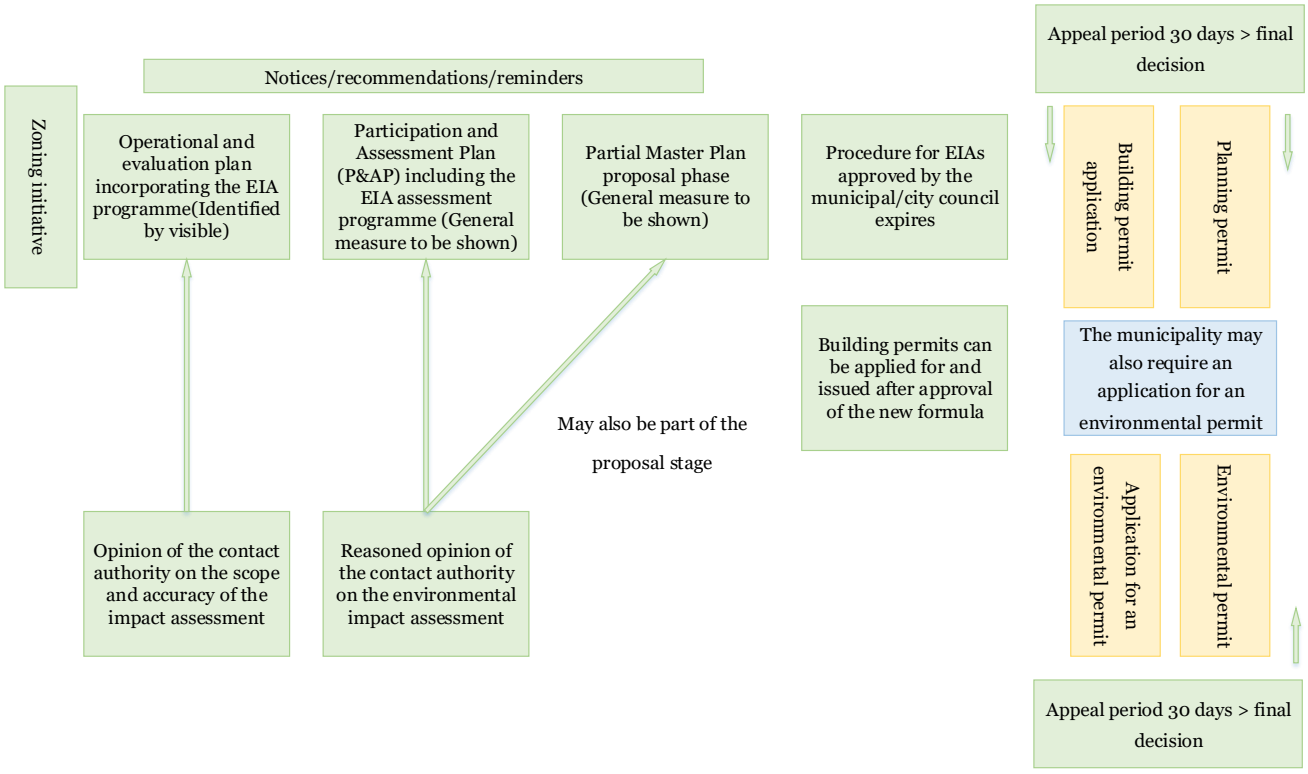

Fig.1.8. EIA+Master plan (1b) 1.5-3 years (Suomen Tuulivoimayhdistys, 2019)

1.5. Construction

The owner of a power plant with an electrical capacity of at least **one MVA** must **notify the Energy Agency of the power plant construction plan**, the decision to increase the capacity, the commissioning and the long-term or permanent decommissioning of the power plant (Energy Agency, n.d.-a). Commissioning or modifications of a power plant must be reported using a notification form. The notification shall include the following information (Energy Agency, n.d.-a):

- the operator and owner of the power plant;
- the capacity and energy sources of the power plant and its main technical characteristics;
- the date of commissioning of the power plant or its upgrading;
- in the case of a permanent or long-term decommissioning of a power plant for at least one year or a permanent reduction in the capacity of a power plant, the planned date of implementation of the measure.

Power plant manufacturers usually do not make a binding offer for wind power projects until the project has a legally valid building permit (Anni Mikkonen, 2019). For this reason, developers usually do not select a power plant type before applying for a building permit (Anni Mikkonen, 2019). After the **building permit has been issued, there are three years to start construction work on the power plant** (Anni Mikkonen, 2019). Specifying the type of turbines installed in the building permit would tie the project to old technology - turbines may no longer be available when the power plant construction begins (Anni Mikkonen, 2019). Currently, Finnish municipalities have different practices in coordinating wind energy projects (Anni Mikkonen, 2019). In some municipalities, the nature and scope of the documents submitted for a building permit vary, requiring submitting documents not directly related to the project. In some municipalities, the cost of the building permit is not proportionate to the amount of work needed for the building permit (Anni Mikkonen, 2019).

The municipal building supervision authority must supervise construction work in the general interest and ensure that construction complies with the rules and regulations laid down in or under the Land Use and Building Act (Ministry of the Environment, n.d.-b). When considering the scope and nature of the supervision task, account should be taken, for example, of the complexity of the construction project, the knowledge and professional skills of the permit applicant and other persons responsible for the design and construction of the building, as well as other issues related to the need for supervision (Ministry of the Environment, n.d.-b). The **municipal building supervision authority** should supervise the compliance with regulations and local obligations, and spatial plans on construction, which should be contacted at an early stage of the project (Ministry of the Environment, 2020b). The **building supervision authority** explains the requirements for obtaining a permit and other prerequisites for the project (Ministry of the Environment, 2020b). A construction project usually requires different types of expertise and involves several parties.

The provisions of the Land Use and Building Act on the construction of a new building do not apply to the construction of a small light structure or small installation unless it has a specific land use or environmental impact (Chapter 16, Article 113) (*Land Use and Building Act 5.2.1999/ 132*, 1999). A permit is also required for the erection and installation of a structure or installation which is not considered to be a building if the operation has an impact on natural conditions, land use in the surrounding area or the urban or landscape image (Chapter 18, Section 126) (*Land Use and Building Act 5.2.1999/ 132*, 1999). Section

126a of the same Chapter provides that an operating permit under Section 126 is required for the siting of a facility that is not a building (*Land Use and Building Act 5.2.1999/ 132*, 1999):

4) construction of a mast, barrel, storage tank, ski lift, monument, larger antenna, **wind turbine** and large lighting pole or the like;

13) installation or construction of a **solar panel** or collector that significantly affects the cityscape or the environment. If this measure referred to in subsection (13) is based on a legally valid plan or street plan or an approved road plan by the Road Act or the Public Roads Act (243/1954), no permit is required.

In the building code, a municipality may provide that a permit is not required to install a wind turbine or solar photovoltaic plant in the municipality or part of the municipality if the installation can be considered minor (*Land Use and Building Act 5.2.1999/ 132*, 1999)**.**

The municipality may provide in the building regulations that construction or other minor and impact measures may be carried out without a building permit or an operating permit after the entity concerned has **notified the municipal building supervision authority** (Article 129) (*Land Use and Building Act 5.2.1999/ 132*, 1999). In the event of public interest or for the legal protection of neighbours, the **municipal building supervision authority** shall require an application for a building or occupancy permit instead of a building notification (*Land Use and Building Act 5.2.1999/ 132*, 1999). **The construction or other activity may be carried out if the building control authority has not, within 14 days of receipt of the notice, required applying for a building permit for the notified project** (*Land Use and Building Act 5.2.1999/ 132*, 1999).

The building permit is submitted in writing to the **municipal building supervision authority** (Article 131), and the application for a building permit must be accompanied by (*Land Use and Building Act 5.2.1999/ 132*, 1999):

1) a statement that the applicant is in charge of the construction site;

2) the preliminary drawings included in the construction project, certified by a construction designer with his signature.

The **municipal building supervision authority** may, if necessary, require that the application for a building permit be accompanied by (*Land Use and Building Act 5.2.1999/ 132*, 1999) taking into account the quality and scope of the project:

1) an extract from the basic map of the area or, when building in the town plan area, an extract from the town plan and an extract from the land register and, if necessary, a plot map, if they are not already available to the building control authority;

2) a statement of the conditions for the establishment and foundation of the construction site and the method of an establishment required by them and the other measures required;

3) energy accounting;

4) a statement of the healthiness and height ratios of the construction site;

5) a report on the condition of the building prepared by a qualified person;

6) other relevant information necessary for resolving the building permit application.

A decree of the Ministry of the Environment may lay down more detailed provisions on the content and presentation of preliminary drawings and reports (*Land Use and Building Act 5.2.1999/ 132*, 1999).

Environmental impact assessment states that if construction or other measure is subject to a permit or require official approval, under this Act requires an EIA by the Environmental Impact Assessment Procedure Act; the result of the application shall be announced on the internet in addition to the provisions of Article 133 (Article 132) (*Land Use and Building Act 5.2.1999/ 132*, 1999). In addition, the **Center for Economic Development, Transport and the Environment** must be allowed to issue an opinion on the application. A summary of the comments and opinions submitted shall be made available to the public simultaneously as the decision. The obligation to consider EIA in the permitting procedure is provided in Chapter 4 of the Environmental Impact Assessment Procedure Act (*Land Use and Building Act 5.2.1999/ 132*, 1999).

Neighbours shall be notified of the initiation of the building permit application, unless the notification is unnecessary in the interest of the neighbour, taking into account the small size or location of the project or the content of the plan (Article 133) (*Land Use and Building Act 5.2.1999/ 132*, 1999). A neighbour means the owner and occupier of an adjacent or opposite property or another area. Where necessary, a site inspection shall be carried out to determine the suitability of the building for the environment, assess the effects of the construction, and consult neighbours (Land Use and Building Act 5.2.1999/ 132, 1999).

Where a building permit is sought for a nature conservation area or an area reserved for recreation or protection in the regional plan by the Nature Conservation Act, as further regulated by government decree, the application shall request the opinion of the Centre for

Economic Development, Transport and the Environment (*Land Use and Building Act 5.2.1999/ 132*, 1999).

Municipal building supervision authority should be contacted well in advance before applying for a building permit, and it is recommended to arrange a meeting for preliminary negotiations with the **municipal building supervision authority** as well, which involves both the person undertaking the construction project and the main designer of the project (the City of Karkkila, n.d.). This will ensure that the necessary permits are obtained quicker and that the project proceeds according to plan. A building permit may be applied for by the owner of the site, which may be the legal owner of the site, a person authorised by the owner or a person managing the area under a lease or other agreement (the City of Karkkila, n.d.).

The application for a building permit must be submitted primarily electronically using the Lupapiste service (the City of Karkkila, n.d.). On the Lupapiste platform, the project developer can also request advice on construction obtaining a building permit (the City of Karkkila, n.d.). If the project contains deviations from the rules or regulations, a deviation permit may be required before issuing a building permit(the City of Karkkila, n.d.).

The **processing time for a building permit** or operating permit is **four weeks** from submitting the permit application, provided that the application documents are complete and appropriate (The city of Karkkila, n.d.). **If the construction work has not started within three years or been completed within five years, the building permit has lapsed** (Article 143) (*Land Use and Building Act 5.2.1999/ 132*, 1999). The authorisation or regulatory approval for the other activity to be carried out is deemed to have lapsed if the action is not completed within three years (*Land Use and Building Act 5.2.1999/ 132*, 1999). The time limits start with the outcome of the authorisation or approval. An extension of the validity of a building permit may be requested for both the start and completion of works. It must be requested within the permit's validity period(the City of Karkkila, n.d.).

➔ Duration of the process	**Four weeks**
➔ Solar PV	applies
➔ Windfarm	applies

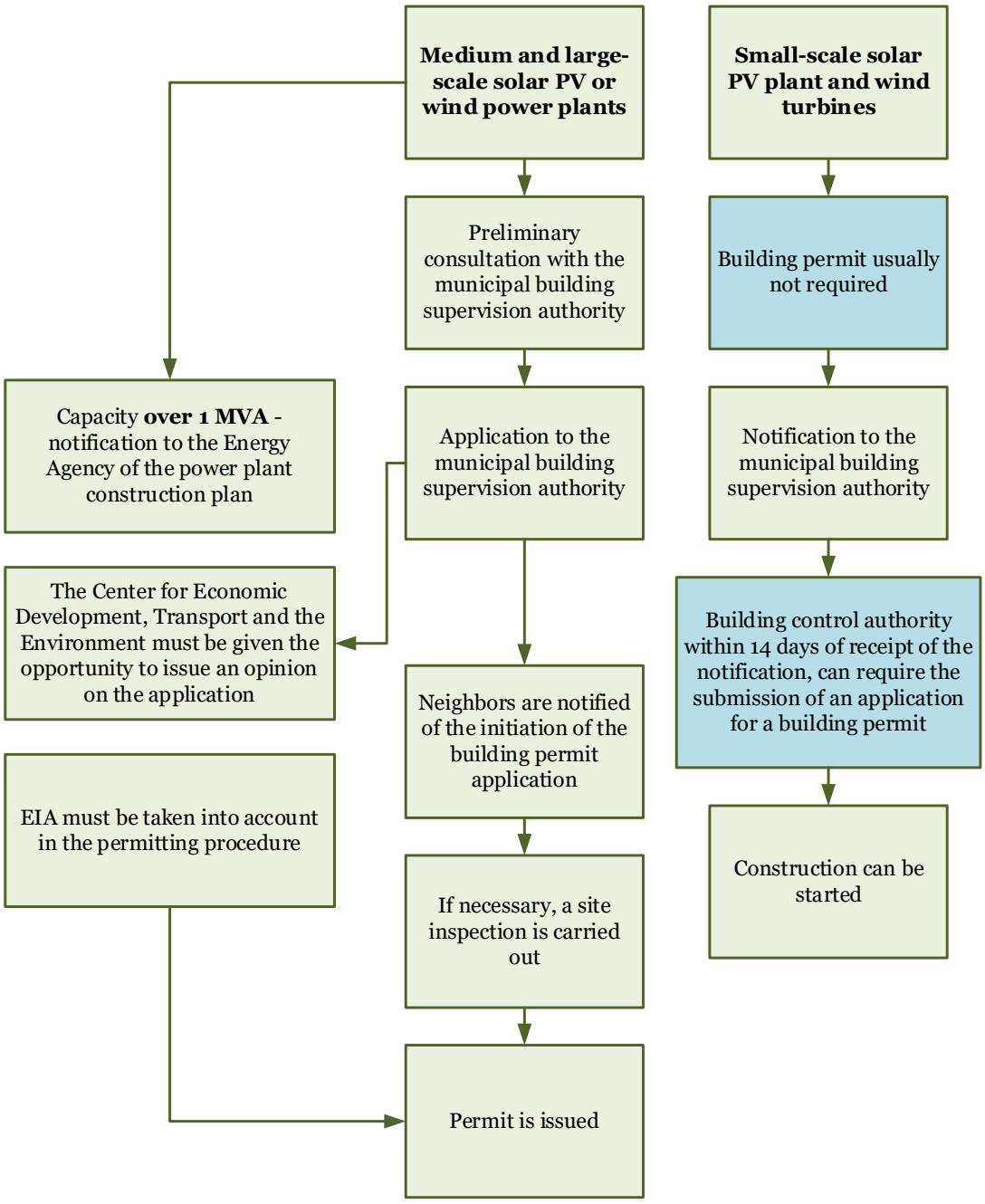

Fig.1.9. Building permit process

1.6. Connection to the grid

In Finland, the grid's use for electricity transmissions is regulated by the general legislation on energy – the Electricity Market Act (Sähkömarkkinalaki - 588/2013). There are no special provisions for electricity generated from renewable energy sources (RES LEGAL Europe, n.d.). The Electricity Market Act aims to ensure an efficient, secure, and environmentally sustainable national and regional electricity market (Parliament of Finland,

2014). This Act applies to the electricity market, which means the generation, import, export and supply of electricity and the transmission and distribution of electricity.

Finland's electricity grid is rated as one of the most stable globally (Bergmann, 2018). The Finnish transmission grid is connected to Sweden, Estonia, Norway and Russia (Bergmann, 2018). The Finnish Transmission System Operator responsible for the nation-wide high-voltage transmission grid is **Fingrid Oyj. Regional electricity and distribution networks are operated by 13 regional electricity network companies and 77 distribution network companies** (Bergmann, 2018).

Upon request, the distribution or transmission operator shall add a reasonable fee. These power plants meet the technical requirements of the electricity network in its area of responsibility (Ministry of Employment and the Economy, 2021). The conditions and technical requirements for connection shall be transparent, fair and non-discriminatory. They shall consider the electricity system's reliability and efficiency (Ministry of Employment and the Economic 2021). The distribution or transmission operator shall publish technical requirements for connection and reasonable time within the network operator to process connection requests (Ministry of Employment and the Economic 2021). Upon request, the network operator shall provide the power plant developer with a comprehensive and sufficiently detailed estimate of the connection costs and the timeframe for establishing the connection. **The power plant shall be connected to the electricity grid within 24 months of the conclusion of the connection agreement**, where the network operator's investments in the development of the electricity network are possible within a reasonable timeframe and without discrimination of network users (Ministry of Employment and the Economy, 2021).

For electricity produced and transmitted using network services on the distribution network and the high-voltage distribution network, prices shall be determined as follows (Ministry of Employment and the Economy, 2021):

- the connection fee charged for the connection of small-scale electricity production equipment to the distribution network shall not include the costs arising from the strengthening of the electricity network;
- The distribution fees charged for electricity production must cover a relatively more minor share of the costs of the distribution network and the high-voltage distribution network than the distribution fees charged for electricity consumption.

The electricity producer shall notify **the Energy Agency** of the construction plan and commissioning of the power plant and the long-term or permanent decommissioning of the power plant (Ministry of Employment and the Economic 2021). The Government Decree lays down more detailed provisions on the content of the notification obligation and the notification procedure.

In 2020 Government of Finland proposed to Parliament to amend the Electricity Market Act and Article 14 of the Electricity and Natural Gas Market Supervision Act. The proposal aims to limit the increase in electricity distribution prices by changing the regulation of distribution system operators (Ministry of Employment and the Economy, 2020). With the proposed amendments, the maximum increase in electricity transmission and distribution charges would be reduced from 15% to 8% (Ministry of Employment and the Economy, 2020). Connecting small electricity-generating installation via a separate line across the property boundary to the electricity point of use or the property's electricity grid would also benefit from the changes, as this could be done without the need for a permit from the distribution system operator (Ministry of Employment and the Economy, 2020).

1.6.1. Connection to Transmission System Operator

Fingrid Oyj is the transmission system operator of Finland. The enterprise takes care of the functioning of the nation-wide high-voltage grid and is the backbone of electricity transmission (Fingrid, n.d.-b). Fingrid transmits electricity from electricity generating companies to distribution network companies and industrial companies (Fingrid, n.d.-b).

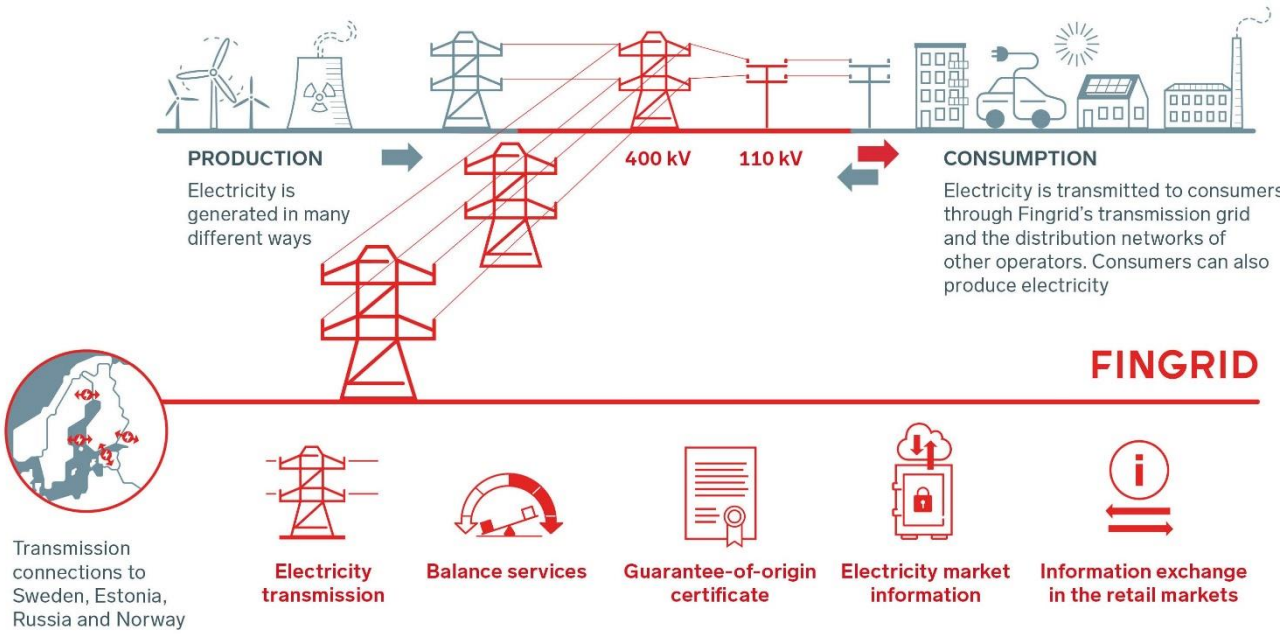

Fig. 1.10. Transmission system operator's role in the electricity system (Fingrid, n.d.)

Small wind parks should be primarily connected to distribution networks. **Each connection is individual, and there is no specific power limit for power plants connected to Fingrid's grid** (Fingrid, 2015). Power plants with a total capacity of more than 15 MW are usually connected to the transmission grid operator's network; connecting stations with a smaller capacity to Fingrid's network is generally not feasible or cost-effective (Fingrid, 2015).

The maximum permitted rated current of a transformer without mechanical ventilation (ONAN) is 25 MVA (Fingrid, n.d.-a). By equipping the transformer in question with mechanical ventilation (ONAF), the transformer's loading up to 30 MW is permitted (Fingrid, n.d.-a). A maximum of two transformers can be switched to a single connection point provided that the lower-voltage networks between the two transformers are not joined in parallel (Fingrid, n.d.-a).

In general, the power plant shall be connected to Fingrid's switchyard circuit breaker bay (Fingrid, n.d.-a). If the transmission capacity permits, small synchronous generators of less than 5 MW or converter connected power plants of up to 30 MW may be connected to the Fingrid's 110 kV transmission line, as long as their short-circuit current fed to the primary grid is no more than 1.2 times the rated current of the power plant (Fingrid, n.d.-a).

Connection to the primary grid (Fingrid, n.d.-a):

1. **Connections are planned at the early phase in cooperation**. Fingrid experts examine customer connection possibilities and agree on the connection solution with the customer. During the connection planning phase, more detailed connection plans are required;
2. **Connectivity** refers to the technical suitability of the connection to the primary grid. The technical data and conditions of the link are examined with the customer as early as possible in the project to determine connectivity. Careful preparations ensure the technical feasibility of the connection before actual planning begins and before the acquisition of any land. Depending on the connection site and projects being connected, there may be some limitations for connectivity. The power volume to be connected also depends on other projects in the same region.

   Important information on the primary grid connection required from the customer is the **customer's contact information, basic information on the**

connection and a potential location, information on the transformer and branch line, detailed location information, and primary grid information. **Power of electricity consumption and/or production of a connection, turbine type and power, connection point location on the map, and the estimated implementation schedule for the project;**

3. During the connection planning phase, the customer compiles detailed plans for its connection and delivers them along with the necessary technical data to Fingrid for review. Planning should be started well in advance in projects where connection requires a transmission line which the customer constructs. The information required from the customer in the **planning phase** is a substation layout and elevation drawing, single line diagram, the realisation of energy metering, earthing system, coordinates, information on the transformer and the branch line, information on the relay protection and communication link. To support the customer in planning, Fingrid provides information about the short-circuit current and earth fault current and the basic requirements for the protection system. The customer is responsible for the installation work for its substation equipment and the specification of their technical values. Fingrid is responsible for arranging the energy metering and for providing an energy meter to the substation in question;

4. **A project agreement** is made before the connection agreement if Fingrid builds a new substation in the primary grid for the needs of a single customer. **A contract can be made when the EIA required by the authorities has been completed, and the land-use process has been started, or a decision concerning the planning solution has been made**. Upon request, Fingrid provides a statement on a possible primary grid connection, if the EIA required by the authorities have been completed and the land-use process has been started, or a decision concerning the planning solution has been made.
5. The details of primary grid connections are agreed in a separate **connection agreement** that specifies the ownership and obligation boundaries and the connection fees. **The prerequisite for signing a connection agreement is that the land-use plan (or decision on the need for planning) required for the project is legally valid**. The connection solution meets the technical requirements, and any expropriation permit application necessary for the transmission line has been sent to the authority. Fingrid's General Connection

Terms and Specifications for the Operational Performance of Power Generating Facilities are part of the connection agreement signed with the customer.

Once the contracting parties have signed it, the connection agreement takes effect, and the customer has paid the connection fees outlined in the connection agreement.

