Nordic Contingency Planning and Crisis Management

The Nordic Forum for Emergency Matters regarding the Power Sector
Since the first half of the 1990s, the energy authorities of the Nordic countries - Denmark, Finland, Norway, Iceland and Sweden, - have held regular meetings about contingency planning and management in the Nordic power sectors. These meetings were formalized in 2004 by means of a Letter of Intent signed by the Nordic countries.

At present, Nordic co-operation in contingency planning and management in the power sectors centres on two interconnected forums. The key forum is the Nordic Energy Authorities’ Group for Emergency Matters in the Power Sector - Nordisk Myndighetsgrupp för Kraftförsörjningsberedskap (NMK) - which consists of all the energy authorities. This co-operation centres on information exchange and experience sharing between the authorities, but can also take the form of joint projects.

In order for this co-operation to also include the TSOs and other significant parties in the Nordic power sector, a larger group has been established based on NMK and called The Nordic Forum for Emergency Matters regarding the Power Sector - Nordisk Elberedskaps- och Säkerhetsforum (NEF) - consisting of NMK plus the TSOs and other organizations of the power industry. This forum is open to other relevant parties within the power sector. The objective of the forum is to conduct a dialogue between the involved parties regarding contingency planning and management in the power sector. NEF deals with issues which are not managed by means of TSO co-operation via Nordel.

Co-operation is important for the security of the electricity supply under normal conditions and before, during, and after serious disruptions and crises. Within the EU, the concept of “security of supply” refers to supply preparedness in general and includes supply security during serious disruptions caused by climatic conditions, or a shortage of generating capacity.

The term Critical Infrastructure Protection (CIP) was originally used by NATO. The term is also used nowadays in a more general meaning to refer to the services and systems used by society. Safeguarding the vital functions of society and the security of supply functions, which have already been in use previously, is gaining increasing attention within the EU. This is why it is useful that the efforts of NEF and NMK are guided and augmented in the direction of the EU. This will probably also have an effect on the topics, contents, and publication methods of research projects and reports carried out within the scope of Nordic energy co-operation.

Risto Leukkunen
Chairman
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Summary

In general, contingency planning and crisis management are principally regulated by national authorities, although some EU regulations are of relevance. This also applies to the power sector. Therefore, at present, no EU regulations are in force which are specifically aimed at contingency planning and crisis management in the power sector.

However, contingency planning and crisis management in the power sector are closely related to matters regarding the security of the supply of power, which is covered by several EU directives. Thus, these directives and the general national regulation governing the power sector are of relevance to contingency planning and crisis management in this sector.

Sections of EU Regulations are normative as regards national legislation within the EU and the European Economic Area. During the process of developing the different regulations, it is of major importance that common aspects of the Nordic countries can be discussed within NEF. Each country however makes its own sovereign statement.

The Nordic power system and electricity market have undergone a comprehensive process of restructuring during recent years. The single electricity market consists of Denmark, Finland, Norway and Sweden. Iceland also takes part in Nordic co-operation via Nordel (the collaboration agency of the Nordic TSOs), but is not interconnected with the other countries.

In all the Nordic countries, an independent TSO solution has been chosen. This means that the TSO owns as well as operates the main national grid. The networks, as natural monopolies, are kept out of competitive activities.

The TSOs are responsible for maintaining the balance of the system. They all have systems and arrangements for reducing consumption in case of power outages. Both automatic and manual systems are used.

During energy shortages, it is necessary to reduce general consumption, remove all unnecessary consumption, and take control of generating resources. The first step is to inform consumers about the situation and appeal for a reduction in consumption. The next step is issuing more stringent orders. Finally, rationing by means of quotas and, ultimately, enforcing supply restrictions by means of physical coupling may be brought to bear.

Resources exist in the form of staff, equipment, and materials for lending across national boundaries in a situation of heightened preparedness. There are also different information systems and databases providing an overview of what is available for loan during a crisis.

In Denmark the Energy Authority is responsible for contingency planning and crisis management in the different energy sectors, including the power sector. State-owned Energinet.dk is TSO. Energinet.dk takes care of the overall coordination of tasks with respect to contingency planning and crisis management in the power sector, and natural gas sector.