The connection agreement is valid subject to the condition that the **customer's high-voltage line is constructed within 36 months** of the signing of the connection agreement, and the connection fee has been paid by the due date on the invoice. The connection agreement is valid until further notice, subject to three years of notice. The agreement may be terminated 15 years after its signature at the earliest. The customer must have a valid connection agreement to sign the main grid contract;

6. **Once the plans have been approved, construction can begin**. The customer delivers the project implementation schedule, final documents and electrical values to Fingrid. Agreement concerning electricity transmission outages in the primary grid during construction of the connection must be reached as early as possible. **The connection need must be reported as early as possible and no later than 21 days before the proposed connection date**. The main grid operation specialists who are responsible for the planning of outages and connections will inform the customer of the connection date;
7. **Before commissioning, the customer must perform a commissioning inspection** on the electrical installation of the connection. Fingrid's operation specialist will examine the new connection and verify that the connection corresponds to the plans agreed with Fingrid earlier and that the connection can be energised. A protocol of the commissioning inspection is drawn up and sent to the operation specialist;
8. The **switching** need must be reported as early as possible and no later than 21 days before the proposed switching date. The main grid operation specialists responsible for planning outages and connections will inform the customer of the switching date. The customer's responsibility is to ensure that all technical information corresponding to the installations is delivered to the transmission system operator within two months of commissioning.

➔ Duration of the process **within 24 months**

➔ Solar PV	applies
➔ Windfarm	applies

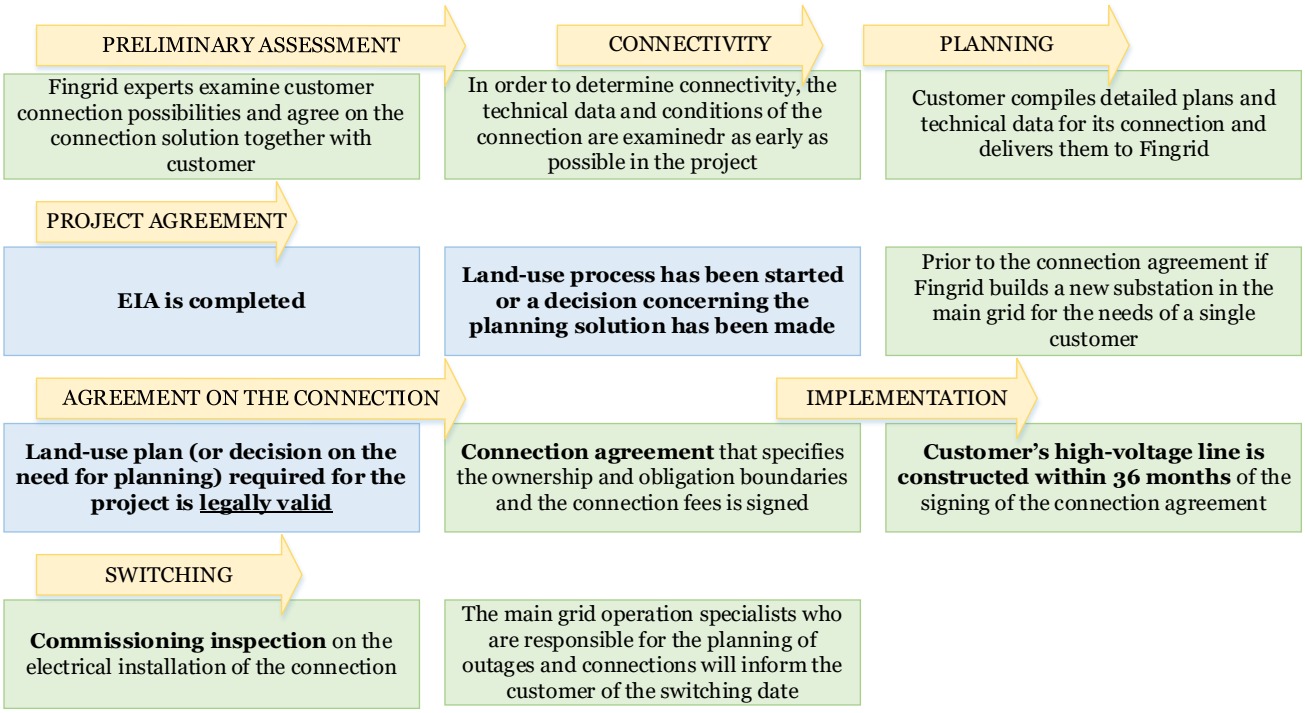

Fig.1.11. Connection to the transmission network (Fingrid, n.d.-a)

1.6.2. Connection To The Distribution System Operator

The following steps must be taken o connect a power plant to the local distribution system operator (Energiaverkot/Tuukka Heikkilä, 2019):

- **Contact the electricity distribution system operator in the relevant area**. The production installation must not be connected to the grid without the permission of the electricity network operator. The grid operator must be contacted for the first time **before purchasing the generating plant is made** to ensure that the plant is connected to the grid and its suitability for the connection site. This helps to avoid situations where someone has already acquired the technical requirements for the production plant. Thus the network operator is forced to prohibit the connection of an already acquired generating installation to the grid because the connection can not be made. The

commissioning of a generating installation **may require changes to metering equipment** or reinforcements to the electricity network. It is also advisable to contact the grid operator in good time to allow for the time needed for any modifications;

- the connection of a generating installation is always electrical work which can only be **carried out by a qualified person with an electrical installation licence**. The purchaser of a production installation should commission a professional electrical contractor to install his equipment. Production plants are usually three-phase installations. The minor production units can also be connected to the grid as single-phase units. A single-phase production plant can be connected behind fuse protection of up to 16 A;
- the connection of a generating installation usually is subject to a **generation connection contract**. However, the need for a connection contract is assessed on a case-by-case basis. For a generation, the connection contract for production is based on the connection conditions recommended by the Energy Industry Association (LE2019);
- when a production facility is connected to the electricity grid so that the energy it produces can be transmitted to the distribution network, **a contract must be concluded with the electricity network operator a network service contract for the generation**. This means that usually, the network service contract normally in force is extended to cover generation at the point of use. The network service contracts at the point of use are subject to the Energy Industry Association (VPE2019).
- **All equipment that feeds electricity into the grid must comply with the technical requirements**. These requirements ensure that the quality of electricity remains high so that other equipment connected to the grid is not disturbed. Another important reason for the needs is to ensure the safety of electricity users and those working on the grid;
- an electricity production installation with a rated output of 100 kVA or less does not need its metering equipment. It is sufficient for the site's remote meter to measure separately the amount of electricity drawn from the grid (extraction) and input (supply) energy from the grid. If the generating installation has a rated output of **more than 100 kVA, the generating installation shall be equipped with a separate metering system to calculate the**

consumption of its generation. Own consumption of own production means the energy produced by the generating installation is used directly on site. The consumption of own production is obtained by subtracting from the electricity produced by the generating plant to the electricity used by the generating plant itself and the electricity fed into the grid.

- The network operator is responsible for metering the electricity taken from and supplied to the grid. The meter is owned and read by the network operator.

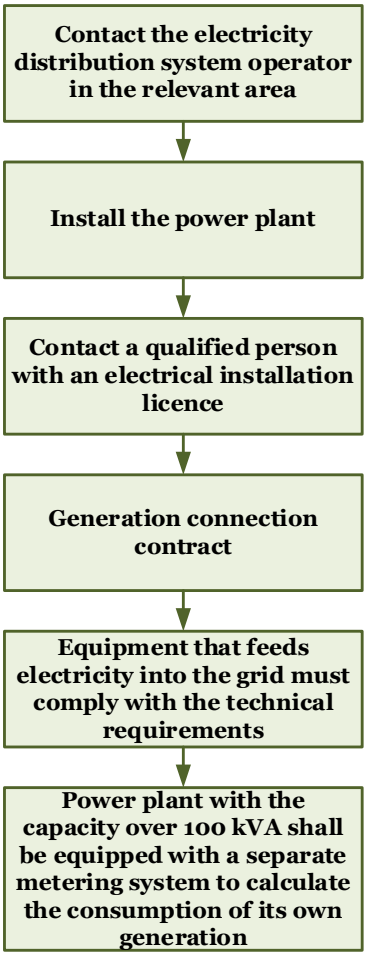

Fig.1.12. Connection to the distribution sistem operator (Energiaverkot/Tuukka Heikkilä, 2019)

1.6.3. Electricity trading

Starting electricity sales activity in Finland **does not require a separate licence for the company carrying out the sales activity** (The Energy Agency, n.d.). However, the company must comply with obligations under electricity market legislation. To become an

electricity trader, the company must organise its electricity supply before selling, for example, by generating, buying electricity on the electricity exchange or purchasing the electricity it needs from another electricity trader (The Energy Agency, n.d.).

Electricity market participants are subject to balance liability, i.e. a party's electricity supply contracts and self-generated electricity must cover its electricity consumption and deliveries to third parties on an hourly basis (The Energy Agency, n.d.). Every seller acting as an open electricity seller must join the open supply chain (The Energy Agency, n.d.). Open supply means the supply of electricity (The Energy Agency, n.d.):

- where the electricity supplier supplies its customer with all the electricity necessary, as well as the supply;
- The electricity supplier balances the difference between the customer's electricity production and supply and the electricity consumption and supply by supplying the missing amount of electricity or receiving the surplus during each equal hour.

At the top of the open supply chain in Finland is the grid company Fingrid Oyj. The party that has a balancing service contract with Fingrid Oyj as the balancing power entity is called the balancing operator (The Energy Agency, n.d.). An electricity trader joins the open supply chain by concluding an open supply contract with the balancing operator or another trader in the open supply chain (The Energy Agency, n.d.).

Each electricity seller must have one balance responsible for each metering area to which the electricity seller sells electricity (The Energy Agency, n.d.). That is, even if the electricity seller does not enter into an open supply contract directly with the balance provider, it must nevertheless be able to prove the balance provider for its supply (The Energy Agency, n.d.). The electricity seller must also register with **eSett Oy**, a company providing settlement services to electricity market participants, to arrange balance responsibility and balance settlement before it starts supplying electricity to its customers (The Energy Agency, n.d.).

1.7. Offshore wind farms

Finland has one of the largest offshore wind parks in the Baltic Sea Region because shallow waters, low waves, and close distances to the coastline offer considerable logistical advantages compared to the North Sea arctic weather conditions and icing (Bergmann, 2018). To evaluate and investigate the risks connected to offshore wind power and develop best

practices and technology for offshore wind power, the Finnish Government granted an investment subsidy of EUR 20 million for a demonstration project in 2014 (Bergmann, 2018). The Tahkoluoto wind farm developed and operated by Suomen Hyötytuuli Oy was commissioned in 2017, located 1.2 km offshore and comprised ten turbines with a combined output of 40 MW (Bergmann, 2018).

The Land Use and Construction Act on Maritime Spatial Planning states that maritime spatial planning should take into account the different uses and needs of the sea and seek to harmonise them as far as possible, in particular, energy, maritime transport, fisheries and aquaculture, tourism, recreation, environmental and nature conservation, protection and enhancement should be taken into account (Chapter 8a) (*Land Use and Building Act 5.2.1999/ 132*, 1999).

A marine spatial plan shall be drawn up for territorial waters, and the exclusive economic zone and the preparation and approval of the marine spatial plan shall be the **responsibility of the Regional Councils** whose territory includes territorial waters (Article 67 b) (*Land Use and Building Act 5.2.1999/ 132*, 1999). Regional Councils must prepare the marine spatial plan in cooperation with each other to coordinate the plans(*Land Use and Building Act 5.2.1999/ 132*, 1999). More detailed rules on the representation and number of marine spatial plans, planning areas and deadlines are laid down by government order (*Land Use and Building Act 5.2.1999/ 132*, 1999).

The Regional Councils shall organise the preparation of the marine spatial plan in such a way that the **authorities and communities whose areas of competence are covered by the plan have the opportunity to participate in the preparation of the plan** (Article 67c) (*Land Use and Building Act 5.2.1999/ 132*, 1999). Regional Councils must seek views of the authorities and entities whose competencies or functions are significantly affected by the plan (*Land Use and Building Act 5.2.1999/ 132*, 1999). The Ministry of Foreign Affairs shall be consulted on the EEA. Other indirect parties can familiarise themselves with the material and express their views using an internet publication. At least 30 days shall be given to submit comments (*Land Use and Building Act 5.2.1999/ 132*, 1999).

The Regional Councils shall publish information on the approved marine spatial plan and its rationale on the internet and send it to the authorities and communities involved in its preparation (Article 67b) (*Land Use and Building Act 5.2.1999/ 132*, 1999). The marine spatial plan shall be freely accessible on the internet. The approved marine spatial plan and any amendments must be sent to the Ministry of the Environment without delay (*Land Use and Building Act 5.2.1999/ 132*, 1999).

Although the Land Use and Building Act provides specific planning, the marine spatial plan is not part of the regional planning system. Therefore the marine spatial plan is a general and strategic plan that supports regional planning and strategy (Suomen Hyötytuuli Oy, 2020). The Regional Council is the authority that approves the marine spatial plan, but the plan is not legally binding, making marine spatial plans strategic plans of a guiding nature (Suomen Hyötytuuli Oy, 2020). The purpose of marine spatial planning is to promote the sustainable development and growth of the different uses of the marine area, the sustainable use of the marine resources and the achievement of a good marine environment (Suomen Hyötytuuli Oy, 2020).

Offshore wind farm projects are subject to an environmental impact assessment procedure under the Law on the Environmental Impact Assessment Procedure Article 4 (Suomen Hyötytuuli Oy, 2020). The EIA procedure aims to avoid and prevent environmental impacts that the project might cause, promote consideration of environmental impacts in planning and decision-making, and increase public access to information and participation (Suomen Hyötytuuli Oy, 2020).

Land Use and Building Act Chapter 10a "Specific provisions on wind energy construction" determines that **a building permit for the construction of a wind turbine may be granted if the legally effective master plan specifically provides for the use of the plan or part of the plan as a basis for granting a building permit** (Article 77a) (*Land Use and Building Act 5.2.1999/ 132*, 1999). When drawing up a master plan for wind energy construction as referred to in Article 77a, in addition to the other provisions of the master plan, it shall be ensured that (*Land Use and Building Act 5.2.1999/ 132*, 1999):

1) the master plan properly regulates the construction and other land uses in the area;

2) the planned wind farm is compatible with the landscape and the environment;

3) it is technically feasible to carry out maintenance on the wind turbines and to transmit electricity.

Suppose a master plan for offshore wind energy development under Article 77a is drawn up at the request of private interest or the person undertaking the wind energy project. In that case, the municipality may charge the entity for all or a part of the costs incurred in drawing up the master plan (Article 77c) (*Land Use and Building Act 5.2.1999/ 132*, 1999).

1.7.1. Permits under water legislation

According to Finland's water legislation, water permits are required for all activities involving construction in water or the water supply (Regional state administrative agencies, 2020). These activities include the construction of piers, bridges, cable crossings, pipelines, dams, hydroelectric power stations, waterways, drainage ditches, canals, barrages and any other regulation or use of water supplies, including groundwater (Regional state administrative agencies, 2020).

Applications should be submitted to the relevant Regional State Administrative Agency (Regional state administrative agencies, 2020). The authority will then make the application public as appropriate, giving the authorities considered and anyone affected by the plans time to comment and make proposals concerning the requirements for the permit. Complaints against any permit decisions may be made to the Administrative Court of Vaasa, then to the Supreme Administrative Court (Regional state administrative agencies, 2020).

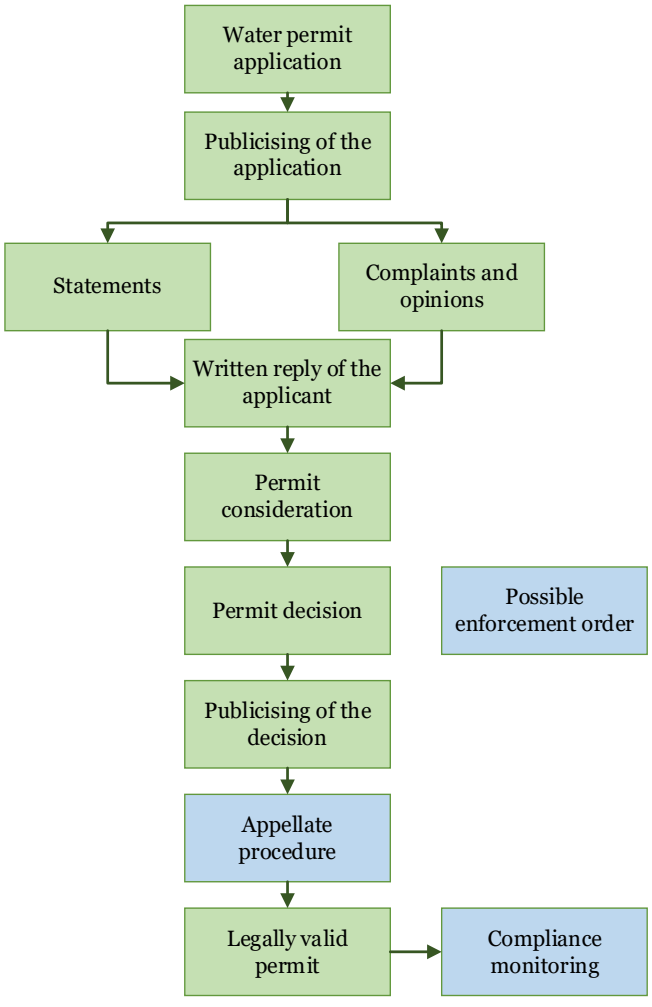

Fig.1.13. Process of issuing a water permit (Regional state administrative agencies, 2020)

As an example of the offshore wind farm project implementation time frame, the Korsnäs offshore wind farm project can be mentioned. Korsnäs offshore wind farm will consist of 70 to 100 turbines with a nominal power of 12 MW to 20 MW and will be built in the area off the west coast of Finland (Adnan Durakovic, 2021). The project development of the Korsnäs wind farm is estimated to **take around four years** - the planning process was launched in 2020. The municipality of Korsnäs approved the planning proposal on the offshore wind farm in autumn 2020IA will begin in 2021 (Adnan Durakovic, 2021).

In general, there is no separate legislation in Finland for introducing offshore wind farms. Still, the project approval and the necessary permits are granted on the same legal basis as onshore wind farms. The required permits are issued by the municipality or municipal authorities, who then assess the specific circumstances relating to installing wind turbines and their impact on the environment.

➔Duration of the process	*around four years*
➔Offshore wind farm	applies

2. NORWAY

Renewable energy accounts for more than 90% of total electricity production in Norway (IEA, no date b). Hydropower contributes the most to the renewable electricity mix with 126 030 GWh of electric energy produced in 2019 (93.44% of the total energy produced in 2019), followed by wind energy with 5 525 GWh (4.10% of the total electricity produced in 2019) (The Norwegian Water Resources and Energy Directorate, n.d.). Norway is currently implementing various mechanisms to promote renewable energy development in the country (Vågerö, 2019a). The most commonly used mechanism to encourage green energy is the electricity certificate scheme. Power plants using renewable energy sources to generate electricity are allocated electricity certificates sold to other companies. In 2012, Sweden and Norway introduced a common market for electricity certificates. The quota system is regulated by the Electricity Certificates Act (*Lov om elsertifikater*) and the Electricity Certificates Regulations (*Forskrift om elsertifikater*) (Vågerö, 2019a).

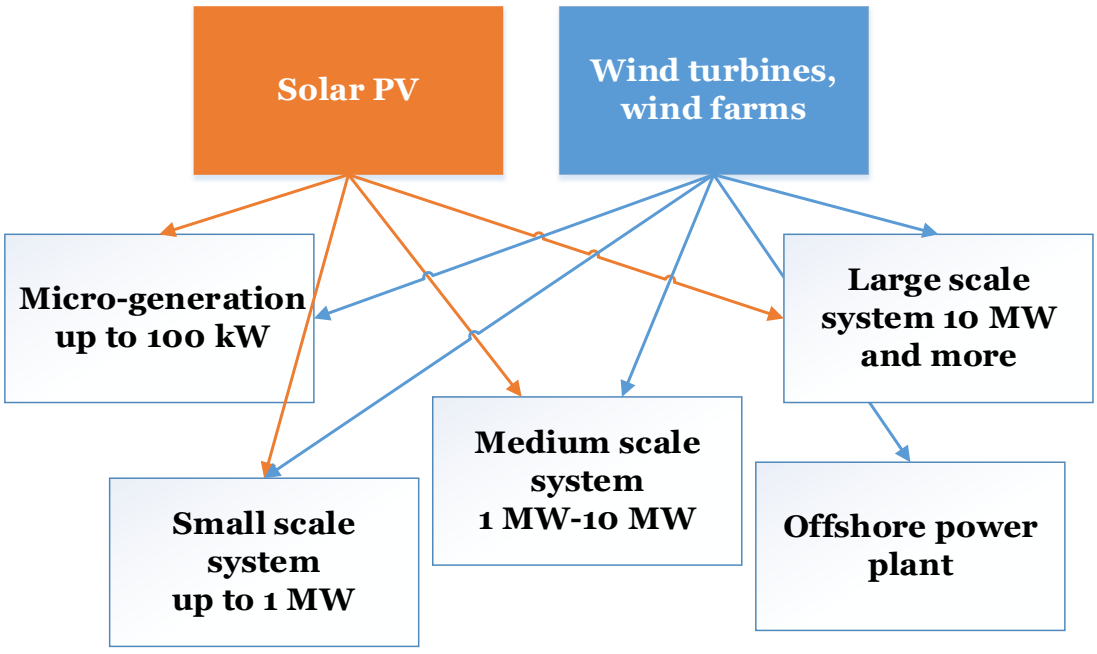

Fig.2.1. Distribution of solar PV and wind turbines, wind farms by installed capacity in Norway

Section 2.1. and Section 2.2. describe the general implementation process for Norway's solar and wind power plants, starting from Section 2.3. an in-depth legislation analysis has been performed. The following sections briefly describe the main steps that the solar PV or wind power plant project developer should undergo to implement the project.

2.1. Main steps for wind power plant implementation

In 2020, 9.9 TWh of energy was produced by wind power in Norway (The Norwegian Water Resources and Energy Directorate, 2019c). The total installed capacity at the end of the year 2020 was 3,977 MW, distributed across 1,164 wind turbines. However, wind power accounts for over six per cent of total electricity produced in Norway (The Norwegian Water Resources and Energy Directorate, 2019d). The authority responsible for managing Norway's water and energy resources is the Norwegian Water Resources and Energy Directorate (NVE),n institution under the Ministry of Petroleum and Energy (The Norwegian Water Resources and Energy Directorate, 2021a). The NVE believes in an open dialogue with the local communities and makes sure that all interested parties receive the required information (The Norwegian Water Resources and Energy Directorate, 2021b). The directorate aims to ensure integrated and environmentally sound management of the country's water systems, promotes efficient energy markets and cost-effective energy systems and contributes to efficient energy use (The Norwegian Water Resources and Energy Directorate, 2021b). As well as the NVE bears the overall responsibility for maintaining national power supplies.

According to the information published on the NVE official website, the installation and operation of wind turbines are regulated by the Energy Act. Projects are generally subject to a licensing process (The Norwegian Water Resources and Energy Directorate, 2021q). However, ower **plants consisting of up to 5 wind turbines with a total installed capacity of less than 1 MW are exempt from the licensing obligation** (The Norwegian Water Resources and Energy Directorate, 2021r). Implementing a wind turbine and wind farm project can be divided into the following steps.

Step 1 ➔ Notification phase (The Norwegian Water Resources and Energy Directorate, 2021r):

All wind power plants with an installed capacity exceeding 10 MW must send a notification to the NVE by the legislation on necessary impact assessments under the Planning and Construction Act (**wind power plant development projects with an installed capacity below 10 MW start at step 3 - application**) (The Norwegian Water Resources and Energy Directorate, 2021r). The notification is an early warning of the project design and will help inform affected parties about the project while providing their feedback. In the notification phase, the developer must account for the measure and preliminary assess

p**ossible environmental effects** (The Norwegian Water Resources and Energy Directorate, 2021r).

Projects with more than 10 MW installed capacity are subject to an impact assessment. The notification stage's primary purpose iso **define an impact assessment programme** describing which topics are to be assessed in the context of the EIA report (The Norwegian Water Resources and Energy Directorate, 2021r). The report includes a proposal on which areas should be examined. When NVE has received the notification, it is sent for consultation, **with a 6-week** consultation deadline. NVE also arranges a public meeting in connection with the hearing (The Norwegian Water Resources and Energy Directorate, 2021r);

Step 2 ➔ Environmental Impact Assessment (The Norwegian Water Resources and Energy Directorate, 2021m):

After consultation with the NVE, NVE determines an impact assessment program (EIA program). The developer is responsible for ensuring that the technical and professional studies stipulated in the EIA program are carried out (The Norwegian Water Resources and Energy Directorate, 2021n). The developer can choose who will carry out the professional studies, but the persons in question must be professionally qualified and have professional integrity;

Step 3 ➔ Application (The Norwegian Water Resources and Energy Directorate, 2021c):

- **Wind power plants with an installed capacity of up to 10 MW** applies the Energy Act Articles § 3-1. Even if the measure is not subject to notification and impact assessment requirements which generally apply to wind power plants over 10 MW, **possible significant consequences of the action must nevertheless be described thoroughly as part of the license application** (The Norwegian Water Resources and Energy Directorate, 2021d). From 1 January 2015, according to the Energy Act, the licensing procedure has changed so that the **municipalities can process applications for the development of smaller wind power plants of up to 1 MW** and with the limit of **five wind turbines** within each project according to the Planning and Building Act.
- For **wind power plants with an installed capacity of over 10 MW,** after the EIA process is concluded, the **developer must prepare an application for obtaining a license** (The Norwegian Water Resources and Energy Directorate,

2021d). The application must contain a more detailed description of the project and the EIA results.