All costs regarding contingency planning and crisis management in the power sector in Denmark are borne by the respective companies.

In Finland, the Ministry of Trade and Industry is ultimately responsible for developing and maintaining supply preparedness, making the related preparatory arrangements. The National Emergency Supply Agency is responsible for developing and maintaining emergency supplies. Fingrid Oyj is TSO pursuant to the Electricity Market Act.

The cost of preparedness efforts is financed by the emergency supply fund or by individual companies.

In Iceland, there is as yet no special organisation which is responsible for preparedness during severe operational disruptions or crises in the electricity supply. The companies themselves must take care of all contingency planning.

Landsnet is TSO. It is already planned to establish a common emergency management team in 2006 for the electrical system in Iceland, managed by Landsnet.

In Norway the Ministry of Petroleum and Energy is responsible for contingency planning and crisis management in the different energy sectors. The Norwegian Water Resources and Energy Directorate (NVE) has been assigned the responsibility of managing Norway’s water and energy resources. This includes the responsibility for coordinating contingency planning and governing the power supply during extraordinary circumstances, during times of crisis and war.

Statnett SF is Norway’s TSO.

The respective companies bear all costs relating to contingency planning and crisis management in the power sector.

In Sweden the Swedish Energy Agency (SEA) has the all-embracing responsibility for contingency preparations in the electricity supply. The Energy Markets Inspectorate, a division of the SEA, is the network authority.

Svenska Kraftnät is the TSO in compliance with the Power Contingency Act and its ordinances.

In Sweden, holders of network concessions must pay power contingency fees for financing contingency measures adopted by the power contingency authority. The SEA’s contingency operation is financed using funds from the national budget.
1. The aim and outline of the report

1.1 Introduction
Modern life is based on electricity being available in sufficient amounts at all times. Such a supply, for most consumers, is taken for granted as the normal supply, and is not regarded to be a problem unless it unexpectedly disappears. Gradually and without being aware of it, society has become more and more dependent on electricity. Thus, our entire basic infrastructure - telecommunications, information technology, transportation systems, the financial sector and electronic payments, water supply, etc. just to mention a few examples - will experience severe difficulties if there is a power outage. Similarly, this applies to health services, industries, distribution networks, shops, offices, etc. in both the private and public sectors.

The power sector is one of the few sectors that have the potential to cause major and widespread breakdowns in many other sectors. Of course, this does not happen during the frequent, local, and brief blackouts. But it could happen when there is a power outage covering a large part of the population for a significant period of time.

Moreover, electricity is an extraordinary commodity in that it differs significantly from other commodities. It cannot be stored in large amounts. It cannot be transported over long distances without high cost. It is dependent on complex networks between producers and consumers. And it has to be produced at the same time as it is consumed, thus functioning in accordance with the ultimate just-in-time principle. Each of these characteristics can be found in other commodities, but very seldom together, and certainly not for a commodity as important as electricity.

The importance of electricity is magnified by two other factors. Firstly, electricity cannot, in many cases, be replaced by another type of energy, increasing our dependence on the power supply. Secondly, a breakdown in the power supply will have immediate effects compared with a breakdown in crude oil or gasoline supplies, which will only have a delayed effect.

Furthermore, the national transmission networks linking production and distribution have gradually become more dependent on each other. The interconnectors have changed from being bridges between different national networks to being integrated and vital parts of these networks. Thus, to some extent, the national power systems have acquired transnational characteristics.

All these elements - the importance of electricity, its fundamental characteristics, and the increasing transnational character of the power systems - play a significant part in work concerning contingency planning and crisis management in order to avoid cascade effects, entailing that a crisis will develop into a severe power outage and from that turn into a more significant crisis for society.