Once the NVE has received the application and carried out the EIA, the **documents are sent to the relevant authorities for consultation**. (The Norwegian Water Resources and Energy Directorate, 2021d). The NVE arranges an open meeting with the interested parties during the consultation period. After all consultation statements have been reviewed, NVE inspects the planned area (The Norwegian Water Resources and Energy Directorate, 2021d);

Step 4 ➔ Decision (The Norwegian Water Resources and Energy Directorate, 2021j):

Based on the application, the EIA comments received from the concerned entities, and NVE's professional knowledge of wind power project development, the NVE makes a comprehensive assessment of the project in question and decides whether to approve or not decline the planned wind power plant project. Assessments on which the NVE decision is based are presented in a separate document, called "background for decision";

Step 5 ➔ Complaint procedure (The Norwegian Water Resources and Energy Directorate, 2021g):

The developer and other persons having a legitimate interest in the decision taken may appeal against it **within three weeks** of receipt of the notification. The complaint must be addressed to the **Ministry of Petroleum and Energy** and sent to the NVE to assess whether the complaints contain new information that provides a basis for changing or revoking the decision. If NVE chooses to uphold the decision, the complaints will be sent to the Ministry of Petroleum and Energy for processing.

Step 6 ➔ Follow-up of the granted license (The Norwegian Water Resources and Energy Directorate, 2021k):

Before the developer can start construction, the NVE and the Norwegian Environmental Protection Agency must approve the **environmental, transport and construction plan** (ETC) and **a detailed plan for the project**. The NVE supervises the development and operation of wind turbines, which, among other things, ensures that the area is restored when the construction work is completed. **It is a standard condition in all licenses for wind**

power that when the license period is over, the area must be returned to the original state of nature as far as possible (The Norwegian Water Resources and Energy Directorate, 2021l).

In Norway, licenses for wind power plants are granted for 25 to 30 years. Closure of a power plant has not been an issue because no Norwegian wind turbines have reached this phase yet. According to the Energy Act, a wind power plant cannot be closed down without a permit from the NVE (The Norwegian Water Resources and Energy Directorate, 2021l). A plan would be required the NVE approves that to ensure that environmental considerations are taken into account during the process that later will have follow-up supervision to acquire such a permit. The licenses stipulate that before the end of the 12th year of operation of the power plant, the licensee must submit to the NVE a specific proposal for a guarantee that ensures cost coverage for the removal of the wind turbines and the return of the area in the previous state before the wind turbines were installed, as a security for the NVE's requirements (The Norwegian Water Resources and Energy Directorate, 2021l). Wind power plants that have been commissioned in earlier years, at this point, have come so far in the operating period that this is starting to become relevant, and the NVE will follow up on this.

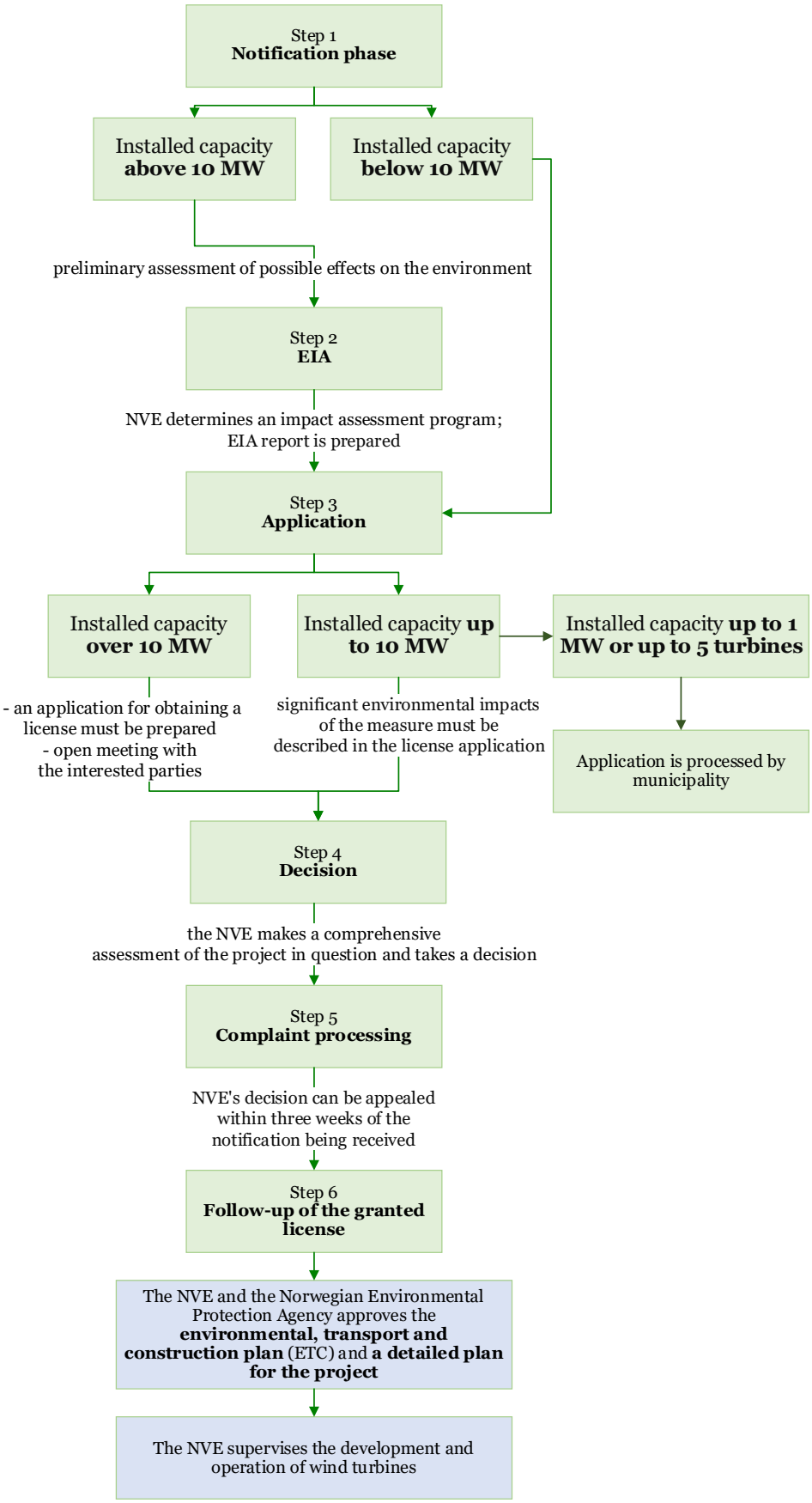

Fig.2.2. Wind power plant development process (The Norwegian Water Resources and Energy Directorate, 2021r)

2.1.1. The environmental, transport and construction plan for wind farm development

Wind measurements should be taken over time to determine where wind turbines should be placed in the planning area to ensure optimal production (The Norwegian Water Resources and Energy Directorate, 2021x). It is costly to take wind measurements, so it would not be appropriate to make investors and developers spend millions of crowns on wind measurements until it is known whether the project will be licensed or rejected (The Norwegian Water Resources and Energy Directorate, 2021y). Wind measurements are therefore often carried out after the licence has been granted.

Wind turbine technologies have developed rapidly in recent years, with more giant wind turbines appearing on the market that are more productive than the existing ones (The Norwegian Water Resources and Energy Directorate, 2021y). The type of wind turbines to be installed that was chosen when the developers applied for the licence may have become outdated as the project would be nearing the construction phase (The Norwegian Water Resources and Energy Directorate, 2021y). However, a new turbine type may mean that turbine locations need to be changed; in addition, the size and number of turbines are only clear once the developer has contracted a supplier (The Norwegian Water Resources and Energy Directorate, 2021y).

The turbine supplier in question always carries out a so-called 'micrositing' of the project, i.e. an analysis of where the wind turbines should be located in the planning area to obtain the best possible design (The Norwegian Water Resources and Energy Directorate, 2021y). Like wind surveys, this is a large and expensive part of the project, so developers do not spend money on it unless a licence has been obtained (The Norwegian Water Resources and Energy Directorate, 2021y).

A license is a permit granted by the NVE to develop wind farm projects (The Norwegian Water Resources and Energy Directorate, 2021y). A permit for a wind farm can be understood as a framework permit, and the person/legal entity who receives the license must comply with the requirements set by the NVE (The Norwegian Water Resources and Energy Directorate, 2021y). Permissions granted to developers or owners of wind power plants contain both general requirements and requirements that depend on the licence's location(The Norwegian Water Resources and Energy Directorate, 2021y). The requirements may therefore vary somewhat from project to project. An example of a requirement may be that the developer must lay roads and turbines outside areas where particular red-listed

habitat types or animal species live, as well as other requirements, may be related to noise and shadow cast from the turbines in the wind turbine (The Norwegian Water Resources and Energy Directorate, 2021y).

After the license has been granted, the developer must make a detailed plan and environmental, transport and construction plan. The NVE must approve; therefore, the wind farm's construction will start (The Norwegian Water Resources and Energy Directorate, 2021ad). **The environmental, transport and construction plan** shall describe how the power plant is to be built in compliance with the restrictions set out in the licence granted and how environmental considerations that have emerged in the licensing process are to be taken into account (The Norwegian Water Resources and Energy Directorate, 2021ae). The plan should include the site and all supporting infrastructure, such as construction routes, mass removal, waste dumps, platforms and technical engineering structures (The Norwegian Water Resources and Energy Directorate, 2021ae).

The detailed plan shall specify the construction plans for the wind power plant. The plan must contain a technical description of all the building components and installations indicate their location on a map (The Norwegian Water Resources and Energy Directorate, 2021ae). The plan shall also account for any changes in the power plants impact on the environment and society if the development solution in the detailed plan has been changed about what was stated in the license application (The Norwegian Water Resources and Energy Directorate, 2021ae). **The detailed plan and the environmental, transport and construction plan are closely connected and can be submitted by the licensee as a single document or as separate plans for approval by NVE**.

The timeframe for **examining the environmental, transport and construction plan and detailed plan is basically around six months**, but this will depend on whether the plan meets the requirements for wind power plant set out in the guidelines (The Norwegian Water Resources and Energy Directorate, 2021ae). In most cases, consultation meetings with the affected municipality(ies) are held before the approval decision is taken (The Norwegian Water Resources and Energy Directorate, 2021ae). **The NVE often carries out a field inspection before a decision is taken**. If the plan is sent for approval in winter, the total time spent waiting for acceptable inspection conditions may be considerably longer (The Norwegian Water Resources and Energy Directorate, 2021ae). The environmental, transport and construction plan should be prepared in consultation with the affected municipality(ies), the landowner(s) and another licence holder (s) unless otherwise specified in the licence. The NVE cannot approve the plan until such dialogue occurs or the

NVE has consulted the plan (The Norwegian Water Resources and Energy Directorate, 2021ae).

2.2. Main steps for solar power system implementation

Solar power makes a small part of power production in Norway but is the fastest-growing power generation technology. At the end of 2020, about 160 MWp had been installed in Norway, with around 40 MWp installed during 2020 (The Norwegian Water Resources and Energy Directorate, 2021z). This corresponds to annual power production of about 0.14 TWh (The Norwegian Water Resources and Energy Directorate, 2021aa). Solar power plants can be divided into grid-connected and stand-alone installations, such as traditional cubicles. Almost 90 per cent of solar installations in Norway are currently connected to the grid. About 5 per cent of the PV plants in Norway are larger plants with a capacity of more than 50 kWp, but they account only for half of the generation capacity (The Norwegian Water Resources and Energy Directorate, 2021aa).

Solar power plants for the production and sale of electricity are subject to licensing by the Energy Act. **Solar power plants subject to a license are also** covered by the Planning and Building Act's regulations on **Environmental Impact Assessment** (The Norwegian Water Resources and Energy Directorate, 2021o). **According to the Energy Act, solar power plants with a voltage of 1000 VAC/1500 VDC or less do not need a license**. These will typically be smaller solar power plants installed on buildings and connected to low-voltage plants (The Norwegian Water Resources and Energy Directorate, 2021p). **This type of solar plant may require a building application** by the Planning and Building Act.

Step 1 ➔ Project development before application (The Norwegian Water Resources and Energy Directorate, 2021w):

Before submitting a license application to the NVE, the **developer should verify land ownership and inform local authorities and relevant professional authorities such as the State Administrator and the county municipality**. Solar power plants are subject to EIA requirements (*Impact Assessment Regulations, Article 7(1)(a) - measures in Annex II that the Energy must assess Water Resources or Watercourse Regulation Act*) (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019a). Persons with appropriate professional competence must carry out the EIA.

Step 2 ➔ Application and environmental impact assessment (The Norwegian Water Resources and Energy Directorate, 2021e):

As mentioned in the previous step, solar power plants are covered by the requirements for impact assessment, the Impact Assessment Regulations. Therefore, the developer must **submit an EIA report** of all possible impacts the measure can have on the environment and society. Solar power plant developers should be aware of the rules and practices related to the EIA (The Norwegian Water Resources and Energy Directorate, 2021f).

Step 3 ➔ Consultation on the application and public hearing (The Norwegian Water Resources and Energy Directorate, 2021i):

The NVE will refer the matter to the relevant advisory entities for consultation. **The consultation date is usually published in local newspapers. It is appropriate to hold a public meeting on the project with local/regional authorities and the community.** If it becomes apparent during the consultation that the knowledge base is not good enough, the NVE may request additional reports or information from the developer.

Step 4 ➔ The NVE's assessment and decision (The Norwegian Water Resources and Energy Directorate, 2021s):

If the **NVE considers that it has gained sufficient information about the project to be developed, it decides on the case.** The NVE can either grant the solar PV plant permission or reject the application. Before giving permission, the NVE assesses the environmental and social impacts based on the submitted information by the developer, the comments received, and the NVE's expertise(The Norwegian Water Resources and Energy Directorate, 2021t). Decisions are sent to the developer, the relevant authorities, the affected landowners and licensees and those who have submitted comments on the project to be developed.

Step 5 ➔ Handling of complaints (The Norwegian Water Resources and Energy Directorate, 2021h):

According to Chapter VI of the Law on Public Administration, **the developer and other persons having a legitimate interest may appeal against decisions taken by the NVE within three weeks** of receiving notification of the decision. Complaints against decisions of the NVE must be addressed to the Ministry of Petroleum and Energy and

sent to the NVE. The NVE will assess whether the complaints contain new information that would warrant a change or reversal of our decision (The Norwegian Water Resources and Energy Directorate, 2021h). If NVE chooses to uphold the decision, the complaints will be sent to the Ministry of Petroleum and Energy for appeal. The Ministry's decision cannot be appealed.

Step 6 ➔ Terms, follow-up and supervision (The Norwegian Water Resources and Energy Directorate, 2021ab):

The NVE and/or the Ministry of Petroleum and Energy may impose conditions that must be met before the developer can start the construction process. **A licence is an authorisation to construct, own and operates the power plant by the conditions set out in the licence** (The Norwegian Water Resources and Energy Directorate, 2021ac). **The NVE monitors whether the facility is constructed, owned, and operated according to the requirements and conditions set out in the licence**.

An application for a **construction license** for a solar power plant should be designed according to the information below (The Norwegian Water Resources and Energy Directorate, 2021f):

- Introduction - the application should start with a summary that describes the project and the impact of the measures. The introduction should also provide information about the facility's location (municipality and county), the developer or legal entity, which permit is applied for, regarding the Energy Act § 3-1; information on ownership and operating conditions. The planned time for commencement and commissioning of the plant;
- measure description and location. Description of the planned building area, and a brief explanation of the planning status and why the current site has been chosen;
- description of the technical project design, including technology choices for the solar power plant (e. g., fixed or movable panel, foundation solution, etc.), design of roads, transformer buildings and any construction sites;
- description of any emergency preparedness and safety systems.

The measure should be shown on a map on a relevant scale. The maps must be of such a quality that the reader quickly understands the location of the measure about known place

names and other relevant map information. Shape files showing the planning area should be attached to the application.

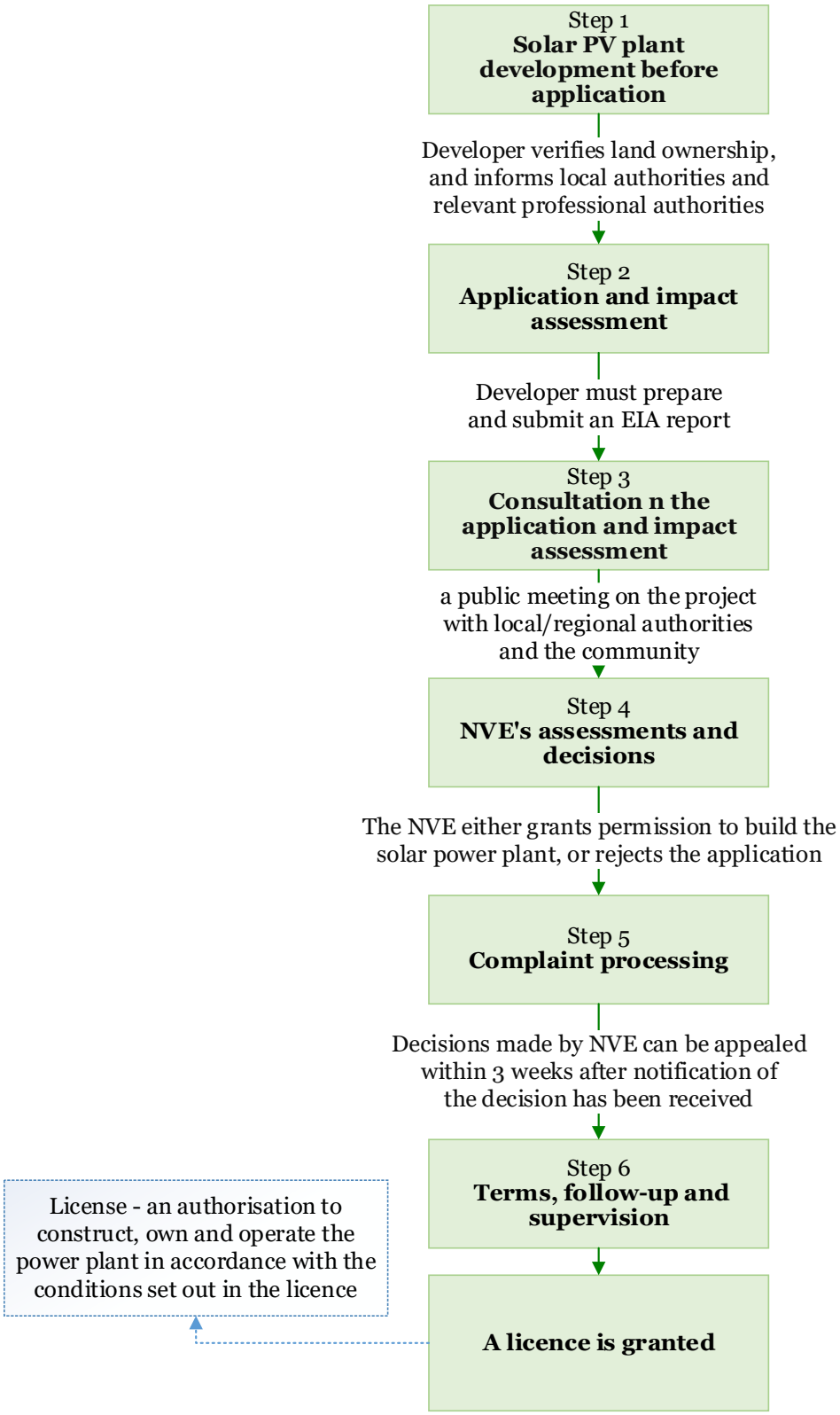

Fig.2.3. Solar PV power plant development process (The Norwegian Water Resources and Energy Directorate, 2021w)

2.3. Territorial planning

Municipal plans and area zoning plans are the municipality's most important tools for managing land use and providing guidelines for detailed spatial planning and building matters (The Norwegian Water Resources and Energy Directorate, 2019a). The municipality's overall planning lays down frameworks and guidelines that provide opportunities or limitations for solutions at a detailed level. The NVE, therefore, prioritises providing input to municipal plans and zoning plans (The Norwegian Water Resources and Energy Directorate, 2019b). **Municipal plans and zoning plans** shall safeguard national and significant regional interests related to (The Norwegian Water Resources and Energy Directorate, 2019b):

- safety against floods, erosion, quick clay landslides and landslides in steep terrain;
- public interests in watercourses and groundwater;
- facilities for energy production and transmission of electric power.

To closely follow the municipalities with major problems related to the areas subject to the NVE liability, the NVE prioritises municipal plans and zoning plans as a consultative party on planning issues (The Norwegian Water Resources and Energy Directorate, 2019e). The NVE will also prioritize zoning plans where the municipality requests assistance for specific professional issues (The Norwegian Water Resources and Energy Directorate, 2019f).

2.3.1. Maps and location information

The municipality shall ensure an updated public map basis for the purposes covered by the Planning and Building Act (Ministry of Local Government and Modernization, 2021a). The state shall make national map data available to all municipalities. State, regional and municipal bodies shall facilitate on-site information so that the information is easily accessible for planning and construction case processing (Ministry of Local Government and Modernization, 2021b). The map basis must also be used for other public and private purposes. **The municipality may require that the person submitting a plan proposal or application for measures prepare a map when this is necessary to take a position on the proposal or application** (Ministry of Local Government and Modernization, 2021b). The municipality can incorporate such maps on a public map basis. Local authorities shall have a planning register, which provides information on

existing spatial plans and other regulations governing the use of land (Ministry of Local Government and Modernization, 2021b).

Tasks and considerations in planning according to the Planning and Building Act shall (Ministry of Local Government and Modernization, 2021b):

- set goals for the physical, environmental, economic, social and cultural development in municipalities and regions, clarify societal needs and tasks, and state how the tasks can be solved;
- secure the land resources, qualities of the landscape and the protection of valuable landscapes and cultural environments;
- promote a good built environment, living environment and educational and living conditions in all parts of the country;
- take climate considerations into account by reducing greenhouse gas emissions and adapting to expected climate change, including energy supply, area, and transport solutions.

The responsibility for planning according to the law lies with the **municipal councils, regional planning authorities and the King** (cf. §§ 3-3 to 3-7) (Ministry of Local Government and Modernization, 2021b). **Public entities and private individuals have the right to submit plan proposals** by the rules set in the Planning and Building Act (§§ 3-7 and 12-3 , cf. § 12-11) (Ministry of Local Government and Modernization, 2021b). All public entities have the right and duty to participate in planning where it affects their field of activity or plans and decisions and provide planning authorities with information relevant to planning (Ministry of Local Government and Modernization, 2021b). **The National Administrator** ensures that local authorities comply with their planning obligations under the law. **The Regional Planning Authority guides and assists local authorities in their planning tasks**. The regional planning authority is the regional council (Ministry of Local Government and Modernization, 2021b).

For all regional and municipal plans and zoning plans that may have significant environmental and social impacts, a planning programme shall be prepared as part of the notice of initiation as a basis for the planning work (Ministry of Local Government and Modernization, 2021b). The planning programme should consider the purpose of the planning work, planning process with timetables and participants, modalities for participation, particularly about groups likely to be particularly affected, what alternatives will be considered, and the need for studies. **Proposals for**

planning programmes are sent out for consultation. They are typically submitted for public examination at the same time as the notice of commencement of planning plans (Ministry of Local Government and Modernization, 2021b). The planning authority usually determines the planning programme.

All plan proposals under the Planning and Building Act must, when subject to public examination, have a plan narrative describing the purpose, main content and effects of the plan and its relationship to the guiding principles and guidelines that apply to the area (Ministry of Local Government and Modernization, 2021b). For regional plans and municipal plans containing guidelines or frameworks for future development and for zoning plans which may have significant environmental and social impacts, the plan description shall provide a separate assessment and description on EIA and of the environmental and social impacts of the plan (Ministry of Local Government and Modernization, 2021b).

When preparing development plans, the **planning authority shall ensure that a risk and vulnerability analysis is carried out in the planning area** or such an analysis(Ministry of Local Government and Modernization, 2021b). The study shall identify all risks and vulnerability factors relevant to determining whether the site is suitable for development and any changes to those conditions due to the proposed development (Ministry of Local Government and Modernization, 2021b). The planning authority shall adopt in the development plan such requirements for growth, including prohibitions, as are necessary to prevent harm and damage (Ministry of Local Government and Modernization, 2021b).

The state and regional authority concerned may submit an objection to a proposal for the area part of the municipal plan and zoning plan in matters which are of national or significant regional importance, or which for other reasons are of significant importance to the entities area of responsibility (Ministry of Local Government and Modernization, 2021b). Other local authorities may object to such proposals on issues of significant importance to the local authority's residents, businesses or natural or cultural environment, or the local authority's activities or planning (Ministry of Local Government and Modernization, 2021b). Objections must be submitted as soon as possible and no later than the deadline for consultation on the draft plan (Ministry of Local Government and Modernization, 2021b).

Where necessary for the protection of national or regional interests, the King, after consulting the relevant municipalities and regional planning authorities, **may prohibit for a period of up to ten years** the implementation of specifically defined building or construction measures in specific geographical areas or throughout the country without the consent of the Ministry, or may decide that such measures may be implemented without such

consent only by a binding part of a municipal plan or spatial plan drawn up by this Act (Ministry of Local Government and Modernization, 2021b). The King may extend the prohibition for five years. Before the decision is taken, the proposed regulation shall be published for consultation and public inspection in the municipalities concerned, with a period of six weeks for notice to be given, and shall be made available in at least one newspaper usually read locally and in the electronic media (Ministry of Local Government and Modernization, 2021b).

When the implementation of important state or regional development, construction or protection measures makes it necessary, or when other societal considerations so require, the Ministry may recommend the relevant municipality to prepare an area partly for the municipal plan or zoning plan according to Chapters 11 and 12 of the Planning and Building Act (Ministry of Local Government and Modernization, 2021b). Under the same conditions, the Ministry may prepare and adopt such a plan. The ministry then is the authority of the municipal council. The municipality in question is obliged to provide the ministry with necessary assistance in the planning work. **In individual cases, the Ministry may decide that a final license for a power production facility under the Energy Act**, **the Water Resources Act or the Watercourse Regulation Act shall automatically affect a state area plan** (Ministry of Local Government and Modernization, 2021b). The Ministry's decision under this subsection may not be appealed.

Planning and Building Act § 11-8. "Consideration zones" determines that the area part of the municipal plan shall, to the extent necessary, show considerations and restrictions that are important for the use of the area. Considerations and conditions included in the second paragraph of this Act**, letters (a) to (f), can be marked in the area section as consideration zones with associated guidelines and regulations**. Multiple zones can be specified for the same area (Ministry of Local Government and Modernization, 2021b). To the necessary extent, the consideration zone shall be specified which provisions and guidelines apply or shall apply under the Act or other acts to safeguard the consideration shown by the zone. The following consideration zones can be determined (Ministry of Local Government and Modernization, 2021b):

- Safety, noise and danger zones indicate the cause of danger or environmental risk. Provisions may be made that prohibit or set conditions for measures and/or activities within the zone (Article § 1-6);
- zone with special requirements for infrastructure with an indication of the type of infrastructure. Provisions may be made for requirements for infrastructure in a

development area, both as a prohibition or injunction under Article § 11-9 No. 3 and No. 4.;

- zone with a special focus on agriculture, reindeer husbandry, minerals, outdoor life, green structure, landscape or the conservation of the natural or cultural environment, with an indication of interests;
- zone restricted until a decision is taken under the Planning and Building Act or other legislation, or restricted under such a legal basis, stating the purpose. Restrictions pending a decision under the Planning and Building Act or other legislation are limited to four years but may be extended by four years upon application to the Ministry;
- zone with requirements for joint planning of several properties, including specific forms of cooperation or ownership and conversion and redevelopment. This zone's provisions may provide the application of joint planning to several properties within an area and the use of specific implementation tools. Regulations may also be adapted based on Article 11(9)(3). The rules for the zone may provide for the application of joint planning to several properties within the zone and the use of specific implementation instruments. Regulations may also be adapted based on Article 11-9(3);
- the zone where the existing zoning plan remains unchanged. The municipality assesses whether the zoning plans are consistent with national and regional interests through this zone of consideration.

The municipality may, regardless of the purpose of the area, adopt provisions for the area part of the municipal plan regarding (Ministry of Local Government and Modernization, 2021b):

- requirements for a zoning plan for certain areas or for certain measures, including that there must be area regulation before detailed regulation can be adopted;
- environmental quality, aesthetics, nature, landscape and green structure, including temporary and mobile constructions and facilities;
- consideration to be given to the preservation of existing buildings and other cultural environments;
- matters that are to be clarified and elucidated in further regulatory work, including provisions on environmental follow-up and monitoring.

2.3.1. Zoning and detailed plans

A zoning plan is a detailed land-use planning map with provisions for the use, protection and design of areas and physical surroundings (Ministry of Local Government and Modernisation, 2014). **Zoning plans shall be adopted by the municipal council but may be prepared by both public and, in some cases, private parties** (Ministry of Local Government and Modernisation, 2014). The level of detail may differ depending on the plan's purpose and whether more detailed zoning plans are scheduled to be prepared for parts of the plan when the time of development is approaching (Ministry of Local Government and Modernisation, 2014).

Zoning plans shall always be prepared before permission for major building and construction work is granted (Ministry of Local Government and Modernisation, 2014). The municipality may introduce a land-use requirement stating that zoning plans shall be developed in other cases. The municipality shall assess the need for preparing zoning plans in the municipal planning strategy and the land use element of the municipal master plan. **Zoning plans are not required to be prepared for energy plants subject to a licensing requirement. However, the municipality may prepare plans for such plants** (Ministry of Local Government and Modernisation, 2014).

There are two zoning plans: area zoning plans and detailed zoning plans (Ministry of Local Government and Modernisation, 2014). The municipality can prepare zoning plans in the form of area zoning plans for several properties or larger areas. The municipality may leave it to other authorities or private parties to prepare proposals for area zoning plans within limits adopted by the municipality (Ministry of Local Government and Modernisation, 2014).

Everyone has a right to prepare proposals for detailed zoning plans (Ministry of Local Government and Modernisation, 2014). Proposers of private detailed zoning plans are entitled to the municipality's proposal received and considered(Ministry of Local Government and Modernisation, 2014). Such consideration shall include taking a stance on whether the proposal shall be forwarded and circulated for public comment. Planning proposals must comply with the main features and limits of overriding plans. The developer’s job iso assess the consequences of major deviations about such plans (Ministry of Local Government and Modernisation, 2014). Detailed zoning plans are suitable for smaller areas and for implementing development projects and other initiatives. **Private developers must start building projects within five years once a detailed zoning plan has**

been submitted (Ministry of Local Government and Modernisation, 2014). On application, the municipality may grant a two-year extension of the deadline (Ministry of Local Government and Modernisation, 2014). The application should be granted unless there are weighty grounds for rejecting it.

An adopted zoning plan is binding for future land use in the area, meaning projects or activities that contravene the plan are not permitted unless dispensation is granted (Ministry of Local Government and Modernisation, 2014). The legal effect of the plan applies to the implementation of new projects. However, in some cases, planning provisions may also lead to more stringent requirements for existing activities, such as noise requirements(Ministry of Local Government and Modernisation, 2014).

Suppose a zoning plan submits a building application. In that case, it shall be granted if the project is by the plan and the provisions relating to building applications (Ministry of Local Government and Modernisation, 2014). Zoning plans form the basis for expropriation. Zoning plans shall be considered under specific rules for public participation. Private parties can submit proposals for zoning plans in connection with, for example, a building project (Ministry of Local Government and Modernisation, 2014).

Notice shall be given of the planning work. The start-up of the planning work shall be announced before a zoning plan proposal is prepared (Ministry of Local Government and Modernisation, 2014). Suppose the plan has a significant impact on the environment or society. In that case, a planning proposal shall be prepared, sent for consultation, and circulated for comment with a deadline of at least **six weeks** (Ministry of Local Government and Modernisation, 2014). Public agencies and other interested parties involved shall be notified of the planning work simultaneously as landowners, lessees and neighbours to the planning area affected by the proposals (Ministry of Local Government and Modernisation, 2014). Planning proposals shall be sent for a consultation with a deadline of at least six weeks.

Private proposals for detailed zoning plans shall be presented to the municipality in a meeting so that the municipality is informed about the content and limits of the plan (Ministry of Local Government and Modernisation, 2014). The municipality can clarify the requirements for a planning proposal. At the same time, it may provide advice and assistance in the planning work (Ministry of Local Government and Modernisation, 2014). If the plan conflicts with an overriding plan, the developer must assess the consequences of the deviation from the overriding plan (Ministry of Local Government and Modernisation, 2014). The municipality decides whether the plan shall be put forward. The municipality can also

demand that an area zoning plan be prepared when further clarification is needed before the detailed zoning plan Ministry of Local Government and Modernisation, 2014).

Within twelve weeks, the municipality shall decide whether the proposal, with any alternatives, shall be put forward and circulated for comment (Ministry of Local Government and Modernisation, 2014). The municipality is free to make alternative proposals, make changes to plans before the consultation round and circulation for comment, or choose not to submit the planning proposal (Ministry of Local Government and Modernisation, 2014). If the municipality does not wish to submit the proposal, the proposer shall receive a letter explaining why (Ministry of Local Government and Modernisation, 2014). A private proposer cannot appeal such a decision. If the proposal is by the municipal master plan, the proposer can demand that the municipal council consider whether the area shall be subject to zoning. Directly affected parties shall be notified of the final zoning decision, and the decision shall be announced.

Suppose a planning proposal and a building application are to be processed jointly. In that case, this requires the consent of both the municipality and the proposer/developer (Ministry of Local Government and Modernisation, 2014). The municipality will also alert the relevant rights holders to the building application. The deadline for issuing statements is **six weeks**. Any objections and comments should be addressed to the municipality. **The plan must be formally adopted before a building permit can be granted**. **Separate decisions must be made regarding the building application and the planning matter** (Ministry of Local Government and Modernisation, 2014).

The same rules apply to alterations and revocation of zoning plans to prepare plans (Ministry of Local Government and Modernisation, 2014). The municipal council or the delegated authority can make decisions regarding minor alterations or supplements within the main features of the zoning plans (Ministry of Local Government and Modernisation, 2014). Minor alterations are changes that have no significant bearing on the affected parties or interests.

➔Duration of the process
➔ Solar PV changes in zoning plan 24 weeks (if necessary)

➔Wind farm	the examination of the environmental, transport and construction plan and detailed plan for issuing the license for development - 6 months

2.3.2. Marking of wind turbines

High installations on the ground, such as wind turbines, must be marked appropriately. This is to ensure safe air traffic (NRK Nordland, 2021a). The rules state, among other things, that all obstacles over **60 meters must be visually marked**. Both with colour marking and obstacle lights (NRK Nordland, 2021b). The NVE and Luftfartstilsynet refer to the regulation BSL E 2–1 and state that the rules determine that (NRK Nordland, 2021b):

- there are rules for marking objects with a height of more than 60 meters on the ground to avoid collisions between aircraft and objects on the ground. It can be anything from wind turbines to air spans, antennas and bridges.
- wind turbines with a height of up to 150 meters (but not included) shall be marked with medium intensity obstacle lights (red solid or flashing) type B or C. Wind turbines with a height of (from) 150 meters shall be marked with high-intensity obstacle lights type B (white flashing light);
- each mandatory turbine must have two obstacle lights located on top of the wind turbine;
- an owner of a wind farm can apply for perimeter marking. Perimeter marking must clearly show the boundaries of a wind turbine. The Civil Aviation Authority of Norway also has the right to demand that a wind turbine at the highest point in a wind turbine must be marked.

2.4. Environmental Impact Assessment

The main purpose of Regulation on Impact Assessment is to ensure that consideration for the environment and society is taken into account during the preparation of plans and measures, and when a decision is made as to whether and on what terms plans or measures can be implemented (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b).

Regulations on Impact Assessment (Article 6) "Plans and measures that must always be impact assessed and have a plan program or notification" states that the following plans and measures must always be impact assessed and have an EIA programme or report prepared

(Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b):

a) the area part of the municipal plan under § 11-5 and regional plans under the Planning and Building Act § 8-1, municipal plans under § 11-1, and area regulations under § 12-2 when the plans set limits for measures in Annexes I and II;
b) zoning plans under the Planning and Building Act for measures in Appendix I. Exceptions to this are zoning plans where the specific measure has been impact assessed in a previous plan and where the zoning plan is by this previous plan;
c) Annexe I deals with laws other than the Planning and Building Act.

The county municipality is responsible for regional and municipal plans (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b). The authority responsible for plans and measures under letters (b) and (c) is set out in Appendix I. For measures under the letter (b) where the implementation of the measure does not require a new plan, the authority controlling the levels of pollution is the responsible authority if the measure requires a permit under the Pollution Control Act (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b).

Measures listed below and plans are always subject to impact assessments under other legislation. However, they do not always have to be reported (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b):

- measures in Annex II that are dealt with by the Energy, Water Resources or Watercourse Regulation Act (**solar PV**);
- plans and programs by other laws that set the framework for measures in Annexes I and II and adopted by a ministry (**wind power plants**).

Regulations on Impact Assessment Article 8 “Plans and measures to be impact assessed if they may have significant effects on the environment or society” states that the following plans and measures shall be impact assessed if they may have significant effects under Article 10 of this Law, but do not have an EIA programme or report to be prepared (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b):

a) Zoning plans for measures in Annex II. Exceptions to this are zoning plans where the specific measure has been impact assessed in a previous plan and where the zoning plan is by this previous plan;

b) measures in Annex II which are dealt with by a law other than the Planning and Building Act.

Plans by the Planning and Building Act and measures by other legislation that must always have a planning program or notification and impact assessment are described in Annex I (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b):

Plans and measures	Responsible authority and law (s) the processing is linked to
Wind power plants with an installed capacity of more than 10 MW (Annex II covers minor measures)	➢ Norwegian Water Resources and Energy Directorate. ➢ The Energy Act.

Plans by the Planning and Building Act and measures by the other legislation that is to be assessed in more detail are described in Annex II (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b):

Plans and measures		Responsible authority and law (s) the processing is linked to
3. ENERGY SYSTEMS		
a)	Industrial plants for the production of electrical energy, steam and hot water require a license by the Energy Act.	➢ Norwegian Water Resources and Energy Directorate. ➢ The Energy Act.
in)	Installations are subject to licensing for wind energy for power production.	➢ Norwegian Water Resources and Energy Directorate. ➢ The Energy Act.

Before the power plant planning work begins, according to the Planning and Building Act (Article 12-8), and **no later than six weeks after** the proposer has provided the information under Article 9 of this Act, **the responsible authority shall be based on all available information, decide whether the plan may have significant effects on the environment or society** (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b).

If the responsible authority finds that the plan may significantly affect the environment or society, the plan shall be subject to an impact assessment. The responsible authority's decision of whether the plan may significantly affect the environment or society shall be substantiated (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b). The reasons shall be stated in the notification and announcement of the start of the planning work and the presentation of the plan proposal for public inspection (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b).

The responsible authority determines the plan or assessment program based on the proposal prepared by the developer and the requirements for the impact assessment (Article 16) (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b). The EIA planning or assessment program shall usually be determined **within ten weeks** of the deadline for submitting consultation statements (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b). Those who have submitted consultation statements must be made aware of the established program. The responsible authority shall provide the necessary guidelines for the planning or assessment work. After consultation, the authority might suspend further consideration of the case without adopting the planning or investigation programme (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b). This decision must be reasoned.

For regional plans, municipal plans and plans under other laws than the Planning and Building Act, the impact assessment may be limited to explaining the effects the plan or program may have at an overall level (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b). Exceptions are provided for when the plan implements specific measures.

Based on the consultation and its assessments, the responsible authority shall decide whether the EIA satisfies the requirement or whether there is a need for additional assessments or additional documentation (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b). Suppose there is a need for additional studies. In that case, these must be sent for consultation to those who have given consultation statements to the plan proposal or application and any other affected authorities. The deadline for submitting consultation statements for the additional report **shall not be shorter than two weeks** (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b). When considering the plan or

measure, the responsible authority shall consider the impact assessment and the consultation statements received.

When the responsible authority has decided on the case, it shall be made known to the public and the authorities concerned. The documents must be electronically available online (Ministry of Climate and Environment & Ministry of Local Government and Modernization, 2019b).

2.4.1. EIA for solar PV plants

Experiences from already built solar power plants In Norway and abroad should be used as a basis for the EIA (The Norwegian Water Resources and Energy Directorate, 2021). If the evidence base is not good enough, the NVE may request further studies or additional information. The application and impact assessment should be adapted to local circumstances (The Norwegian Water Resources and Energy Directorate, 2021). Both positive and negative impacts of the measure should be described. Possible negative effects on the environment and society must be described, for example (The Norwegian Water Resources and Energy Directorate, 2021f):

- *Visual effects* - a report on the plant's visual impact on buildings, landscapes, outdoor spaces and the visual impact on surrounding cultural monuments and the environment. The visual impact shall be illustrated by photorealistic images from relevant vantage points and depicted on maps at an appropriate scale. The map should show all significant landscapes, monuments and surroundings, and significant outdoor spaces affected. **The NVE recalls the requirement to survey cultural monuments by Article 9 of the Law on Cultural Monuments**;
- *Biodiversity* - The biodiversity study shall provide a basis for assessing the Biodiversity Act Articles 8-12. For an overview of the valuable or red-listed habitat types and species that may be affected by the measure - Nature in Norway (NiN), Norwegian Red List of Species (2015) and Norwegian Red List of Habitat Types (2018). Description of the impact of the measure on large unspoilt natural areas and protected areas. This should be described where the development may affect watercourses, wetlands, and/or groundwater. Valuable habitats and red-listed species likely to be affected by the development shall be described and mapped in conjunction with the measure;

- *Contamination* - a description of the sources of pollution and waste during the construction and operation phases of the solar plant. Description of potential impacts on drinking water and sources of backup drinking water. The **Norwegian Food Safety Authority** and the owners/responsible managers of the local drinking water companies should be contacted for documentation of the drinking water sources that may be affected;
- *Agriculture and outfield resources* - an assessment of the impact of the measure on agriculture and forestry, including grazing, hunting and reindeer husbandry, if applicable. The management of the site with agriculture should be described. For more information on cultivated/ arable land, refer to the Ministry of Agriculture and Food Circular M-2013-1, Section 6.2. Local and regional agricultural authorities should be contacted to collect information on current and planned land use for agriculture;
- *Other business and social interests* - description of how the measure can affect the economy in the municipality concerned, including employment and value creation locally and regionally. The description must include both the construction and operation phases. Assessment of the possible effects on tourism;
- *Return* – to provide an overview of the plan for closure of the plant at the end of its lifetime and in the event of bankruptcy.

➔ Duration of the process	
➔ Solar PV	*EIA (if necessary) - 6 months**
➔ Wind farm	*EIA (if necessary) - 6 months**

**no timeline given, assumption*

2.5. Construction

According to the Planning and Building Act, "Case Processing" planning by the law shall contribute to coordinating state, regional and municipal tasks and provide a basis for decisions on the use and protection of resources (Ministry of Local Government and Modernization, 2021b). Construction case processing according to the law shall ensure that measures are by law, regulations and planning decisions. Individual measures must be appropriately carried out. Planning and decisions must ensure transparency, predictability and participation for all affected interests and authorities (Ministry of Local Government and

Modernization, 2021b). **Chapters 2 and 14 only apply to electrical energy transmission or conversion facilities mentioned in the Energy Act Article 3-1 third paragraph** (Ministry of Local Government and Modernization, 2021b).

Measures under the Planning and Building Act mean construction, demolition, alteration, including facade alterations, altered use and other measures related to buildings, structures and facilities, as well as terrain encroachment and creation and alteration of property (Articles 20-1, first paragraph, letters (a) to (m)) (Ministry of Local Government and Modernization, 2021b).

The Planning and Building Act (Chapter 20, Article 20-1) "Measures covered by the building regulations" list such activities (Ministry of Local Government and Modernization, 2021b):

a) construction, extension, addition, substructure or location of a building, construction or facility;
b) significant change or significant repair of measures as mentioned under letter a;
c) facade change;
d) permanent or temporary change of use, significant expansion or significant change of the previous operation of measures as mentioned under letter a;
e) demolition of measures as mentioned in letter a;
f) construction, alteration or repair of building technical installations;
g) division or joining of utility units in homes as well as another redevelopment that entails deviation from the housing;
h) erection of fencing against the road;
i) placement of sign and advertising facilities;
j) location of temporary buildings, structures or facilities;
k) significant terrain encroachment;
l) construction of road, car park and landing site;
m) creation of new land property, new construction property or new land ownership, or creation of new land for attachment that can be valid for more than ten years, or change of boundaries for such cadastral units that can not be treated as boundary adjustment, see the Cadastral law.

The measures referred to in Article 20-1 may not be carried out unless an application has first been sent to the municipality and subsequently authorised it unless listed exceptions (Ministry of Local Government and Modernization, 2021b).

Chapter 21 of the same law states that for further clarification of the framework and content of the power plant to be built, a meeting can be required by the developer or the planning and building authorities and held between the developer, the municipality and other affected professional authorities (Ministry of Local Government and Modernization, 2021b).

An application for a building permit must be in writing and signed by the developer and applicant (Article 21-2) (Ministry of Local Government and Modernization, 2021b). The application must provide the information necessary for the municipality to grant permission for the measure (Ministry of Local Government and Modernization, 2021b). **The application must be accompanied by documents proving that the neighbours have been informed in a lawful manner, as well as by a declaration that those who have a lien on the property to be demolished have been informed** (Article 21-3) (Ministry of Local Government and Modernization, 2021b). Any comments from neighbours or reoccupiers must be attached, together with a statement from the applicant as to what has been done to take them into account. The application must also be accompanied by any decisions or opinions received from another authority if the measure is dependent on it (Article 21-5) (Ministry of Local Government and Modernization, 2021b).

The application can be divided into **basic and operating authorisation** (Ministry of Local Government and Modernization, 2021b. The municipality may allow the subdivision of an application for an operating permit. However, activities cannot start until the establishment permit has been granted (Ministry of Local Government and Modernization, 2021b).

Before the application is submitted, neighbours and remaining residents must be notified by the applicant if they have not been notified in writing that they have no comments on the application (Article 21-3) (Ministry of Local Government and Modernization, 2021b). The notification shall state that possible comments must have reached the applicant within at least **two weeks** after the notification has been sent and the basic material for the application has been made available (Ministry of Local Government and Modernization, 2021b). The notification may be omitted if the landowner's address is unknown or not found in the cadastre.

When the application is complete, the municipality shall serve as soon as possible and **no later than the deadline stated in Article 21-7** of the Planning and Building Act, grant permission if the measure is not in conflict with provisions given in or under this Act (Ministry of Local Government and Modernization, 2021b). In the case processing, the municipality shall use the information provided by the project owner or the responsible

company that the project meets technical requirements (Ministry of Local Government and Modernization, 2021b).

➔ Duration of the process	*not stated*
➔ Solar PV	3-12 weeks
➔ Wind farm	3-12 weeks

2.5.1. Solar PV (micro-generation)

There is no need to submit a building application for installing solar PV if (Oslo kommune, n.d.-a):

- the character of the facade does not change significantly. If a person planning to install solar PV panels is not sure about the need for a building permit, they can contact the local authority, which will provide an assessment;
- the solar energy system will not conflict with provisions or intentions in the zoning plan.

A building application must be submitted in the following cases (Oslo kommune, n.d.-b):

- the solar energy system must be installed on a building that has been classified as protected;
- there is a risk of precipitation on public areas such as streets, pavements and common entrances;
- Solar energy systems have become important for fire safety. This can be the case, for example, when solar energy systems are installed in several residential buildings.

In many cases, the installations are so small that the local authority might grant an exemption from the requirement, even if an application for a solar energy system has been submitted (Oslo kommune, n.d.-b). This can be considered more specifically if a request is made to the relevant authority.

Installation of a solar energy system on single-family houses - dwellings of up to four persons, detached houses, terraced houses and atriums (inclusive) – are subject to building application (Oslo kommune, n.d.-b). The Planning and Building

Agency will assess whether the measure can be permitted under the Planning and Building Act (Oslo kommune, n.d.-b) and whether an application obligation applies if the facade of the building is to be altered as a result of the solar energy system. When installing solar energy systems on houses, there may be other conditions that make the measure subject to the application obligation (Oslo kommune, n.d.-b). For example, where solar energy systems are installed in more than one dwelling unit, they will impact fire safety and may be subject to an application.

Measures are always subject to the application if (Oslo kommune, n.d.-b):

- the building has been declared as cultural heritage. This includes buildings that have formal conservation status, either through conservation decisions or that it is regulated for conservation;
- the measure will conflict with provisions or intention stated in the zoning plan;
- duty to apply based on specific assessment, to clarify if the measure may be subject to application.

In the following cases, it must be assessed explicitly whether the solar energy system triggers an application obligation (Oslo kommune, n.d.-b):

- the building has a cultural heritage value that has not been formally clarified. The building on which the solar energy system is to be built is listed on Byantikvaren's yellow list, is SEFRAK-registered or is a building that has a high cultural heritage value;
- the area has a uniform character - groups of houses that are designed with a uniform architectural expression;
- The solar energy system is mounted freestanding on the roof or facade and does not level with the facade or roof surface.

If no building permit is required, the installation and approval of the solar PV system take on average **8-10 weeks**, during which the developer coordinates the installation process with the municipality and the responsible electricity company if the remaining electricity is to be fed into the grid (Sodvin, n.d.).

In addition to the building permit, the installed solar PV system must comply with the following wiring and fire safety regulations. This means that the installed solar system must comply with the following fire safety regulations (Stølen et al., 2018):

- Planning and Building Act (PBL);
- Building regulations (SAK10) with instructions;

- Technical building regulations (TEK17) with instructions;
- Regulations on the documentation of construction products (DOC);
- Fire and Explosion Protection Act;
- Fire safety regulations.

The following electrical safety regulations (Stølen et al., 2018):

- Electricity Monitoring Law;
- Provisions for low voltage electrical systems (FEL);
- SEK 400, in particular SEK 400-7,712.

2.6. Connection to the grid

According to the Energy Act, the transmission network comprises plants for the transmission of electrical energy of at least 200 kV and plants of 132 kV, which are of significant importance for the operation of these plants (Ministry of Petroleum and Energy, 2021b). The transmission network also includes plants for the conversion of electrical energy, when the converter plant is directly connected to the plant for transmission as mentioned in the first paragraph and transforms to a voltage of at least 33 kV (Ministry of Petroleum and Energy, 2021b).