This work requires co-ordination; co-ordination within the power sector and between industry and the authorities, co-ordination between the power sector and other sectors of society, co-ordination between the national power sector and the power sectors of neighbouring countries. Such co-ordination can take many forms. It can consist of information-sharing, understanding each other's systems, vulnerabilities and capabilities, identification of problems of mutual interest, joint projects, etc. It can also be more far-reaching and can include, for example, joint crisis management mechanisms and standardisation (of equipment, methodologies, goals, etc.). This report forms part of such co-operation between the Nordic authorities responsible for contingency planning with regard to the power supply.
When reading this report on contingency planning and management in the Nordic power sectors, it should be remembered that, although the Nordic countries are rather homogeneous, this is not quite the case when it comes to their power sectors. The conditions dictated by nature are very different, in particular with respect to the hydropower potential. In addition, the energy policies pursued have been rather different. Thus, both the amount of electricity consumed per capita and the price per kWh vary from country to country, see also Section 5.1.

1.2 The aim of the report

The aim of the report is to describe the organisation of the power system in the Nordic area, which resources are at our disposal and how preparedness across national boundaries can be improved. On the basis of the areas of collaboration identified during work on the report, a plan of action will be produced with the aim of increasing the security of the Nordic electricity supply.

The target group for the report, besides its commissioner, will be the Nordic countries’ ministries, authorities, trade organisations and associations, system operators, industry companies, and contractors, as well as our European collaboration partners.

The report is available in print and has also been posted on the authorities’ websites. More detailed information about laws, ordinances, power systems etc. can be obtained via links on the authorities’ websites (see Appendix).
2. International and national legislation

2.1 EU regulations
In general, contingency planning and management are mainly regulated by national authorities, although some EU regulations are of relevance. This also applies to the power sector. Thus, at present, no EU regulations are in force specifically aimed at contingency planning and management in the power sector.

However, contingency planning and management in the power sector are closely related to matters concerning the security of the power supply, which is covered by several EU directives. Thus, these directives and the general national regulation regarding the power sector are of relevance to contingency planning and management in this sector.

Furthermore, the present work of the European Commission, according to the Commission's Communication of 20 October 2004, regarding Critical Infrastructure Protection, is directly relevant to contingency planning and management in the power sector and may result in EU regulations being implemented via national regulations. The Commission has held two seminars - in June and September 2005 - regarding Critical Infrastructure Protection and this important and complex, cross-sectoral work is likely to increase during coming years.

During the process of developing EU Regulations, each Nordic country is given the opportunity to propose modifications and amendments. Sections of EU Regulations are normative as regards national legislation within the EU and the European Economic Area. It is of major importance that common aspects of the Nordic countries can be discussed within The Nordic Forum for Emergency Matters Regarding the Power Sector (NEF). Each country however makes its own sovereign statement.

2.2 Legislation, authorities and TSOs

Denmark
Legislation
The Civil Emergency Procedures Act whereby all ministers shall, each within their respective areas, plan for the maintenance and continuation of social functions in case of incident and catastrophe.

The Electricity Supply Act governing contingency planning and crisis management for the power sector in general.

Regulation no. 58 of 17 January 2005 governing contingency planning in the power sector.

Regulation no. 917 of 13 November 2002 governing contingency planning regarding fuel storage in the electricity sector.

The Danish regulation governing contingency planning and management is almost identical with respect to both the power and natural gas sectors.

Authorities
On behalf of the Minister for Transport and Energy, the Danish Energy Authority is responsible for contingency planning and crisis management in the different energy sectors, including the power sector.

Transmission system operator (TSO)
State-owned Energinet.dk is the TSO. This company was established in the autumn of 2005 by combining Elkraft System, Eltra, and Gastra. Energinet.dk has the overall, coordination responsibility for contingency planning and crisis management in the power and natural gas sectors in Denmark.

Finland
Legislation
The act governing the ensuring of supply preparedness aims to secure the livelihood of the population as well as the industrial, commercial, and economic functions of the country in the event of exceptional circumstances and serious disruptions occurring during normal conditions. The act governing the obligatory storage of imported fuels stipulates that coal, crude oil, oil products, and natural gas must be stored, with natural gas being stored as oil-equivalents. The act governing security storage also stipulates provisions concerning the energy industry. The Emergency Powers Act and the act governing the state of defence stipulate provisions concerning the powers of the authorities. The Electricity Market Act stipulates provisions concerning issues such as the system responsibility and a general obligation to develop the electricity grid. The Energy Market Authority is responsible for supervising the generating capacity on the electricity market.