2.6.1. Grid levels: Transmission, Regional and Distribution grid

The Norwegian electricity grid consists of the transmission grid (operated by Statnett), the regional grid, and the distribution grid. Both the regional and the distribution grids are considered distribution systems, as defined by EU legislation (Energifakta Norge, n.d.-c). The **transmission grid** connects producers with consumers in a nationwide system. Interconnectors with other countries are part of the transmission grid. There are specific requirements relating to transmission system operators. Statnett is Norway's designated transmission system operator (TSO) (Energifakta Norge, n.d.-d). The transmission grid carries a high voltage, usually 300 to 420 kV, but lines carry32 kV (Energifakta Norge, n.d.-d). The total length of the transmission grid is about 11 000 km (Energifakta Norge, n.d.-d).

The **regional grid** often links the transmission grid to the distribution grid, including production and consumption radials carrying higher voltages (Energifakta Norge, n.d.-d).

The regional grid carries a voltage of 33 to 132 kV and has a total length of about 19 000 km (Energifakta Norge, n.d.-d).

The **distribution grid** consists of the local electricity grids that typically supply power to smaller end users. It carries a voltage of up to 22 kV, divided into high-voltage and low-voltage segments (Energifakta Norge, n.d.-d). The dividing line between the two segments is 1 kV, and the low-voltage distribution to ordinary customers carries typically 400 V or 230 V. The total length of the high-voltage distribution grid is about 100 000 km (Energifakta Norge, n.d.-d).

Large electricity producers are connected to the transmission or regional grid, and smaller ones to the regional or distribution grid. Major consumers such as power-intensive manufacturing or the petroleum industry are generally connected to the transmission or regional grid (Energifakta Norge, n.d.-d). Small-scale consumers such as households, service industries and small-scale producers are usually connected to the distribution grid (Energifakta Norge, n.d.-d).

2.6.2. Administrative organisation of the electricity grid

Statnett owns most of the transmission grid in Norway and is the designated transmission system operator (TSO) (Energifakta Norge, n.d.-d). Statnett is a state-owned enterprise, and the Ministry of Petroleum and Energy is responsible for it. Regional grid companies, also engaged in production and/or electricity trading, currently own about 6 % of the transmission grid (Energifakta Norge, n.d.-d). Statnett rents these parts of the grid. When the third energy market package is incorporated into Norwegian legislation, this requirement will apply to Statnett as the Norwegian TSO (Energifakta Norge, n.d.-d). Consequently, ownership unbundling requirements will also apply to any grid infrastructure that Statnett rents. Regional grid companies will then be required to transfer ownership of transmission grid facilities to Statnett by a specific date.

Municipalities and county authorities own most of the regional and distribution grids, but there is also some amount of private ownership (Energifakta Norge, n.d.-d). Many grid companies are part of vertically integrated companies, i.e. companies involved in electricity production, transmission, and/or trading (Energifakta Norge, n.d.-d). By 2021, all grid companies must undertake legal unbundling, and grid companies with more than 30 000 customers must undertake functional unbundling (Energifakta Norge, n.d.-d). This will make the distinction between market-based and monopoly activities more transparent. At present, the requirement applies to grid companies with more than 100 000 customers (Energifakta

Norge, n.d.-d). Only seven grid companies are subject to this requirement (Energifakta Norge, n.d.-d).

Distribution system operators (DSOs) are subject to legal and functional unbundling. **Legal unbundling** means that grid operations and production and/or trading activities are carried out by separate companies (Energifakta Norge, n.d.-d). In addition, a grid company may not own or be owned by an entity engaged in electricity production or trading (Energifakta Norge, n.d.-d). **Functional unbundling** means that nobody with management responsibilities in a grid company may be involved in managing other company structures in an integrated company (Energifakta Norge, n.d.-d). The parent company or controlling owner is allowed to influence the financial framework for the grid company but may not be involved in day-to-day management and operations or investment decisions.

2.6.3. The process of connecting to the grid

Planning and implementing projects at the transmission grid level takes time, including necessary application processes (licence). Here are some examples of how much time different measures can take, including application processes (Energifakta Norge, n.d.-d):

- operational measures: 0–12 months;
- increased transformer capacity: 4-5 years;
- new substation: 4–7 years;
- new power line: 5–10 years.

Grid owners are obligated by law to offer all customers a grid connection (Energifakta Norge, n.d.-d). When a customer contacts a grid owner to connect or increase their consumption or production, the grid owner must assess the grid capacity (Energifakta Norge, n.d.-d). If the customer cannot be connected to the existing grid, it may require grid investments. The customer must cover a proportionate share of the connection installation costs (Energifakta Norge, n.d.-d):

- First, **Statnett will confirm that it has received the application**. Early-stage - guidelines: some clients apply at an early stage of the project and only need preliminary guidelines. Statnett can provide them with free advice within a few weeks, based on the information available and without any analysis;
- Early-stage - **grid analysis**: In some cases, the client's MW requirements and location have not yet been confirmed, and they want several options to be evaluated. Where customers require more information than Statnett can provide without

carrying out an analysis, grid operators may choose to charge a fee for carrying out a grid analysis.

- **Assess whether the customer's project can be connected to the network without network investment**. Once the customer's electricity needs and location have been reasonably ascertained, Statnett will analyse, free of charge, whether the customer's order is economically feasible. Examples of the time taken for the analysis:
  - simple cases take around 2–3 months;
  - more complex cases can take up to 6 months. This time is necessary to more thoroughly assessment;
- **Allocate network capacity.** If Statnett concludes that there is sufficient network capacity, the customer can reserve network capacity. Network owners must cooperate in allocating capacity. A time limit must be set for the use of the reserved capacity. If the capacity is not used by the deadline, it shall be available to other customers. For electricity production projects, a **deadline of two years** to start construction is set.
- Evaluation of network actions. If it becomes necessary to assess network measures to meet a customer's needs, Statnett is obliged to conduct this assessment, often cooperating with the local network owners. Customers are required to pay their proportionate share of costs incurred after 01.01.2019. **Statnett will enter into contracts with customers prior to the commencement of the study**. The assessment is carried out in dialogue with customers and other owners of affected networks. Examples of time spent on the analysis after the contracting work has been completed:
  - Simple connection process – 2–4 months: for example, increased transformer capacity in an existing substation;
  - More extensive connection process – 6–12 months: for example, a new substation or minor works on lines;
  - Major connection process – requires application processing by the authorities: 6–12 months in Statnett and additional 12–18 months for external quality assurance and application processes.

➔Duration of the process	2-18 months
➔ Solar PV	applies
➔Wind farm	applies

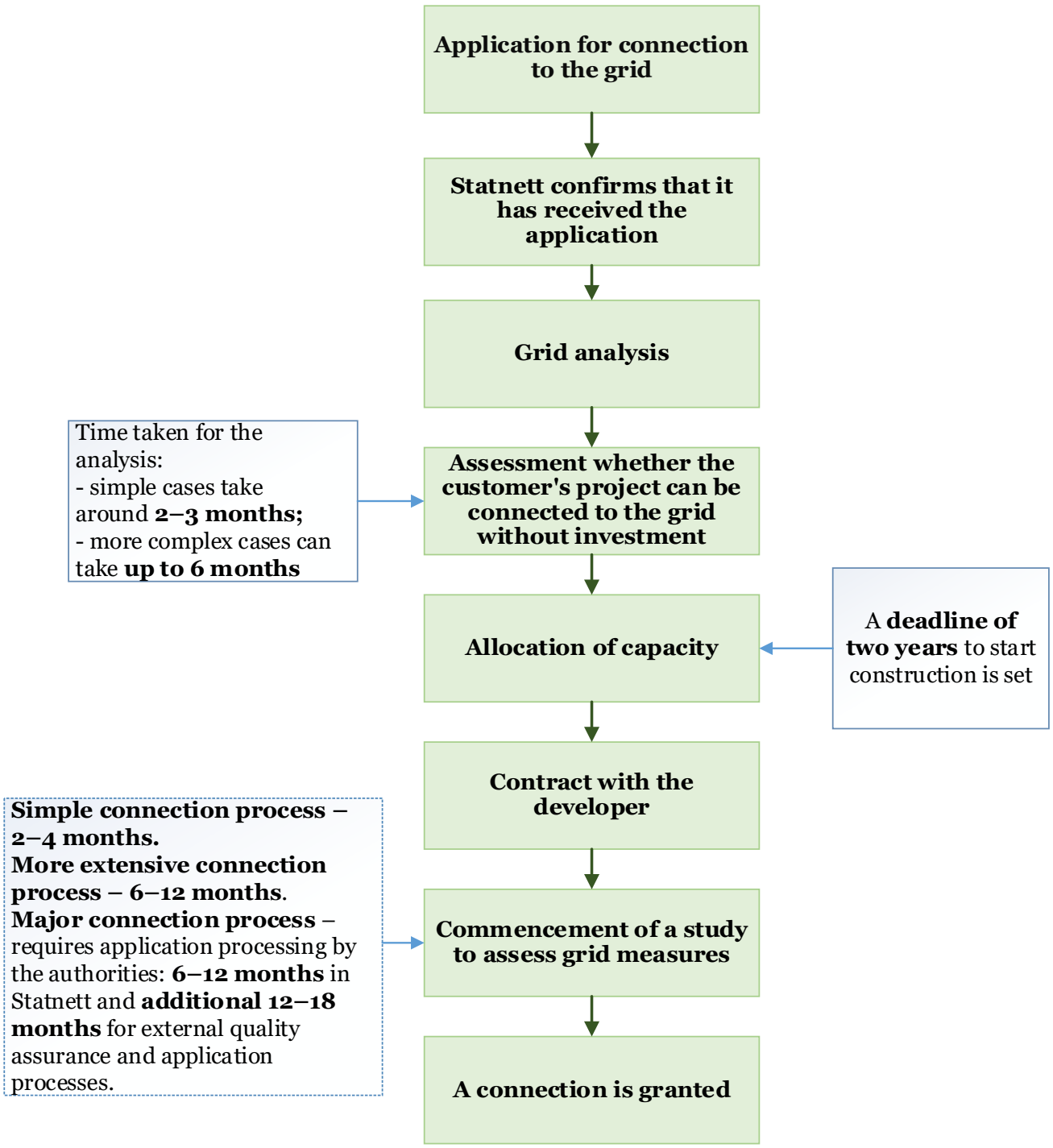

Fig.2.4. Connection to the transmission network (Energifakta Norge, n.d.-d)

2.6.4. Trading license

Without a license from the regulatory authority, no one other than the state can be responsible for selling electrical energy (Ministry of Petroleum and Energy, 2021b). In case of doubt, the regulatory authority decides whether the licensing obligation exists. The regulatory authority may stipulate conditions of (Ministry of Petroleum and Energy, 2021b):

- the internal organization and accounting of the licensee;
- market access for anyone requesting online services by offering non-discriminatory and objective point tariffs and terms;
- neutral behaviour of the network owner;
- determination and calculation of tariffs and revenues from the sale of online services;
- information to customers connected to the licensee's network;
- other activities in connection with the development and utilization of common infrastructure;
- coordination of networks and network services;
- affiliation to an appeal body approved by the Approval Act. Such a condition can also be imposed on companies that have previously been granted a license;
- storage of relevant information from transactions concerning electrical energy supply entered into with wholesale customers and the system operator. Such a condition can also be imposed on companies previously granted a license.

The regulatory authority may lay down additional conditions if deemed necessary in the public interest. In exceptional cases, the regulatory authority may dispense with conditions mentioned in the second and third paragraphs (Ministry of Petroleum and Energy, 2021b).

A trading license is required for all companies operating electricity networks, production and/or trading of electricity (The NVE, 2021). This also applies to mergers or other changes in corporate conditions that require a new application for a sales license (Altinn, n.d.). Companies must send one application for each company (organization number) that will have a business requiring a trading license (The NVE, 2021). The current license period is from January 1, 2021, to December 31. 2024 and the license must be renewed when the license period expires. (The NVE, 2021).

2.7. Offshore wind farms

The Offshore Energy Act provides the legal basis for the future development of offshore renewable energy production (The Norwegian Water Resources and Energy Directorate, 2021u). The Norwegian state has the right to exploit offshore energy resources. The Act applies to Norway's territorial sea outside the baselines and the continental shelf, but individual provisions can also be made applicable to internal waters (The Norwegian Water Resources and Energy Directorate, 2021v). A licence is required for electricity generation, conversion and transmission in areas covered by the Act. As a general rule, licences can only be obtained after the **central government authorities have carried out a strategic environmental assessment and decided to open specific areas for licence applications** (The Norwegian Water Resources and Energy Directorate, 2021v). However, the authorities may exempt pilot projects and similar projects from these requirements with a limited time frame.

The Marine Energy Act was adopted on 12 June 2020, and at the same time, the government opened two areas for the development of marine energy facilities in Norway. These areas are Utsira North and Southern North Sea II (The Norwegian Water Resources and Energy Directorate, 2021v). The Marine Energy Regulations entered into force on 1 January 2021, and notifications of marine energy facilities can be submitted from this date. **The authority to grant a license for offshore energy facilities lies with the Ministry of Petroleum and Energy** (MPE). It will be the recipient of messages and applications (The Norwegian Water Resources and Energy Directorate, 2021v). The NVE will assist the MPE with professional advice in the licensing process, and the authority to approve detailed plans lies with the NVE (The Norwegian Water Resources and Energy Directorate, 2021v).

Act on Renewable Energy Production at Sea (Ocean Energy Act) promotes the use of renewable energy at sea in line with societal objectives and plans, construct and decommission energy installations in a way that safeguards energy supply, the environment, safety, business and other interests (Ministry of Petroleum and Energy, 2021c). The law applies to renewable energy production and the conversion and transmission of electrical energy at sea. The law applies to Norwegian maritime territory outside the baselines and on the continental shelf (Ministry of Petroleum and Energy, 2021d). The right to use renewable energy resources at sea belongs to the state (Ministry of Petroleum and Energy, 2021d).

Before the opening of an area can occur, impact assessments must be prepared. The **impact assessments shall include environmental and social assessments of renewable energy production,** such as consequences for other business interests (Ministry of Petroleum and Energy, 2021d). **Applications for the opening area with completed impact assessments shall be sent for consultation and submitted for public inspection** (Ministry of Petroleum and Energy, 2021d). The Ministry may make exceptions from the rules on the area opening in exceptional cases. The Ministry may issue regulations on the opening of land. Production facilities may not be built, owned or operated without a license from the MPE (Ministry of Petroleum and Energy, 2021d). The same applies to the rebuilding or expansion of existing facilities.

Before constructing an electricity production facility with a license can begin, the licensee shall submit a detailed plan for development and operation to the Ministry for approval (Ministry of Petroleum and Energy, 2021d). The detailed plan shall deal with the technical, safety and environmental requirements and otherwise supplement the license as far as has been determined. Prior to the approval of a detailed plan, the impact assessment of the development measure shall be approved (Ministry of Petroleum and Energy, 2021d).

The license application and detailed plan under Ocean Energy Act §§ 3-1 and 3-2 shall be sent to the MPE. The MPE may issue regulations on license applications and detailed plans, including (Ministry of Petroleum and Energy, 2021d):

- the right to apply for and obtain a license, including pre-qualification qualifications;
- what kind of information an application must contain;
- what kind of information a detailed plan should contain;
- what kind of surveys the applicant must apply for and;
- Requirements for the announcement, public inspection, consultation and participation from relevant governing bodies and interests.

Prior to the start of impact assessments, a notification shall be prepared with a submission to the assessment program (Ministry of Petroleum and Energy, 2021d). **Submissions for the assessment program must be sent for consultation and submitted for public inspection before the program is determined** (Ministry of Petroleum and Energy, 2021d). When opening an area and concluding or approving a detailed plan pursuant, the case presentation or the decision shall state how the impact

assessments and received statements have been assessed and what they have had to say for the decision (Ministry of Petroleum and Energy, 2021d).

2.7.1. License application

If a developer that meets the requirements in the Marine Energy Act Article 3-5 wishes to apply for a license for an offshore power plant, a notification must first be sent to the MPE, with a submission to a project-specific assessment program (Ministry of Petroleum and Energy, 2021e). A notification with submission to a project-specific assessment program must at least contain a description of (Ministry of Petroleum and Energy, 2021f):

- the power plant, current development solutions and costs, the project area and, based on available knowledge, possible effects for other industries, the environment and society;
- apply what is to be done and what methods are to be used;
- information about the activities of the applicant.

The MPE sends submissions to project-specific review programs to consult relevant authorities and interest organizations and makes submissions available to the public on the Internet (Ministry of Petroleum and Energy, 2021f). A reasonable deadline is set, which should not be shorter **than six weeks** (Ministry of Petroleum and Energy, 2021f). The Ministry may determine the assessment program based on the submission, and the consultation statements received (Ministry of Petroleum and Energy, 2021f).

According to the Marine Energy Act Article 6, project-specific impact assessment shall be adapted to the scope of the power plant and prepared by the established assessment program (Ministry of Petroleum and Energy, 2021f). It shall contain a discussion of any previous impact assessments for the project area. For energy projects that are also to be impact assessed by the Energy Act, a joint impact assessment can be prepared (Ministry of Petroleum and Energy, 2021f).

The impact assessment shall at least describe (Ministry of Petroleum and Energy, 2021):

a) the plant's physical properties and planned technical solutions, location and land use in both the construction and operation phases;
b) a description of alternative developments that the applicant has investigated and a justification of the choice of development solution and project area, a definition of criteria for choices made, and connection to grid facilities and possible coordination with petroleum activities;

c) the most important features of the measure in the operational phase, such as the energy needs of the measure, the energy use, energy solutions, the throne for transport and the type and amount of natural resources that will be used;
d) an estimate for the type and amount of waste, residues, emissions and pollution that will be produced in the construction and operation phase;
e) impact related to climate change;
f) alternatives to design, technology, location, scope and scale that the proposer has assessed;
g) an assessment of what licenses, approvals or consents should be applied for by otherwise applicable legislation;
h) a timetable for implementation;
i) a description of measures in connection with the closure of the energy plant.

The impact assessment shall include a description of the current environmental condition and an overview of how the environment is likely to develop if the plan is not implemented (Ministry of Petroleum and Energy, 2021f). The description shall include positive, negative, direct and indirect effects in the short and long term. Collect effects of the plant in light of already implemented or approved plans in the area of influence shall be assessed (Ministry of Petroleum and Energy, 2021f). If the plan or application includes several alternative solutions, it must be clear what consequences they may have on the environment and society and a basis for the proposer's alternative.

The impact assessment shall be based on relevant and available information. If there is a lack of knowledge about important practices, such information must be obtained. Where new knowledge is obtained, this shall be systematized by existing standards and made available to the authorities (Ministry of Petroleum and Energy, 2021f). Assessments and field investigations shall follow a recognized methodology and be carried out by persons with relevant professional competence. The data basis and methods that are useful for describing effects, and any professional or technical problems with the collection and use of data and methods, must be briefly explained (Ministry of Petroleum and Energy, 2021f).

Marine Energy Act Article 7 determines that **within two years** after the Ministry has determined the assessment program for a project area, the legal entity who has applied for approval of the assessment program must apply for a license to the Ministry (Ministry of Petroleum and Energy, 2021f). A project-specific impact assessment must be attached to the

application. The application must contain the following information(Ministry of Petroleum and Energy, 2021f):

- The applicant, the applicant's business, ownership and financial capacity. If the application includes several applicants, all names, addresses and nationalities must be submitted;
- who in Norway is to be the representative is the ministry;
- for which area a license has been applied for;
- whether a license has also been applied for by the Energy Act, for example, for connection of the energy plant to the power grid on land;
- a description of the planned project: estimated installed performance, estimated annual production, solution for connection to power grids, cost estimates, assessment of the profitability of the project, the potential for conflict with other interests.

The Ministry sends the license application with a project-specific impact assessment to consult relevant authorities and organizations concerned and makes it available to the public on the Internet. The developer must set a deadline that should not be shorter than **six weeks** (Ministry of Petroleum and Energy, 2021f).

The MPE shall take decisions on the granting of a licence and the approval of the impact assessment of a project by Articles 3-1 and 3-2 of the Marine Energy Act based on an application for a licence and an impact assessment for energy facilities (Ministry of Petroleum and Energy, 2021f). The Ministry shall give reasons for its decision. The licence may be granted for a period of **up to 30 years** from the date of commissioning of the installation (Ministry of Petroleum and Energy, 2021f).

Marine Energy Act Article 9, "Application for approval of detailed plan", states that an application for **approval of a detailed plan is sent to the NVE within two years of the decision on the license** (Ministry of Petroleum and Energy, 2021f). The NVE may demand that alternative solutions be considered. The detailed plan must contain at least the following (Ministry of Petroleum and Energy, 2021f):

a) the planned time for the start of construction work and completion of the energy plant;
b) technical description of the development;
c) a description of the planned operation and financing of the energy plant;
d) plan for closure and removal of the energy plant;

The NVE decides on the approval of a detailed plan and shall substantiate the decision (Ministry of Petroleum and Energy, 2021f). The basic provisions shall state the conditions associated with the approval and any preconditions for reducing negative environmental effects.

The NVE shall approve the detailed plan for the development and operation of the power plant before the work on the construction of the energy plant begins (Ministry of Petroleum and Energy, 2021f). **The power plant shall be put into operation within three years after a decision has been made on an approved detailed plan for the development and operation of the energy plant.** A power plant is put into operation when electricity has been produced and transported out of the project area (Ministry of Petroleum and Energy, 2021f).

➔Duration of the process	Five years

3. SWEDEN

Sweden uses domestic renewable energy sources such as water, wind, sun and biofuels to generate electricity (Swedish Energy Agency, 2021a). Electricity generation in 2019 reached 166 TWh. It consisted of 39 % nuclear power, 39 % hydropower, 12 % wind power and 0.4 % solar power (Swedish Energy Agency, 2021a). Combustion-based power provided the majority of the remaining ten per cent, primarily from combined heat and power plants and industrial processes (Swedish Energy Agency, 2021a). The total Swedish energy supply was 548 TWh in 2019 (Swedish Energy Agency, 2021).

As seen from the energy mix, Sweden does not prioritise renewable energy. However, it does try to encourage the production and development of renewable electricity through a quota system, a tax regulation mechanism and subsidies (Vågerö, 2019a). Renewable energy is mainly channelled towards the transport sector and through tax incentives for citizens and companies using biofuels in transport. Sweden also provides research and development funding for wind energy development (Vågerö, 2019b).

The Ministry of the Environment and Energy (MEE) is responsible for energy policy in Sweden (International Energy Agency, 2019). Division for Energy's Ministry consists of a relatively small staff (25 people), as most policy implementation is delegated to governmental agencies (International Energy Agency, 2019). The Division for Climate in the Ministry is responsible for Sweden's participation in global climate change negotiations and the European Union's work on fulfilling its commitments under the Kyoto Protocol (International Energy Agency, 2019). In addition, this Division is responsible for emissions trading, project-based mechanisms and other climate policy instruments, as well as air-quality issues (International Energy Agency, 2019). The Ministry also coordinates and governs the national work on the environmental objectives system (International Energy Agency, 2019). **Under the MEE, the Swedish Energy Agency (SEA)** is a government agency in charge of implementing most of the energy policy (International Energy Agency, 2019). It is responsible for the energy projections and forecasts, provides energy statistics and policy analysis, administers the electricity certificate system, implements the sustainability criteria for biofuels, etc. (International Energy Agency, 2019). It also oversees the implementation of energy efficiency measures and publicly-funded energy research, development and demonstration (International Energy Agency, 2019). **The Swedish Energy Markets Inspectorate** is the national regulator for the electricity, natural gas and DH markets (International Energy Agency, 2019). It works to improve the functioning and

efficiency of these markets. **The Swedish National Grid** (Svenska kraftnät) is the transmission system operator (International Energy Agency, 2019). It owns and operates the national high-voltage electricity grid and is responsible for the electricity system's short-term balance (International Energy Agency, 2019). **The Swedish Competition Authority** works to safeguard and increase competition in Sweden (International Energy Agency, 2019). In addition to applying the Competition Act, it proposes changes to rules and suggests other measures to eliminate obstacles to effective competition (International Energy Agency, 2019). **The National Board of Housing, Building and Planning** is the national agency for planning, managing land and water resources, urban development, building and housing (International Energy Agency, 2019). It is responsible for promoting the efficient use of energy in buildings, notably the reduction of electricity use for residential heating and the implementation of the building regulations (International Energy Agency, 2019). **The Swedish Environmental Protection Agency** has responsibility for Sweden's regular climate reporting to the United Nations Framework Convention on Climate Change and the European Union (International Energy Agency, 2019). It regularly prepares projections and prepares reports related to climate change, GHG emissions and climate policies and measures (International Energy Agency, 2019). It does this work in collaboration with the responsible sectoral authorities. The Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS) promote and supports fundamental research and need-driven research in the environment, agricultural sciences, and spatial planning (International Energy Agency, 2019).

Sweden is divided into 290 municipalities and 21 regions (Sveriges Kommuner och Regioner, 2021). **Municipalities and regions have no hierarchical relation since all have their self-governing local authorities responsible** for different activities (Sveriges Kommuner och Regioner, 2021). The only exception is Gotland, an island in the Baltic Sea, where the municipality also has the responsibilities and tasks usually associated with a region (Sveriges Kommuner och Regioner, 2021). The Parliament, Riksdagen, is the supreme political decision-making body in Sweden (Sveriges Kommuner och Regioner, 2021).

The country's municipalities and regions provide a significant proportion of all public services (Sveriges Kommuner och Regioner, 2021). They have a considerable degree of autonomy and have independent taxation powers (Sveriges Kommuner och Regioner, 2021). Local self-government and the right to levy taxes are stipulated in the Instrument of

Government, one of the four pillars of the Swedish Constitution (Sveriges Kommuner och Regioner, 2021).

In Sweden, microgeneration installations and medium or large power plants are not categorised by capacity, as in previous countries. The distinction between small and large-scale wind farm and solar farm power plants and the relevant requirements for the permitting process are described in the following chapters. Section 3.1. and Section 3.2. describes the general implementation process for Sweden's solar and wind power plants, starting from Section 3.3. an in-depth legislation analysis has been performed. The following sections briefly describe the main steps the solar PV or wind power plant project developer should undergo to implement the project.

3.1. Main steps for wind power plant implementation

As mentioned above, wind power in Sweden accounted for 12 % of the country's total energy mix in 2019; however, several reports suggest that the potential for wind power in Sweden is much higher than is currently being exploited (Swedish Energy Agency, 2021a). The installation and operation of wind turbines have different requirements from the viewpoint of legislation and permit frameworks. Separate requirements are set for small, medium and large wind power plants. The individual requirements and characteristics for each are given below.

3.1.1. Small wind power plants

According to the Swedish Energy Agency, a small wind power plant is characterised by its height and rotor diameter (Swedish Energy Agency, 2020e). A so-called mini-power plant is defined as a wind turbine with a total height of a maximum of 20 meters and with a rotor diameter of a maximum of 3 meters (Swedish Energy Agency, 2020e). **A building permit is not required** under the Planning and Building Act and associated ordinance to build such a wind turbine **unless the plant is mounted on a building corrected at a closer distance from the boundary than the plant's height** (Swedish Energy Agency, 2020e).

The definition of a mini-plant is based on the planning and building legislation's rules on building permits (Swedish Energy Agency, 2020e). An activity does not need a building permit according to the Planning and Building Act (2011: 338) if it fulfils one or more of the points below (Swedish Energy Agency, 2020e):

a) is 20 meters or less above the ground;

b) placed at a distance from the boundary that is greater than the height of the power plant above the ground;

c) not be fixed to a building;

d) has a wind turbine with a diameter of not more than three meters.

Height above the ground refers to the highest point that the device reaches, including the mast or tower. The diameter of the wind turbine is calculated on the largest circle that the turbine describes around its axis. If any of the above requirements are not met, the business is subject to a building permit (Swedish Energy Agency, 2020e).

Even if a building permit is not needed for a mini-plant, **notification is required** by the Planning and Building Act (Article 5 point 8) (Swedish Energy Agency, 2020e). Notification must be made in the event of a new construction or significant alteration of a micro-generator or so-called mini-plant (Swedish Energy Agency, 2020e). The notification shall contain documentation for the municipality to examine whether the wind turbines meet the technical property requirements specified in the legislation (Swedish Energy Agency, 2020e). The erection of wind turbines may not begin before the building committee has given a start notice (Swedish Energy Agency, 2020e). A final decision must be received before the wind turbine can be put into operation.

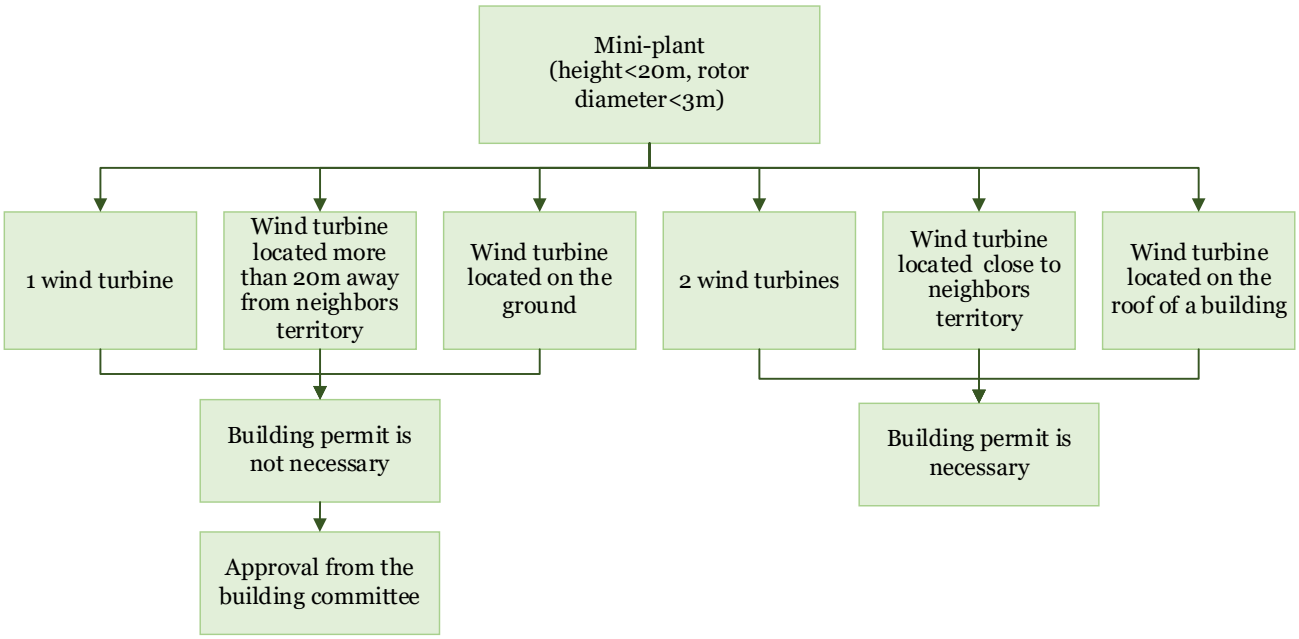

Fig.3.1. Permit granting process for mini-plants (Swedish Energy Agency, 2020e)

3.1.2. Farm system

A so-called farm plant or farm system is defined as a wind turbine with a total height of 20-50 meters or a turbine whose rotor diameter exceeds three meters (Swedish Energy

Agency, 2020b). **A building permit is required** by the Planning and Building Act and the associated ordinance to install such a wind turbine. The municipality's building committee handles building permits.

The definition of a so-called farm system is based on the rules of building legislation on building permits and, as defined below, is subject to a building permit by the Planning and Building Act (2011: 338) (Swedish Energy Agency, 2020b):

- is higher than 20 meters above the ground;
- placed at a distance from the boundary that is less than the height of the power plant above the ground;
- mounted on a building;
- has a rotor with a diameter greater than three meters.

Height above the ground refers to the highest point that the wind turbine reaches, including the mast or rotor. The diameter of a wind turbine is calculated by the most extensive circle the turbine rotor makes around its axis (Swedish Energy Agency, 2020b).

Wind turbines that are higher than 50 meters are subject to notification by the Environmental Code (Swedish Energy Agency, 2020b). According to the Environmental Code, if two or more plants stand together, the activity is also covered by the notification obligation(Swedish Energy Agency, 2020b).

3.1.3. Medium-sized wind power plants

In order to build a medium-sized land-based wind power plant, **notification is required by the Environmental Code and a building permit by the Planning and Building Act** (Swedish Energy Agency, 2020d). According to the Environmental Code, building permits and notifications according to the Environmental Code are examined by the municipality (Swedish Energy Agency, 2020d).

The definition of a so-called medium-sized facility is based on the Environmental Assessment Act code C 40.100 (Swedish Energy Agency, 2020d). Such an activity, as defined below, is subject to notification by Chapter 9 of the Environmental Code (Swedish Energy Agency, 2020d). Chapter 21 Section 15 of the Environmental Assessment Act states that notification obligation C and activity code 40.100 applies to activities with (Swedish Energy Agency, 2020d):

- a wind turbine that, including rotor blades, is higher than 50 meters;

- two or more wind turbines standing together (group station);
- a wind turbine standing with another wind turbine, if it is erected after the other turbine has started operating.

The obligation of notification according to this description does not apply if the activity is subject to a building permit.

The **developer also has the opportunity to apply for a voluntary permit from the County Administrative Board for an activity subject to notification, regardless of whether the expected environmental impact is significant or not** (Chapter 9, Section 6 b of the Environmental Code)(Swedish Energy Agency, 2020d).

According to the Planning and Building Act (2011: 338), a building permit is required to build wind turbines higher than 20 meters above the ground. **A wind power plant that corresponds to the definition of a medium-sized plant is thus subject to a building permit** (Swedish Energy Agency, 2020d). For wind turbines that require a building permit, the start notice and final notice must also be obtained from the building committee before the plant can begin construction or be put into operation (Swedish Energy Agency, 2020d).

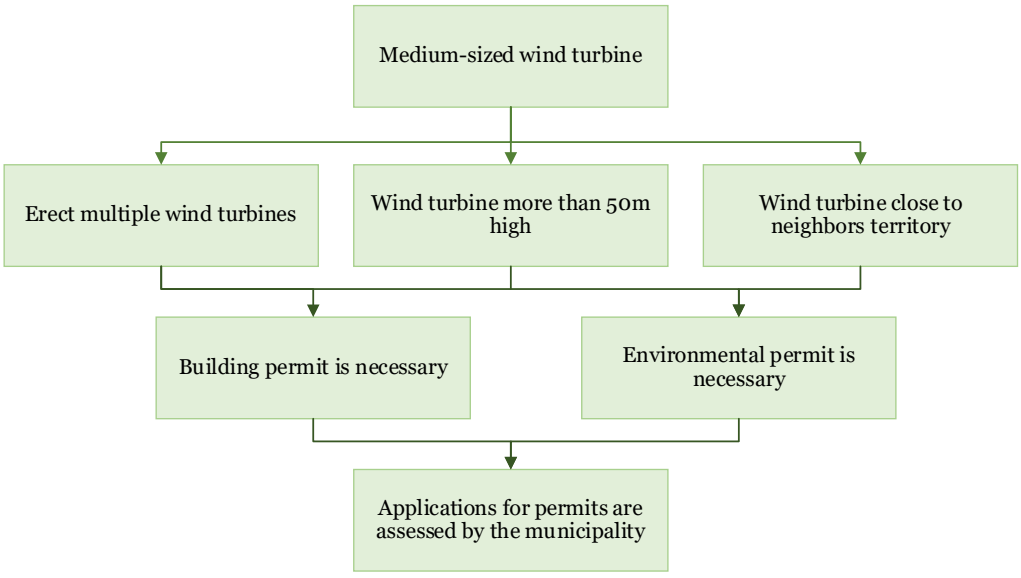

Fig.3.2. Permit granting process for middle-sized wind power plants (Swedish Energy Agency, 2020c),

3.1.4. Large-scale wind farm (onshore)

A permit by the Environmental Code and the municipality's approval is needed to build a large onshore wind power plant (Swedish Energy Agency, 2020c). The application for a permit by the Environmental Code will be examined by the County Administrative Board (Swedish Energy Agency, 2020c).

The definition of a large wind power plant is based on ch. Article 13-14 of the Environmental Assessment Act (2013: 251) permits B and business code B 40.90 or B 40.95 (Swedish Energy Agency, 2020c). Such an activity, as defined below, is subject to a permit requirement by ch. the Environmental Code and Chapter 21 Article 13 of the Environmental Assessment Act (Swedish Energy Agency, 2020c). Permit requirement B and operating code 40.90 applies to large wind farms with (Swedish Energy Agency, 2020c):

1. two or more wind turbines that stand together (group station) and each of the wind turbines including rotor blades is higher than 150 meters;
2. a wind turbine that includes rotor blades is higher than 150 meters and stands together with such a grouping station as referred to in point 1;
3. a wind turbine, including rotor blades, is higher than 150 meters and stands together with another such wind turbine if the operation is commenced after the operation with the other wind turbine was commenced.

Alternatively, as an alternative, Chapter 21 Article 14 of the Environmental Assessment Article permit requirement B and operating code 40.95 applies to operations with:

1. seven or more wind turbines that stand together (group station) and each of the wind turbines including rotor blades is higher than 120 meters;
2. a wind turbine that includes rotor blades is higher than 120 meters and stands together with such a grouping station as referred to in point 1;
3. one or more wind turbines, each of which, including the rotor blade, is higher than 120 meters and stands together with so many other such wind turbines that the group station consists of at least seven wind turbines if operations commence after the business or activities with the other wind turbines were started.

According to the Planning and Building Act (2011: 338), a building permit is not required to erect such a licensed activity by Chapter 6. 2 § pkt. 2. A report must, however, be made, according to ch. 5 § pkt. 8 of the Planning and Building Ordinance, even if the facility does not require a building permit (Swedish Energy Agency, 2020c).

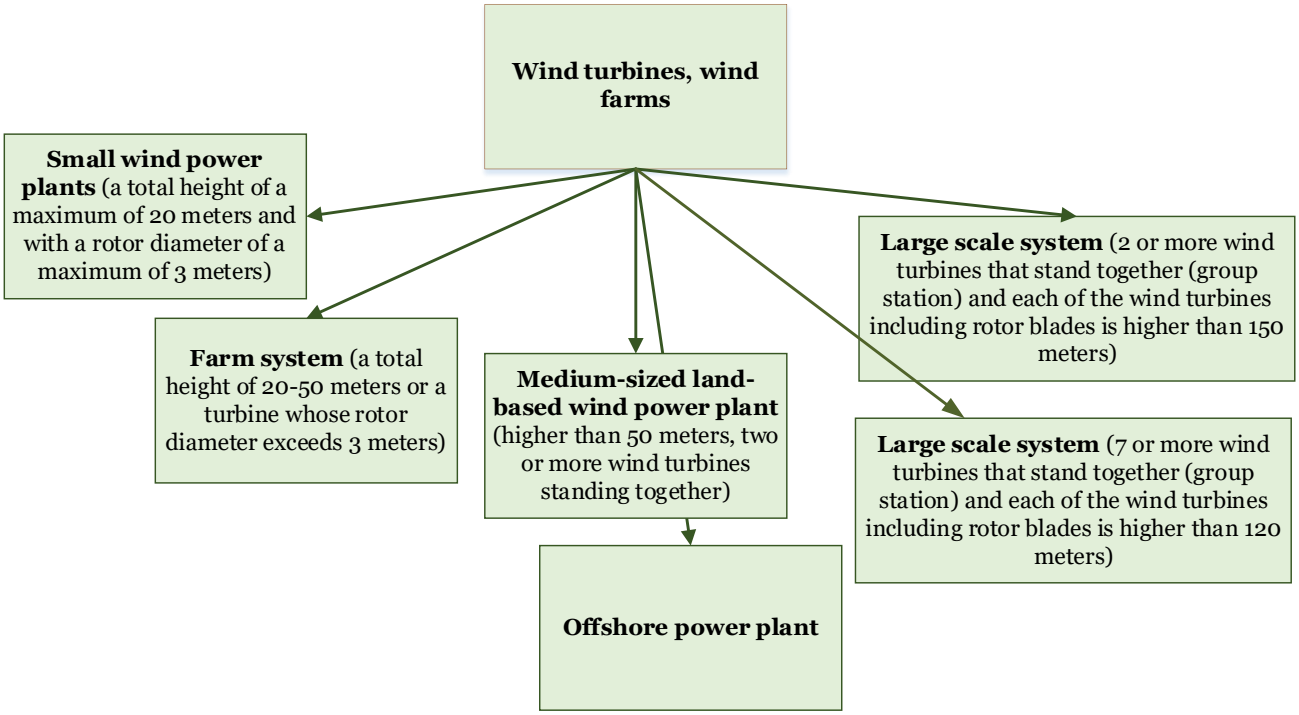

Fig.3.3. Wind power plant categorisation

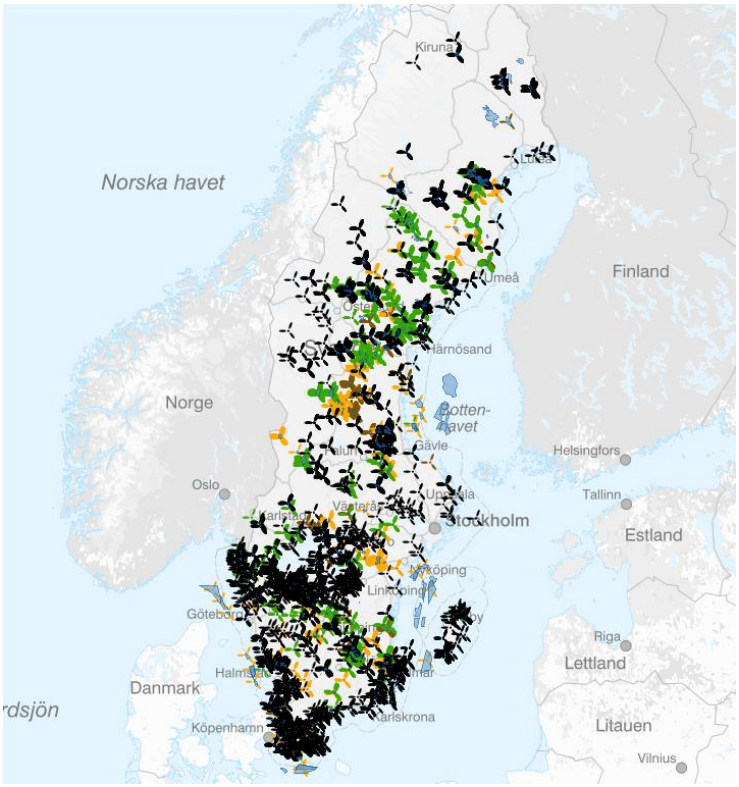

Fig.3.4. Wind power plant map of Sweden (County Administrative boards, n.d.)

3.2. Main steps for solar power plant implementation

Electricity generation from solar power is less developed than wind power in Sweden, accounting for only 0.4% of the country's total electricity generation in 2019 (Swedish Energy Agency, 2021a). The Government of Sweden has tried to boost the amount of energy produced with solar PV panels with financial incentives. Till the end of the year 2020, it was possible to get a tax reduction for installing Green Technology - tax reduction of 15% for installation of mains-connected photovoltaic systems and tax reduction of 50% for installation of systems for storage of self-produced electricity. (Swedish Energy Agency, 2021d). On January 1, 2021, a new tax reduction system was introduced for labour and material costs for installing solar cells, which replaced the previous tax incentive (Swedish Energy Agency, 2021c).

The need for a building permit for installing solar PV panels depends on the municipality in which the household is located and the size of the system to be installed (Boden's Energy, n.d.-a). If the solar PV panels are placed directly on the roof of the building or a roof slope, in most cases, no building permit will be required (Boden's Energy, n.d.-b). Most municipalities take the following principles into account when determining the need for a building permit (Boden's Energy, n.d.-b):

- if the solar panels are close to each other and adjacent to the roof of the domestic building, no building permit is required;
- if the solar PV panels are mounted on a stand, a building permit is required;
- if the panels are installed on protected buildings, a building permit is required.

Several Swedish solar panel advisories and regulations reiterate that only a person/company specialised in this field can install solar panels on a building (Ellevio, n.d.-a). The specialist must have an electrician's licence, even if the solar system is not connected to the common electricity grid (Ellevio, n.d.-b). Suppose the solar PV system is connected to the common Swedish electricity grid. In that case, it must comply with the requirements of the Energy Market Inspectorate, the Swedish Grid and the Swedish Electrical Safety Agency regarding the installation of the solar system and the transfer of the energy produced to the common electricity grid (Ellevio, n.d.-b).

Municipalities are the authorities that create legal conditions for the local solar developers through physical planning (Swedish Energy Agency, 2020g). Physical planning means general plans, detailed plans, and building permits (Swedish Energy Agency, 2020g). However, other regulatory documents relating to renewable energy or energy-

efficient buildings may also lay down basic principles for using solar energy (Swedish Energy Agency, 2020g).

A master plan sets out long-term guidelines for spatial planning in the municipality (Swedish Energy Agency, 2020g). It is not legally binding but guides decisions on how the built environment should be used and developed (Swedish Energy Agency, 2020g). The master plan should include issues relating to energy use and renewable energy production (Swedish Energy Agency, 2020g). **Solar energy solutions need to be addressed as the plan provides a basis for detailed planning** (Swedish Energy Agency, 2020g).

One way for the municipality to clarify its approach to solar energy is to make it a thematic addition to the master plan (similar to the so-called wind farm plans) (Swedish Energy Agency, 2020g). In the supplement, the municipality can, for example, set targets for solar radiation on roof surfaces, define targets for locally produced renewable energy and set other guidelines (Swedish Energy Agency, 2020g).

The development plan sets out how an area may be built and how land and water may be used in that particular area. Unlike the master plan, it is legally binding, but exceptions can be made in certain cases (Swedish Energy Agency, 2020g). According to the Planning and Building Act, municipalities cannot impose their requirements on the building technical characteristics when planning, implementing a detailed plan, and other matters (Swedish Energy Agency, 2020g). However, it is possible to regulate the use of buildings and the size of buildings in terms of, for example, height and roof angles. **Municipalities can thus influence the potential for solar energy through detailed planning** (Swedish Energy Agency, 2020g). **The Swedish National Board of Housing, Building and Planning or Boverket** is the authority responsible for the Planning and Building Act (Swedish Energy Agency, 2020g).

Suppose the municipality wants to promote solar energy. In that case, it is advantageous to carry out a solar/shade study of the proposed area early in the planning process (Swedish Energy Agency, 2020g). How well the solar potential can be exploited depends on the design and orientation of the buildings, the positioning of new buildings concerning older ones, and the height and pitch of the roofs (Swedish Energy Agency, 2020g). In order to promote solar energy, it is important not only to look at new buildings but also to protect existing ones. **This can be done by securing the solar radiation of existing buildings, or "solar right", as it is also called** (Swedish Energy Agency, 2020g). **There is a ready-made method for including solar potential in detailed planning for new buildings or densification** (Swedish Energy Agency, 2020g). It has been developed from pilot projects

in Sege Park in Malmö and Norra Djurgårdsstaden in Stockholm. It is based on three steps: shadow analysis, weather orientation and optimal location (Swedish Energy Agency, 2020g).

There is a risk that detailed plans that impose specific aesthetic requirements on roofs will, in practice, eliminate the possibility of installing solar cells, given the current regulatory framework (Swedish Energy Agency, 2020g). If a municipality wants to promote solar energy, it can review these requirements in detailed plans and choose how to interpret them (Swedish Energy Agency, 2020g).

3.2.1. Solar power parks

Solar power parks are becoming increasingly common in Sweden. Land costs should not be too high to build a profitable solar PV plant. Therefore, land with no other use should be chosen, or it is possible to combine solar with other activities. Examples of suitable low-cost land include pasture land, unused airport areas or land adjacent to roads (Swedish Energy Agency, 2019).

In order to connect a large PV installation, the electricity grid may sometimes need to be upgraded, which can be expensive (Swedish Energy Agency, 2019). So the electricity grid operator should be contacted in advance to determine the conditions at the site in question (Swedish Energy Agency, 2019). The distance from the PV installation to the connection point should not be too long, as this can also result in high connection costs (Swedish Energy Agency, 2019). Once the installation is complete, the grid owner must make a final notification.

A solar power park does not require a building permit if it is built outside a planned area. However, the **transformer station requires planning permission, so the municipality's planning and permission department must be contacted** (Swedish Energy Agency, 2019). The developer should notify the county administrative board to make an appointment for a consultation, even if the land is not classified as protected (Swedish Energy Agency, 2019). A photovoltaic park changes the natural environment, but it is relatively easy to restore the land (Swedish Energy Agency, 2019).

When the developer builds an extensive solar PV system to sell electricity, the revenue per kilowatt-hour is typically much lower than if the system is built for self-use (Swedish Energy Agency, 2019). Solar PV installations directly linked to the electricity use of a building with a total installed peak power of fewer than 500 kilowatts, usually rooftop installations, have the advantage that energy tax is not levied on own electricity use (Swedish Energy Agency, 2019). However, it does if the electricity is transmitted through the grid before use

(Swedish Energy Agency, 2019). The energy tax is a consumption tax. Therefore, the 500 kW limit is relevant for constructing solar parks if no electricity is used for own consumption (Swedish Energy Agency, 2019). **Therefore, the owner of a solar park is liable to pay tax and must register with the Swedish Tax Agency** (Swedish Energy Agency, 2019).

In order to receive revenue from a solar power park, a contract needs to be signed with a buyer of the electricity. Also, any electricity certificates and guarantees of origin can be sold (Swedish Energy Agency, 2019). The revenue from a solar park can vary greatly with different contracts. If the electricity is sold directly on the electricity market, the remuneration varies according to supply and demand (Swedish Energy Agency, 2019). Historical prices on the spot market can be found on the Nordic Electricity Exchange on Nordpool's website. The developer can also get electricity certificates and guarantees of origin for a solar park (Swedish Energy Agency, 2019).

3.3. Territorial planning

Planning a wind farm often requires contact with many different stakeholders, such as the municipality, the county administrative board and certain government authorities (Swedish Energy Agency, 2020a). **Permitting process for wind power plant development may only be started if the municipality has approved** (Swedish Energy Agency, 2020a). No specific rules **govern the municipality's opinion in the context of the permit assessment,** other than the general requirements of objectivity and impartiality that apply to municipal activities (Swedish Energy Agency, 2020a). **The government may**, even though the municipality has not approved a project for plant development, **authorise the operation** based on Chapter 17. 6 of the Environmental Code, if it is particularly urgent from a national point of view that the activity be carried out (Swedish Energy Agency, 2020a). It is important that a municipality against the construction of a wind power plant already clearly states its opinion during the consultation process under Chapter 6 of the Environmental Code (Swedish Energy Agency, 2020a). Otherwise, the developer risks incurring unnecessary costs for the review process.