Authorities
The Ministry of Trade and Industry is ultimately responsible for developing and maintaining supply preparedness and manages the related preparatory arrangements. The National Emergency Supply Agency is responsible for developing and maintaining the emergency supply.

In exceptional circumstances, the emergency supply organisation, made up of energy industry companies, may obtain official authority.

Transmission system operator (TSO)
Fingrid Oyj is a private and public shareholding company and bears the system responsibility pursuant to the Electricity Market Act.

Iceland
Legislation
No laws or ordinances deal directly with the electricity companies’ preparedness due to power shortages or other major incidents. In a crisis, the Civil Defence Act applies.

The intention of the Civil Defence Act is to safeguard preparedness during a crisis. Within the framework of the Act, it is possible to obligate certain companies to draw up special contingency plans for emergency handling.
2. International and national legislation.

The purpose of the Electricity Act is to separate electricity production from transmission. The new Act removes Landsvirkjun’s responsibility to supply all customers with sufficient volumes of power. All parts of the Act came into force in January 2005.

Associated with the Electricity Act, there are different laws and ordinances describing the function of Landsnet during the operation of the electricity system which are to ensure, among other things, a sufficient level of quality and delivery reliability in the power produced, as well as the quality of the system operation.

Authorities
Orkustofnun is responsible for implementing the Electricity Act. The National Commissioner of the Icelandic Police is responsible for implementing the Civil Defence Act.

Transmission system operator (TSO)
Landsnet’s task is to manage power transmission and system operation, as well as maintenance, in accordance with the stipulations of Chapter III of the Electricity Act.

Norway

Legislation
The relevant legislation is the law governing the production, transforming, transmission, trading, distribution, and consumption of energy etc. (the Energy Act). The Energy Act regulates matters pertaining to electricity and district heating, as well as contingency planning and the rationing of energy.

Security regulations for the power supply industry cover provisions aimed at preventing damage during wartime or sabotage to plants that are or will be important to the national power supply. This includes existing plants, and plants under construction. The intention of the security provisions is to prevent intruders, who intend to inflict damage, from gaining access to information and plants.

The regulation of 1 January 2003 governing contingency planning in the energy sector defines a preparedness planning concept that all entities are obliged to implement. This concept will optimize both the prevention and management of all extraordinary situations that may restrict the production, transmission, and distribution of electricity. Integrated into the companies’ ordinary activities, it will consist of the following phases: analysis of risks and threats, implementing preventive measures, planning and organizing in order to be able to manage extraordinary situations, managing extraordinary situations and restoring functionality, and evaluating training and incidents.

Authorities
The Ministry of Petroleum and Energy is responsible for contingency planning and crisis management in the power sector, including district heating. The Norwegian Water Resources and Energy Directorate (NVE) has been assigned the responsibility of managing Norway’s water and energy resources. This includes the responsibility for coordinating contingency planning and governing the power supply during extraordinary circumstances, during times of crisis and war.

Transmission system operator (TSO)
State-owned Statnett SF is the Norwegian transmission system operator. Statnett’s area of responsibility is operating and developing the Norwegian transmission grid and its international connections, setting the main grid tariffs, and executing its system operator responsibility, including key operational functions.

Sweden

Legislation
The Electricity Act contains the basic stipulations governing the production, transmission, and consumption of electricity, as well as trading in electricity.

The Electricity Contingency Planning Act contains stipulations governing preparedness during the production and transmission of electricity, as well as during trading in electricity, and regulates the responsibility for planning and other measures required to provide the electricity supply during a heightened state of preparedness.

The ordinance governing measures for peacetime crisis management and a heightened state of preparedness regulates the preparedness authorities’ special responsibility to plan and make preparations in order to prevent, counteract, and restrict vulnerability and risks and to be able to adapt operations ahead of changes to security policy.

The Act governing total defence and a heightened state of preparedness stipulates that, in the event of a heightened state of preparedness, organisations and companies that are obligated to continue to operate are to be able to use the available resources to fulfill their tasks. The Act states that the resources of the total defence are to be arranged in such a way that they can also be used to augment society’s capacity to prevent and manage severe stresses and strains during peacetime and international humanitarian efforts.