Municipalities have the freedom to organise their activities and distribute responsibilities between committees in different ways (Swedish Energy Agency, 2020a). The municipal council adopts the municipality's regulations and allocates tasks between the various committees and boards (Swedish Energy Agency, 2020a). The council adopts the master plan and the detailed plans as a general rule. In addition, **the municipal council can call for government approval of significant wind power projects**

under Chapter 17 of the Environmental Code (Swedish Energy Agency, 2020a). In addition, the **municipal council sets fees for examination and supervision** under both the PBL and the Environmental Code (Swedish Energy Agency, 2020a).

The municipal board prepares matters for the municipal council and may also be responsible for master planning (Swedish Energy Agency, 2020a). **The municipality has the right to speak, including the right to appeal, in matters concerning permits under the Environmental Code to protect environmental and other public interests within the municipality and is usually represented by the municipal council** (Swedish Energy Agency, 2020a).

The **municipality's environmental and health protection board** or equivalent receives notifications under the Environmental Code for wind turbines on land that requires notification and is also the supervisory authority under the Environmental Code for these (Swedish Energy Agency, 2020a). The committee may also be the supervisory authority for wind turbines requiring a permit if the county administrative board has delegated this supervision to the municipality (Swedish Energy Agency, 2020a). The county administrative board may also issue supervisory decisions related to any disturbance caused by wind turbines (Swedish Energy Agency, 2020a).

The **municipality's building committee** or equivalent is responsible for the municipality's **building permit management** (Swedish Energy Agency, 2020a). Furthermore, the **building committee decides whether or not a detailed plan is required for a wind power project** (Swedish Energy Agency, 2020a). It is the building committee that is responsible for the planning process.

The county administrative boards play an active role in wind power development by, among other things: drawing up planning documents for the municipalities, being involved in spatial planning, processing permit applications for large wind farms (Swedish Energy Agency, 2020a).

The **county administrative boards provide planning documents and review the municipalities' master plans and detailed plans** (Swedish Energy Agency, 2020a). Cases concerning decisions and exemptions under Chapters 7 and 8 of the Environmental Code are handled by the county administrative boards' nature conservation units or equivalent (Swedish Energy Agency, 2020a). **In the consultation process prior to applying for a permit, the county administrative board provides planning documentation and** descriptions of the value of areas of national interest and other conservation areas. It **ensures that the future environmental impact assessment is**

given the focus and scope required for the assessment (Swedish Energy Agency, 2020a). The county administrative board also decides whether the planned activity will significantly impact the environment (Swedish Energy Agency, 2020a). Officers at the **county administrative boards' environmental protection units prepare and process permit applications in consultation with the environmental assessment delegation (EAD)** (Swedish Energy Agency, 2020a).

The EAD are an independent and impartial decision-making body within the county administrative boards which - under court-like forms - examines cases concerning permits for so-called environmentally hazardous activities under Chapter 9 of the Environmental Code and re-examines existing permits and conditions under Chapter 24 of the Environmental Code (Swedish Energy Agency, 2020a). The EAD usually takes decisions in cases after a report by the administrator of the county administrative board's environmental protection unit (Swedish Energy Agency, 2020a). The decision of the EAD can be appealed to the Land and Environmental Court.

➔Duration of the process	Ten weeks
➔ Solar PV	applies
➔Windfarm	applies

3.3.1. Proposed changes in the existing permitting process

In order to achieve a more predictable permitting process, the Swedish Energy Agency has developed a draft measure to amend the provision on municipal approval (Swedish Energy Agency, 2021b). The proposal replaces the previous proposal that the Swedish Energy Agency and the Swedish Environmental Protection Agency submitted to the Government in 2017 (Swedish Energy Agency, 2021b).

The purpose of the proposal is to ensure that consent is given at an early stage and cannot be changed during the permit process (Swedish Energy Agency, 2021b). The intention is to clarify the impacts and measures the municipality must consider (Swedish Energy Agency, 2021b).

According to the assessment of the Swedish Energy Agency and the Swedish Environmental Protection Agency, the proposed amendment will result in a higher proportion of wind power projects that are initiated, leading to permits that can be

implemented and that inappropriately located wind power projects are stopped at an early stage of the project (Swedish Energy Agency, 2021b).

The difference between this new proposal and what procedures apply today is that the **issue of municipal consent is no longer part of the review process at the environmental review authority but is handled before the permit review begins** (Swedish Energy Agency, 2021b). The proposal means that **an application for a permit submitted to the review authority must contain a decision on municipal consent to be considered at all** (Swedish Energy Agency, 2021b). This means that the decision on municipal consent will be taken earlier than at present (Swedish Energy Agency, 2021b). **At present, the environmental assessment authority asks for the municipality's consent when the permit application has been submitted or when the application is complete** (Swedish Energy Agency, 2021b).

Another change compared to the existing procedures, the Swedish Energy Agency proposes that the municipality's consent decision be binding to further development(Swedish Energy Agency, 2021b). This means that the reviewing authority does not need to check whether the municipality stands by its assessment in order to be able to proceed with the review and decide the case (Swedish Energy Agency, 2021b). Today, a municipality can change its mind and reject a project that it has previously approved (Swedish Energy Agency, 2021b).

The proposal also clarifies what the municipality must consider approving the project. This is done by introducing a provision stating that **the municipality must consider whether the use of the site for wind power purposes is an appropriate use of land and water-based on the master plan** and the municipality's planned use of land and water areas in general (Swedish Energy Agency, 2021b).

The information that Swedish Energy Agency considers as necessary for municipalities approval is (Swedish Energy Agency, 2021b):

- information on the maximum area that will be used for the activity,
- the maximum number of wind turbines that the operation will involve, and
- the maximum height of the wind turbines.

In the opinion of the Swedish Energy Agency and the Swedish Environmental Protection Agency, a **more detailed assessment of the environmental impact of the wind turbines should be made by the review authority in the review of the permit application under the Environmental Code** (Swedish Energy Agency, 2021b).

This avoids the duplication of issues that are best decided within the environmental assessment process (Swedish Energy Agency, 2021b).

3.4. Environmental impact assessment

The County Administrative Board handles applications for permits for environmentally hazardous activities, and then the Environmental Assessment Delegation makes decisions on the cases (Västernorrland County Administrative Board, n.d.). **The application documents are usually public** (Västernorrland County Administrative Board, n.d.).

- An assessment of an environmentally hazardous activity always begins with the **applicant carrying out a consultation** with, among others, the County Administrative Board (Västernorrland County Administrative Board, n.d.).
- The next step is to apply **for a permit together with an environmental impact statement** to the Environmental Assessment Delegation (EAD) (Västernorrland County Administrative Board, n.d.).
- The EAD usually **sends the application and the environmental impact statement to the parties concerned** in an additional request (Västernorrland County Administrative Board, n.d.).
- **If the EAD considers that the documents need to be supplemented, it will send the applicant a supplementary order** (Västernorrland County Administrative Board, n.d.).
- When the documents are complete, EAD usually announces the application (Västernorrland County Administrative Board, n.d.).
- Then EAD sends the file to the interested parties again for a referral (Västernorrland County Administrative Board, n.d.). **The interested parties must then assess whether they think the application can be granted and whether special conditions should be imposed on the activity** (Västernorrland County Administrative Board, n.d.). The applicant always can respond to the comments submitted in the case.
- It is then up to the EAD to make a decision.

3.4.1. Consultation

The consultation process depends on the environmental impact of the activity (Västernorrland County Administrative Board, n.d.). Some activities should always be presumed to have a significant environmental impact. For other activities, the County Administrative Board decides whether or not they are likely to have a significant environmental impact (Västernorrland County Administrative Board, n.d.). Suppose a developer wants to apply for a permit for a type of activity that is not always presumed to have a significant environmental impact. In that, case the process can start with an **investigation consultation** (Västernorrland County Administrative Board, n.d.). **The purpose of the study consultation is to determine whether or not the activity will have a significant environmental impact and get your views on what the application and the environmental impact statement should contain** (Västernorrland County Administrative Board, n.d.). The County Administrative Board will then assess whether or not the activity is likely to have a significant environmental impact (Västernorrland County Administrative Board, n.d.).

If the activity is likely to have a significant environmental impact, the developer must hold a **delimitation consultation** (Västernorrland County Administrative Board, n.d.). The purpose of this consultation is to discuss the content of a more comprehensive environmental impact statement that the developer must then prepare (Västernorrland County Administrative Board, n.d.).

When an application for an environmentally hazardous activity permit must be prepared, the applicant should always start by **preparing a consultation document and then carry out a consultation** (Västernorrland County Administrative Board, n.d.). **The county administrative board, the municipality, the relevant authorities, neighbours and other interested parties must be approached during the consultation process** (Västernorrland County Administrative Board, n.d.). The applicant is responsible for the consultation process.

When **the application and the environmental impact statement is prepared, the comments received during the consultation must be used** (Västernorrland County Administrative Board, n.d.). A well-conducted consultation increases the chances that the application and the environmental impact statement are complete when submitted (Västernorrland County Administrative Board, n.d.). **This leads**

to more efficient processing and shorter processing times (Västernorrland County Administrative Board, n.d.).

3.4.2. Application and environmental impact statement

After the consultation has ended, the **developer must prepare an application and environmental impact statement and submit it to the Environmental Assessment Delegation** (Västernorrland County Administrative Board, n.d.). The comments made during the consultation must be considered (Västernorrland County Administrative Board, n.d.).

The minimum content of the application and the environmental impact statement is set out in Chapters 6 and 22 of the Environmental Code, the Environmental Assessment Regulation (SFS 2017:966) and the Regulation on Environmental Hazardous Activities and Health Protection (SFS 1998:899) (Västernorrland County Administrative Board, n.d.). An application must contain, among other things (Västernorrland County Administrative Board, n.d.):

- administrative information;
- activity codes;
- current decisions under the Environmental Protection Act/Environmental Code and other laws;
- claims, commitments and proposals for protective measures;
- proposals for monitoring and control of the activity;
- technical description with drawings, production volume, on-site information conditions;
- description of best available techniques to minimise environmental impact.

Various options must be presented with a description of their effects and costs (Västernorrland County Administrative Board, n.d.):

- information on energy use, sources of emissions, amount of foreseeable emissions and proposals for measures to prevent the generation of waste;
- information on housekeeping and recycling issues;
- status report and BAT conclusions for IED activities;
- safety report or action programme according to the Seveso Act (SFS 1999:381) for the activities concerned;

- environmental impact statement and record of consultation;
- location study (if the activity is likely to have a significant environmental impact).

The application can be submitted through an e-service and must also be submitted in paper format (Västernorrland County Administrative Board, n.d.). It must be checked with the relevant case officer how many copies are needed.

3.4.3. Notification and decision

When the application and the environmental impact statement are complete, the EAD will publish them in local newspapers and on the County Administrative Board's website (Västernorrland County Administrative Board, n.d.). The applicant is responsible for the cost of the announcement (Västernorrland County Administrative Board, n.d.). **The EAD also sends the documents to those concerned for consultation. They then have the opportunity to comment** on whether the application can be granted or whether any special conditions are needed for the activity (Västernorrland County Administrative Board, n.d.). **The applicant can respond to the comments received** (Västernorrland County Administrative Board, n.d.).

The EAD decides on the matter. Those affected by the decision can appeal to the Land and Environmental Court. The court then decides who is affected by the decision and has the right to appeal (Västernorrland County Administrative Board, n.d.).

3.4.4. Noise pollution from wind power plants

An important issue connected with the authorisation and permit issuance for wind power plant development is how high the noise levels may be (Swedish Energy Agency, 2015). The noise level from wind power in residential areas should not exceed the guideline value of 40 dB(A) (Swedish Energy Agency, 2015). In certain areas, so-called quiet areas, the noise level should not exceed 35 dB(A) (Swedish Energy Agency, 2015). **Where wind turbines emit audible tones, so-called pure tones, the noise level should be 5 dB lower** - the value of **35 dBA should not be exceeded in residential areas, and 30 dBA should not be exceeded in quiet areas** (Swedish Energy Agency, 2015).

The Swedish Energy Agency supports research and develops knowledge on wind power noise (Swedish Energy Agency, 2015). The Swedish Energy Agency also participates in the noise coordination group led by the Swedish Environmental Protection Agency, contributing

to a common understanding for uniform application and guidance on environmental noise (Swedish Energy Agency, 2015). The **Swedish Environmental Protection Agency,** provides support in what noise levels should not be exceeded and **how the measurement and calculation of noise from wind power should be carried out** (Swedish Environmental Protection Agency, 2020).

40 dBA in residential areas corresponds to an often audible level and can be perceived as disturbing (Swedish Environmental Protection Agency, 2020). However, scientific studies have not provided evidence that noise from wind turbines at these levels causes any other, more severe health effects (Swedish Environmental Protection Agency, 2020).

The Swedish Environmental Protection Agency recommends that the **Nord2000 calculation model calculate wind power noise** (Swedish Environmental Protection Agency, 2020). **For individual wind turbines on flat, open land, the Swedish Environmental Protection Agency's calculation model can be used** (Swedish Environmental Protection Agency, 2020). Concerning the measurement of noise at dwellings, the Swedish Environmental Protection Agency recommends that the measurement method in Elforsk report 98:24 can be used in the main, even though it is relatively old (Swedish Environmental Protection Agency, 2020). Research and development of new measurement methods are ongoing in Sweden and internationally (Swedish Environmental Protection Agency, 2020).

Among other things, the current guidance states that wind turbine noise monitoring should take place at the wind speed where the wind turbine generates the highest sound levels, which may be at lower wind speeds than the reference conditions of 8 m/s at 10 m height (Swedish Environmental Protection Agency, 2020).

➔Duration of the process	1.5-3 years
➔ Solar PV	not applicable
➔Windfarm	applies

3.5. Construction

3.5.1. Prior notification

If a plan is to build something that requires planning permission, the developer can apply **for prior notification first** (The National Board of Housing, 2020). The prior

notification is a way to determine whether it is possible to build the project on a particular site (The National Board of Housing, 2020). Application for prior planning permission must be handed into the **municipality's building committee** (The National Board of Housing, 2020).

A positive prior decision gives the developer the right to carry out a specific measure on a certain site, provided that the developer **applies for a building permit within two years** of the prior decision being legally valid (The National Board of Housing, 2020). Before the construction works begin, the developer **must apply for and wait for a decision on a building permit and planning permission** (The National Board of Housing, 2020).

Prior planning permission does not require as many application documents as an application for a building permit (The National Board of Housing, 2020). The preliminary decision tells whether it is possible to build on the site, and the developer does not have to produce drawings of what is planned to be built(The National Board of Housing, 2020). This means that the developer does not have to spend time and money on an unnecessary building permit application later in the project development (The National Board of Housing, 2020).

If the site is suitable for building, a positive prior decision from the building committee will be given. If it is not, a negative one will be given. The building committee has the right to charge a fee for processing an application (The National Board of Housing, 2020).

Usually, detailed plans in towns and cities determine what the land can be used for and what kind of buildings can be built (The National Board of Housing, 2020). Outside of a planned area, it is more uncertain what can be built, so it may be a good idea to seek prior approval before applying for planning permission (The National Board of Housing, 2020). When the building committee examines the application, they conduct a **location assessment** (The National Board of Housing, 2020). This means that the building committee **examines whether the site is suitable for the building**. In carrying out this assessment, the building committee bases itself on the provisions of Chapter 2 of the Planning and Building Act and the guidelines in the master plan (The National Board of Housing, 2020). The committee does not consider detailed issues such as the design of the building or its exact location in the preliminary decision (The National Board of Housing, 2020). It is assessed later in applying for a building permit (The National Board of Housing, 2020).

The Planning and Building Act states, among other things, that land should be used for the purpose for which the area is best suited (The National Board of Housing, 2020). There are many things to consider in the assessment, such as whether a building is appropriate for the site in terms of the landscape and the buildings that already exist nearby (The National

Board of Housing, 2020). There should also be appropriate distances to natural areas, ancient monuments, facilities, roads and pipes in the ground and air (The National Board of Housing, 2020). It must also be possible to make a road to the building if it does not already exist (The National Board of Housing, 2020).

When the application for prior notice is received, **the building committee notifies neighbours and other people affected and allows them to make their views known** (The National Board of Housing, 2020). In some cases, the Transport Agency, electricity companies, telecommunications companies, the County Administrative Board or other relevant authorities may also be consulted (The National Board of Housing, 2020). **Neighbours and other interested parties usually have two to four weeks** to respond to the building committee (The National Board of Housing, 2020).

Application for a prior decision must be made a good time ahead, as **it often takes longer to process a prior decision than a building permit** (The National Board of Housing, 2020). This is partly because the building committee has to visit the site and hear neighbours and other interested parties (The National Board of Housing, 2020). The building committee usually takes the decision, and it is common for the committee to meet only once a month (The National Board of Housing, 2020).

The decision should be given within ten weeks of the application, but if the building committee needs more time to investigate the case, it may take longer, but **not more than 20 weeks in total** (The National Board of Housing, 2020). The time is counted from the date the application is considered complete, i.e. when the building committee has received all the documents it needs to deal with the application (The National Board of Housing, 2020).

A **positive prior decision is binding for two years** from when the decision becomes final (The National Board of Housing, 2020). This means that the developer must apply for **planning permission** within that time if the prior decision is planned to be used as grounds for construction works (The National Board of Housing, 2020). During the two years, the building committee cannot reject a building permit application for the measure to which the prior decision relates, but this presupposes that the application for a building permit is entirely consistent with the prior decision (The National Board of Housing, 2020).

3.5.2. Building permit

1. Prepare an application.

The developer must consult the local building committee to determine what applies to the project and whether the building permit is needed (Eslöv municipality, 2021). A

notification is still required for construction works that do not need permission(Eslöv municipality, 2021). Documents to be handed in with the application must be checked. Documents depend on the project to be built (Eslöv municipality, 2021). It may also be good to inform the construction plans of the neighbours or the housing association board(Eslöv municipality, 2021).

2. Apply

The application form must be filled in and sent together with other documents to the municipalities building committee (Eslöv municipality, 2021). If the application is filled out, the process of issuing a building permit is faster (Eslöv municipality, 2021).

3. Application review

Once the building committee has received the application, the developer will receive a letter confirming that it has been received (Eslöv municipality, 2021). Sometimes it is asked to provide additional documents (Eslöv municipality, 2021). In this case, the building committee will let the developer know what is missing **within three weeks** (Eslöv municipality, 2021). Depending on the nature of the permit application, the building committee may need to take comments from interested parties - neighbours and other interested parties (Eslöv municipality, 2021).

The decision should be given **within four weeks of the date the application** is complete. (Eslöv municipality, 2021). The processing time can sometimes be extended. If the processing time is extended, the fee will be reduced by one fifth for each additional week started (Eslöv municipality, 2021).

4. Decision on permission or notification

Once the building committee has investigated the application or notification, a decision will be made, and the developer will send the decision(Eslöv municipality, 2021).

Neighbours who have made comments are notified of the decision, and if they want to appeal the decision, they need to do so within three weeks of receiving it (Eslöv municipality, 2021). If no one appeals, the building permit decision becomes final. This means that the decision can no longer be appealed (Eslöv municipality, 2021). **A building permit is valid for five years, planning permission for notification is valid for two years** (Eslöv municipality, 2021).

5. Start-up notice, construction works can begin

The construction works can start **four weeks after the permit decision has been announced and the developer has received a start-up notice** (Eslöv municipality, 2021). For smaller projects, start-up notice and the decision could be

given simultaneously (Eslöv municipality, 2021). Even then, four weeks after the decision has been announced, construction works can begin (Eslöv municipality, 2021).

6. Completion notice, start using the building

The building should not be used before a completion notice has been received from the building committee (Eslöv municipality, 2021). **When the construction works have been finished, the developer must notify the building committee and approve completion** (Eslöv municipality, 2021). Once the developers have shown that all the requirements set out in the project have been met, a final decision will be given, and the case will be closed (Eslöv municipality, 2021). Sometimes a **final consultation** is required, but usually for larger or more complex projects (Eslöv municipality, 2021).

➔Duration of the permit issuance	within ten weeks (construction can start four weeks after receiving permit)
➔ Solar PV	applies
➔Windfarm	applies

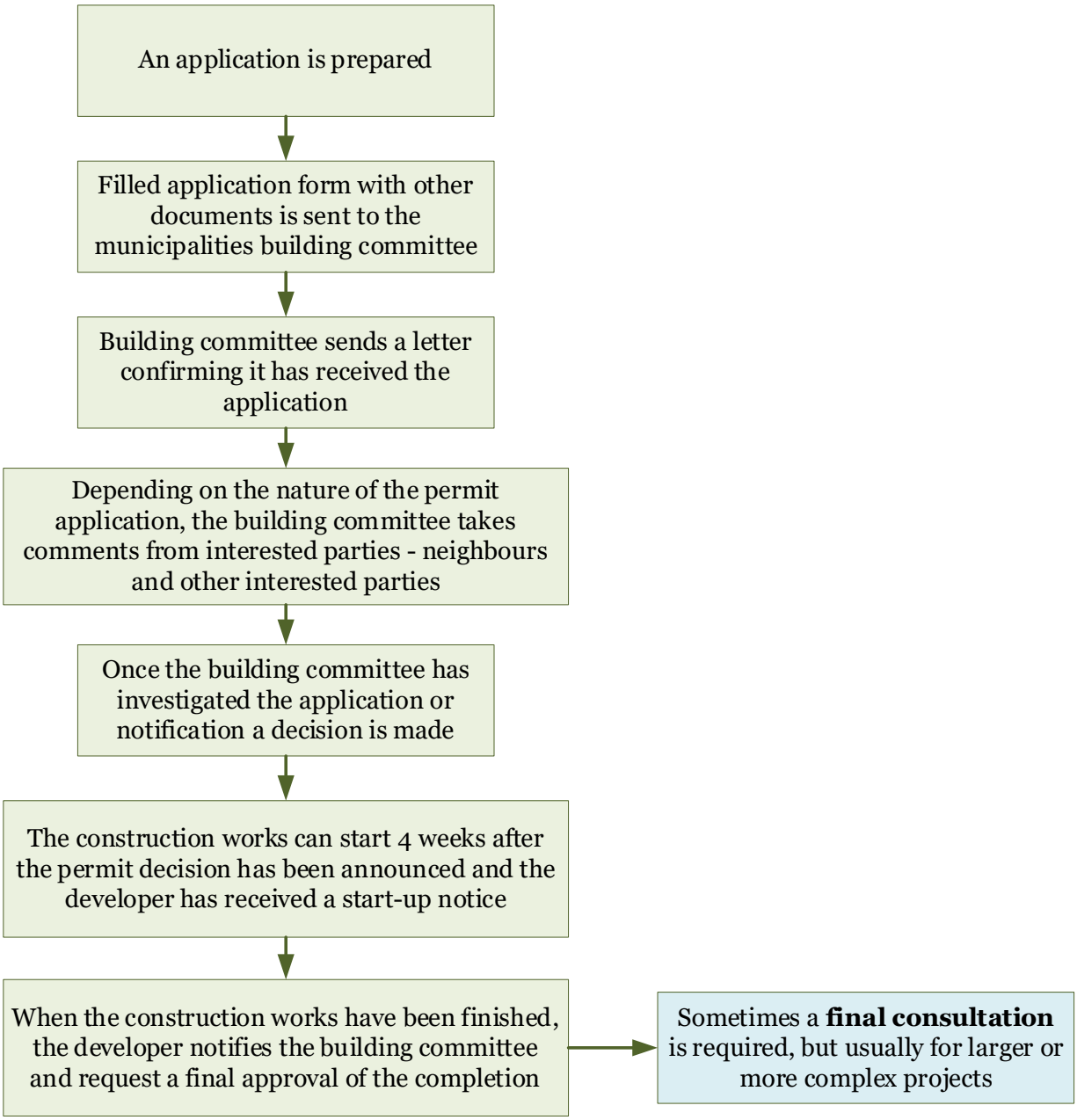

Fig.3.5. Steps required for granting a building permit

3.6. Connection to the grid

The electricity grid in Sweden has three levels: **the main grid, regional grids and local grids** (Jämtkraft AB, n.d.). The main grid is the network closest to the major power plants and carries electricity across the country and to Sweden's neighbouring countries (Jämtkraft AB, n.d.). Electricity is passed on to regional and local grids from the main grid. On the main grid, the voltage is as high as 400 000 volts, but in individual households, it is

230 volts (Jämtkraft AB, n.d.). The higher voltage on the main grid is that it reduces energy losses.

The government has assigned Svenska kraftnät the task to maintain and develop the Swedish national grid for electricity (Svenska kraftnät, 2021b). The national grid power lines transport electricity from wind, hydro and nuclear power stations to regional and local electricity networks, transmitting the electricity to the consumers (Svenska kraftnät, 2021b). The connection of renewable energy is one of the reasons that Svenska kraftnät is currently reinforcing and expanding the grid at several locations in the country (Svenska kraftnät, 2021b). Another reason is to promote competition in the electricity market where electricity is bought and sold (Svenska kraftnät, 2021b). In order for the electricity market to operate more efficiently and with free competition, Svenska kraftnät is also eliminating so-called "bottlenecks" in the Nordic electricity network and the networks that connect Sweden with the rest of Europe (Svenska kraftnät, 2021b). Bottlenecks are narrow passages in the network that we need to strengthen to transmit more electricity (Svenska kraftnät, 2021b).

The electricity network is divided into different areas, called grid areas (Jämtkraft AB, n.d.). Around 170 electricity network companies in Sweden are responsible for their network areas (Jämtkraft AB, n.d.). In each network area, there is only one company responsible for the networks (Jämtkraft AB, n.d.). The electricity networks fed from various production facilities into the main grid and out of the main grid to customers in the local and regional grids (Jämtkraft AB, n.d.). Nowadays, it is no longer evident that all the electricity produced comes from a large power plant and goes into the grid (Jämtkraft AB, n.d.). More and more people have their production facilities at home, such as solar panels on the roof of their houses (Jämtkraft AB, n.d.). So the input and output of electricity to the grid can take place at several different levels (Jämtkraft AB, n.d.).

3.6.1. Connecting a small-scale power plant to the grid

Generating electricity from renewable energy sources in a small power plant, mainly for household use, is called microgeneration and is a form of small-scale generation (Jämtkraft, n.d.). Microgeneration refers to an installation that is permanently connected to the electricity grid and that (Jämtkraft, n.d.):

- is a net consumer, i.e. consumes more electricity in a year than it produces;
- has input and output at the same point;

- has a main fuse of not more than 63 amperes and an input power of not more than **43,5 kW**.

Own electricity production is defined as **small-scale** if the production plant has an installed capacity of less than **1500 kW** (Jämtkraft, n.d.). When installing and connecting a small-scale electricity production to the grid, there are a few things that need to be considered (Jämtkraft, n.d.):

- a qualified electrician must be contacted who makes a pre-notification to the distribution system operator (DSO) to install the power plant;
- complete the pre-notification by filling in the form "Notification of connection of microgeneration";
- DSO checks if the electricity network is sufficiently rated to connect the generation. If the grid needs to be upgraded, DSO will provide the customer with an offer;
- once the electrician has received approval from the DSO, installation of the power plant takes place;
- the electrician then sends a completed notification to the DSO, which installs a new electricity meter in customers property free of charge;
- the customer will also need to sign an electricity trading agreement with an electricity trader to sell the surplus electricity that it produces.

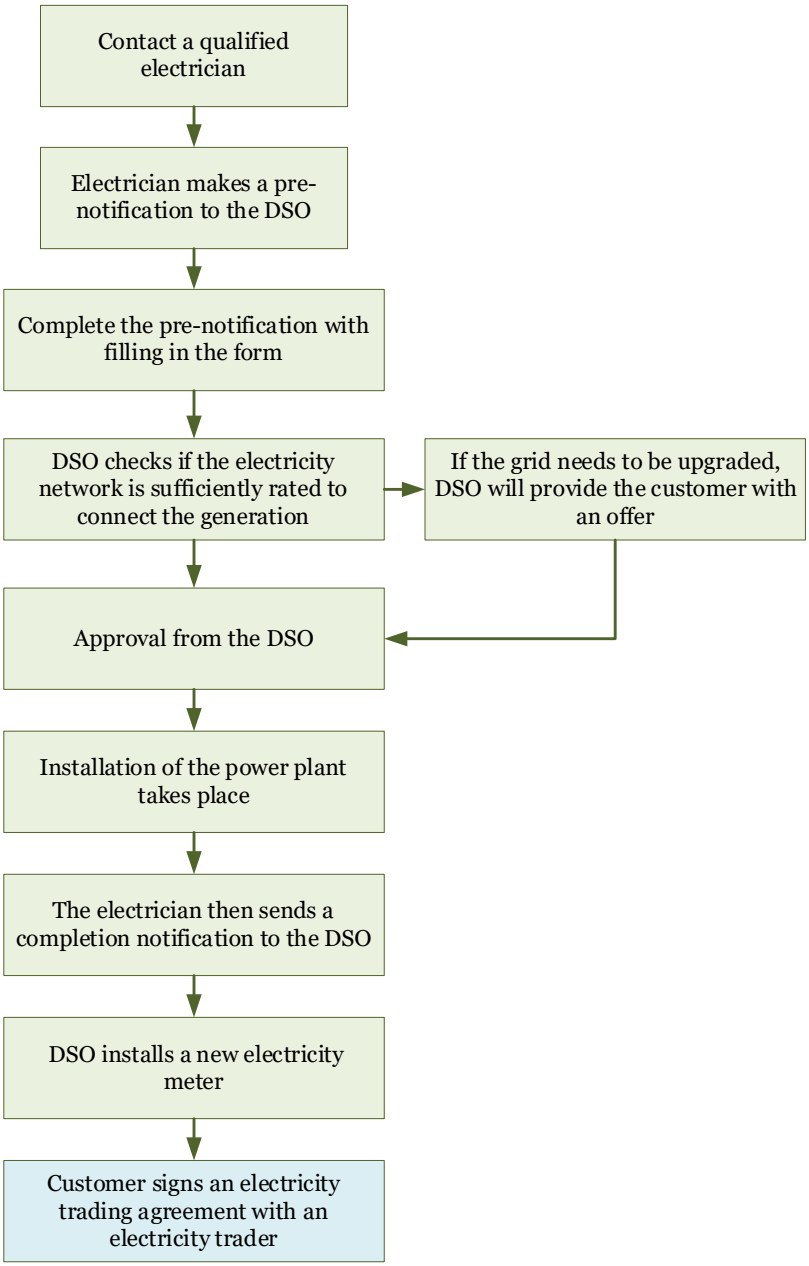

Fig.3.6. Connection process to Distribution System Operator

3.6.2. Connection to the grid for large-scale power plants

Large electricity producers and network owners can transport electricity on the grid if their facilities are connected (Svenska kraftnät, 2021a). An input or socket of at least 100 megawatts is required, and the 400-kilovolt network requires at least 300 megawatts to connect to Svenska kraftnät 220-kilovolt network (Svenska kraftnät, 2017). To establish a connection to the main grid (Svenska kraftnät, 2017):

- formal application must be submitted using the online form on Svenska kraftnät homepage;
- Svenska kraftnät will investigate whether it is possible to connect the plant/network to the transmission network and, if so, what measures will be necessary. The investigation should be completed **within 12 months** of receiving all the information needed;
- once the investigation is complete, Svenska kraftnät will send the developer an **advance notice of connection with information on the estimated connection fee and a timetable for when the connection can be made**;
- the developer will then **sign an agreement of intent** with Svenska Kraftnät. The agreement means that Svenska Kraftnät will carry out a technical feasibility study. Once the letter of intent has been signed, Svenska Kraftnät will start the technical feasibility study. Svenska Kraftnät charges a fixed fee for carrying out the feasibility study;
- once the technical feasibility study is completed, the developer signs a **connection agreement with Svenska Kraftnät**. The connection agreement regulates the conditions for the connection and sets out the timetable for the connection.

In some cases, Svenska Kraftnät charges a connection fee (Svenska kraftnät, 2017). Sometimes investments in the transmission network must be made because of many new connections (Svenska kraftnät, 2017). For example, Svenska Kraftnät may need to extend an existing station or build a completely new one (Svenska kraftnät, 2017). The connection fee also covers additional costs if Svenska kraftnät needs to make investments earlier than planned, if the plant had not been connected, so-called early investments (Svenska kraftnät, 2017).

Svenska Kraftnät cannot guarantee an exact time for connection. Usually, it can be expected that it will take **three and a half years from signing the connection agreement until the connection is operational** (Svenska kraftnät, 2017). It takes longer when new lines need to be built(Svenska kraftnät, 2017).

➔Duration of the permit issuance	3.5 years
➔ Solar PV	applies
➔Windfarm	applies

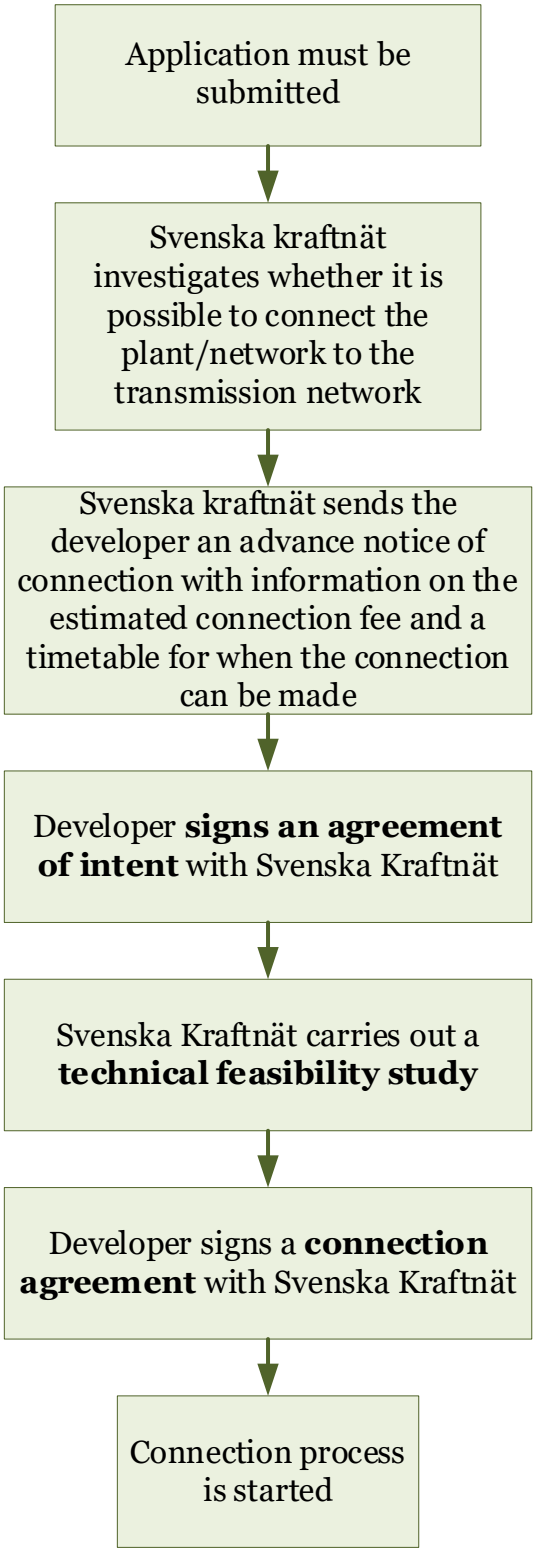

Fig.3.7. Connection to the Transmission System Operator

3.6.3. Electricity trade

Sweden's electricity trades deregulated (Swedish Energy Markets Inspectorate, 2020). As a customer, everyone can decide whom they want to buy electricity. Electricity distribution, however, takes place via the electricity network monopoly (Swedish Energy Markets Inspectorate, 2020). Electricity network operations in Sweden are regulated by the Swedish Energy Markets Inspectorate (Ei) (Swedish Energy Markets Inspectorate, 2020).

The distribution of electricity, however, is conducted in a monopoly. Different companies are responsible for different parts of the electricity network around the country (Swedish Energy Markets Inspectorate, 2020). In total, there are approximately 170 Distribution Systems Operators (DSO:s), and the sale of electricity is competitive - customers have approximately 120 suppliers to choose from (Swedish Energy Markets Inspectorate, 2020).

3.7. Offshore wind farms

Establishing an offshore wind farm is often a large project with many stakeholders. The significant environmental impact must also be assessed and tried. The legal process is complex and time-consuming as it involves an application for many different permits and notifications, and consultations with concerned authorities, organizations, and individuals (Setterwalls, 2021). **The location and design of the wind farm determine which permits are necessary for the particular project** (Setterwalls, 2021).

The construction of offshore wind turbines in the Swedish Economic Zone requires government approval under the Swedish Economic Zone Act (Swedish Energy Agency, 2020a). Sweden's maritime territory is defined in the Swedish Maritime Territory Act (1966:374), and the territory extends at most **12 nautical miles (about 22.2 km) from the coast** (Swedish Energy Agency, 2020a).

Outside the territorial limit, the Swedish economic zone begins with the Government's decision in the Swedish Economic Zone Act (1992:1226) (Swedish Energy Agency, 2020a). The zone is delimited towards the economic zone of another State by an agreement with that State or otherwise with the median line towards the other State (Swedish Energy Agency, 2020a).

Within the Swedish economic zone, the construction and use of installations and other facilities for commercial purposes require authorisation

from the Government, under Section 5 of the Swedish Economic Zone Act (1992:1140) (Swedish Energy Agency, 2020a). In the case of an authorisation assessment, Chapters 2 to 4, Chapter 5(3) and Chapter 16(1) must be complied with. 5 of the Environmental Code shall apply (Swedish Energy Agency, 2020a). The application must include an environmental impact assessment, which must be prepared by the rules laid down in Chapter 6 of the Environmental Code (Swedish Energy Agency, 2020a). Under the Continental Shelf Act (1966:314), a permit is also required to investigate the seabed and the laying of cables for wind power installations in public waters and the economic zone (Swedish Energy Agency, 2020a).

The construction of wind turbines in water areas within the maritime territory boundary in the sea requires a permit for **environmentally hazardous activities and water activities** under the Environmental Code and the **approval of the municipality** (Swedish Energy Agency, 2020f). Permits for wind power installations in water are usually examined by the **Land and Environmental Court** (Swedish Energy Agency, 2020f).

According to Chapter 11. 9 of the Environmental Code, a permit is generally required for water activities (Swedish Energy Agency, 2020f). Such a permit is applied for by Chapter 11. 9 b § of the Environmental Code. Permits for environmentally hazardous activities are usually applied from the County Administrative Board (Swedish Energy Agency, 2020f). When an operator applies to the Land and Environmental Court for a Chapter 11 permit, it is easiest to include the Chapter 9 examination directly in the examination at the Land and Environmental Court (Swedish Energy Agency, 2020f). The fact that this is possible follows from Chapter 21, Section 3 of the Environmental Code (Swedish Energy Agency, 2020f). The construction of wind turbines outside Sweden's maritime territory requires a permit under the Swedish Economic Zone Act (Swedish Energy Agency, 2020f).

Within the Swedish territorial sea, the legal procedure for establishing a wind farm is similar to the process on land (Setterwalls, 2021). **Under Chapter 9 of the Environmental Code, an environmental permit is required, and a permit for water activities is required under Chapter 11** (Setterwalls, 2021). An application for an environmental permit is usually tried by the **County Administrative Board** and a permit for water activities by the **Land and Environmental Court**. However, when both permits are required for the same project, **the permit applications are usually tried jointly by the Land and Environmental Court** (Setterwalls, 2021).

The permit process includes an environmental impact assessment (EIA) and consultations with concerned authorities, organizations and individuals (Setterwalls, 2021).

The Swedish Armed Forces should always be consulted early, as they must not oppose the project (Setterwalls, 2021). An airport obstacle analysis must also be performed (Setterwalls, 2021). If the wind farm is located within a Swedish **municipality, they must approve the project** (Setterwalls, 2021).

The EU has ratified the Espoo Convention, which requires the parties to the convention to notify and consult each other regarding activities expected to have a significant adverse environmental impact across boundaries (Setterwalls, 2021). **If a planned wind farm is located close to a neighbour state, the neighbouring state must therefore be notified and consulted** (Setterwalls, 2021). They ensure that consultation under the Espoo Convention lies with **the Environmental Protection Agency**.

In order to obtain a permit for water activities, the wind farm operator must show that it has a legal right to the disposal of the water area where the wind farm is to be constructed (Setterwalls, 2021). All water within the Swedish territorial sea constitutes public water unless it is included in a property, in which case it constitutes individual water. When establishing a wind farm in public water, **approval from the Legal, Financial and Administrative Services Agency (Sw. Kammarkollegiet) is required** (Setterwalls, 2021). **In private waters, approval must be obtained through an agreement with concerned property owners** (Setterwalls, 2021).

3.7.1. The large offshore wind park

The design of wind farms should consider existing traffic routes in and out of ports and vessel traffic along the country's coastline. Bypassing shipping increases fuel consumption, which counteracts the environmental benefits of wind energy (Transportstyrelsen, n.d.-a).

The **Swedish Transport Agency** and the **Swedish Maritime Administration** should be contacted first to build an offshore wind farm (Transportstyrelsen, n.d.-a). For planned wind farm and turbine installation sites, a **document including a detailed nautical chart** (in GIS format) should be presented in the consultation to indicate that the construction of the wind farm will not interrupt or severely affect existing shipping lanes, the traffic along the quays and the access to maritime safety devices (Transportstyrelsen, n.d.-b). **There is also a need to establish a safe distance between the wind turbines and the nearest marine traffic lane**. This distance is adapted to the local conditions - the intensity of maritime traffic, height and rotor diameter of the wind turbines, etc. (Transportstyrelsen, n.d.-b).

Following the consultation, an EIA should be carried out, including a risk analysis of how changes in shipping traffic could affect the environment if shipping routes are altered due to the construction of wind farms (Boverket, 2020b; Energimyndigheten, 2020l, 2020j, 2020h; Miljödepartementet, 2006a). In addition, the permits required and the authorities that examine these permits differ (Boverket, 2020b; Energimyndigheten, 2020l, 2020j, 2020h; Miljödepartementet, 2006a).

➔Duration of the permit issuance	7.5 years
➔ Solar PV	applies
➔Windfarm	applies

3.8. Experience in developing wind farms and the permitting process in Sweden

Vattenfall Ltd. shares its experience in developing wind farms and the permitting process in Sweden

Vattenfall Ltd starts the construction and implementation of the wind park by finding a suitable site and concluding an agreement with the landowners (Vattenfall, n.d.-a). In many cases, it takes a long time, seven to ten years, before an environmental permit is legally in place and construction can begin. Careful studies are carried out of the natural and cultural environment and the geotechnical conditions in the area where the wind turbines are installed and where roads and internal electricity networks are built (Vattenfall, n.d.-b). Any impact on humans, animals and plants in the area shall be assessed. Consultations and dialogues with authorities, residents and other stakeholders are being held to obtain the views of residents and authorities on the potential construction and operation of the wind farm (Vattenfall, n.d.-b).

Wind farms almost always require an environmental permit under the Swedish Environmental Code. The results of the investigations and the views of the consultations are summarised in an Environmental Impact Statement (EIS), which is submitted to one of the country's environmental assessment delegations together with the environmental permit application (Vattenfall, n.d.-b).

The environmental assessment delegation then submits its requirements for supplements. Once the responses are received, the documents are communicated, and those concerned have the opportunity to comment before the environmental assessment delegation

decides on the permit (Vattenfall, n.d.-b). However, an environmental permit can only be granted if the municipality has approved the application. The permit always contains conditions to be fulfilled by the wind farm owner(Vattenfall, n.d.-b). The condition usually regulates, for example, how high noise levels are to be tolerated at nearby residential buildings. The permit can be appealed to a higher court.

Construction can start once the environmental permit has become legally valid (i.e. it can no longer be appealed) (Vattenfall, n.d.-b).

Consultation process

First, information on planned activities in the area must be gathered and sent to the municipal council and the responsible municipal committee (Alanko et al., 2012b). The information to be sent should include the proposed location, its dimensions, and potential environmental impact. It is also desirable to include simple maps, sketches and short descriptions of each section. Together with the County Administrative Council, the applicant shall determine which stakeholders will be included in the consultation process (Alanko et al., 2012b). The process by which this consultation will be carried out shall be determined in consultation with the County Administrative Board. A public consultation is organised, where information meetings are held, and the public is informed about the forthcoming project. Advertisements may be placed in the local press, letters sent to stakeholders to inform the public of the forthcoming public consultation (Alanko et al., 2012b). The consultation process must be documented. On average, the consultation process takes about six months (Alanko et al., 2012b).

Environmental impact assessment

The preparation of an EIA can start after the consultation process has been completed. The purpose of the EIA is to identify and describe the direct and indirect impacts of the construction and operation of the wind farm on the environment, people, animals, climate, landscape, and the conservation of land, water and raw materials (Alanko et al., 2012b). The county administrative council determines the scope of the EIAs part of the consultation process (Alanko et al., 2012b).

Application for authorisation

The permit application can be obtained after the EIA has been completed. The written permit application must include the following additional information (Alanko et al., 2012b):

- drawings and technical descriptions;
- detailed information on the projected emissions;

- a statement of how the provisions of the Environmental Code will be complied with;
- recommendations for monitoring and control of the wind farm.

Once the application with all the information described above has been submitted to the county administrative council, it is passed on to other organisations that could assess and give their opinion on the wind farm. For example, the Swedish Energy Agency, the local municipality, the Nature Conservation Society, the Swedish Post and Telecommunications Authority (Alanko et al., 2012b). These institutions have the right to request additional information from the applicant at any point mentioned in the application. Once the application has been examined and clarified by the applicant (if necessary), the licensing authority will decide whether to grant the licence (Alanko et al., 2012b). Licensing decisions are often subject to appeal in Sweden.

Other permits

Depending on circumstances, other permits may be required. These may only be requested after the County Administrative Council has granted authorisation. Examples of additional permits required during construction (Alanko et al., 2012b):

- Permit for installation and use of power lines;
- a permit under the Cultural Heritage Act;
- permits for violations of protected areas under the Environmental Code.

These additional permits are granted five years (Alanko et al., 2012b). A new permit is required if the wind farm construction is not completed within this period. If construction is not started within these five years, it becomes null and void. If construction is completed within five years, the permit is valid for 30 years (Alanko et al., 2012b).

Connecting to the common electricity network

At the request of the wind farm installer, the local grid operator shall, for reasonable compensation, connect the electricity installations that meet the technical specifications to the common electricity grid (Alanko et al., 2012b). A contract is usually concluded between the grid operator and the person in charge of the wind farm. The contract shall contain conditions for both parties to connect the wind farm to the common electricity grid. The contract is concluded for the wind farm's installed capacity, which the grid allows. This is the reason why the local grid operator is reluctant to enter into a contract with the person in charge of the wind farm, as there is no definitive assurance that the project will be carried out with the specific capacity envisaged and that the initially forecasted capacity will remain

unchanged (Alanko et al., 2012b). Therefore, the grid connection agreement is one of the last documents required for the wind farm.

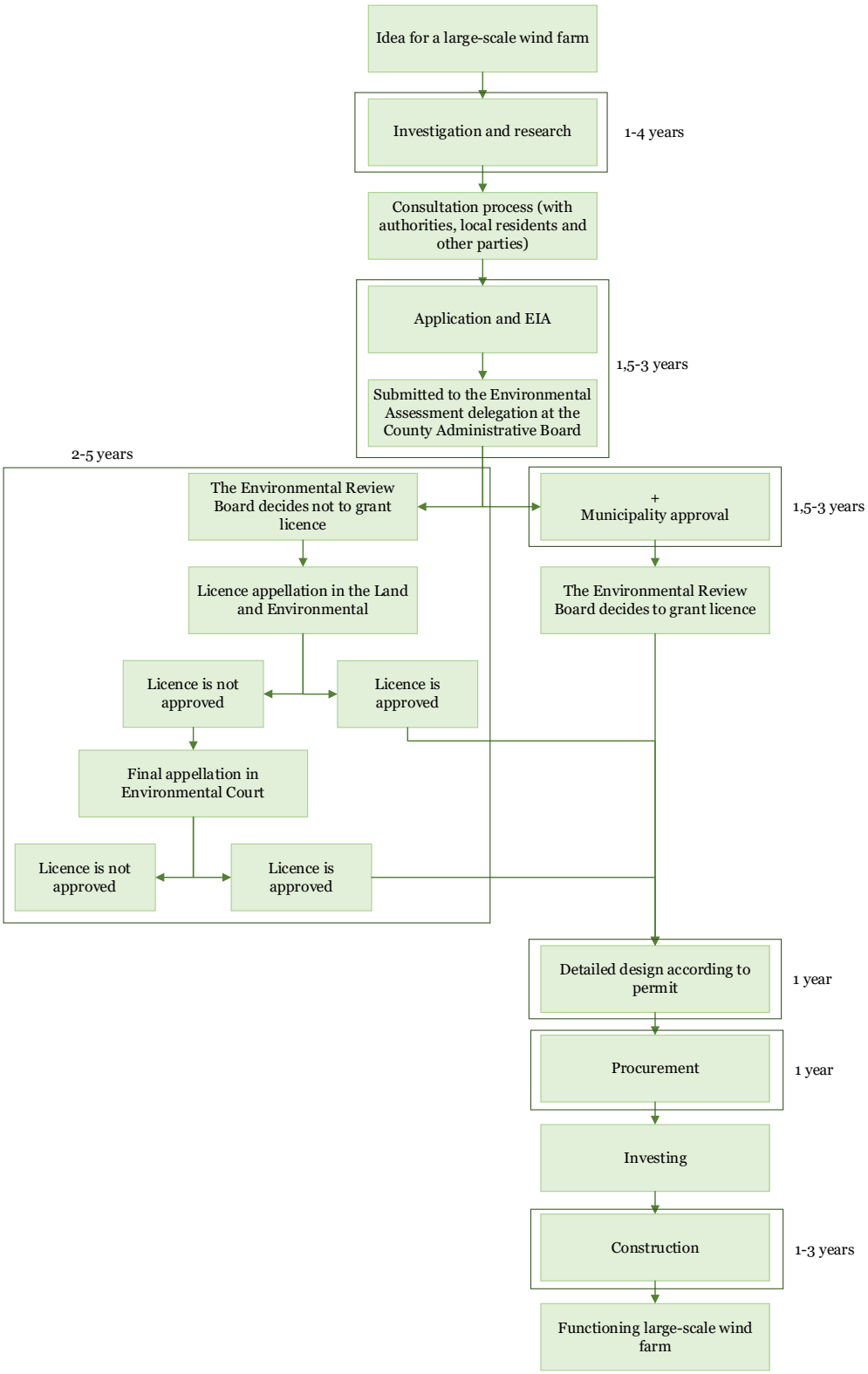

Fig.3.8. Proces of large-scale wind farm construction and implementation process (Swedish Energy Agency, 2020b), (Alanko et al., 2012b)

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