The Rationing Act contains stipulations relating to rationing and other regulations concerning the consumption of energy.

Authorities
The Swedish Energy Authority (SEA) is comprehensively responsible for contingency planning in the electricity supply. This responsibility concerns all types of energy, including electricity. The departure point is the degree of interchangeability which exists, to a certain degree, between the types of energy. The SEA’s responsibility includes planning and fact-finding duties with respect to energy preparedness as a whole and preparations for the regulation of consumption vis-à-vis all forms of energy, which can be relevant during a crisis.

State-owned Svenska Kraftnät is the authority that manages contingency planning, also monitoring that the Electricity Contingency Planning Act and its ordinances are adhered to.

The Energy Markets Inspectorate, a division of the SEA, is the network authority.

Transmission system operator (TSO)
Svenska Kraftnät is the system-responsible authority.
3. Organisation for contingency planning

Traditionally contingency planning and preparedness in general have been closely linked to the national military planning; this is also the case in the power sector. This link to national planning and differences in geography and natural resources, is why contingency planning is a national matter in all of the Nordic countries.

Denmark

In Denmark, contingency planning and crisis management relating to electricity rests with the Minister for Transport and Energy. This is based on Article 24 of the Civil Emergency Procedures Act. Since February 2005, the energy sector is handled by the Minister for Transport and Energy.

Matters concerning contingency planning and crisis management relating to electricity are handled by the Danish Energy Authority (Energistyrelsen). This work is based on Article 85 b of the Electricity Supply Act which stipulates:

- All companies in Denmark providing electricity production, transmission, and distribution pursuant to the Act, together with the transmission system operator (TSO) Energinet.dk, shall prepare the necessary planning and shall take the necessary steps to safeguard the electricity supply during crises and other extraordinary situations.

- The TSO shall manage the general, co-ordinating planning and the operational tasks relating to contingency planning and crisis management which are carried out by the companies.

- The Minister for Transport and Energy has the authority to lay down rules governing management of the contingency planning and crisis management tasks.

- The Minister for Transport and Energy has the authority to lay down regulations governing the performance of inspections of the contingency planning and crisis management tasks, including the submission by the companies of information as supportive data for the inspections and other related matters. Such regulations may specify that the TSO shall carry out the inspection tasks in relation to the companies.

- More detailed regulation of contingency planning and crisis management in the electricity sector came into force on 1 February 2005 and is presently being implemented by both the TSO and by companies in the power sector. It contains stipulations governing the following:
  a. Organizational matters.
  b. Contingency planning and crisis management, including vulnerability analyses, general contingency plans, detailed contingency plans, and security plans.
  c. The general, co-ordinating tasks are to be carried out by the TSO, Energinet.dk.
  d. Training, exercises, reporting of relevant incidents, statistics, etc.
  e. Operational matters during a crisis.
  f. Inspection of the companies’ work regarding contingency planning and crisis management.

Finland

Finland applies a pool system to preparedness issues, whereby the pools represent the various sectors of industry and commerce. The work of the pools is based on voluntary participation, and the framework of the co-operation has been decided upon in an agreement with the National Board of Economic Defence. The pool organisation does not employ any staff of its own, rather the relevant workforce is composed of experts from the companies involved.

Detailed company-specific preparedness and contingency planning in the power supply, i.e. energy generation, transmission, and distribution, is headed by the Power Suppliers’ Pool, which has been established through a pool agreement between the TSO, Fingrid Oyj, and the National Board of Economic Defence. No separate organisation is formed in the event of exceptional circumstances, rather the existing organisations continue with their work in all situations. The Pool is made up of the Pool Committee, which leads the pool, and the pool office, the regional organisations, and all the energy generation and distribution companies. A separate district heating section comes under the Pool.

The main task of the Power Suppliers’ Pool is to create a state of preparedness during normal conditions in order to safeguard the power supply in Finland during exceptional circumstances, and to make preparations for leading and managing the power supply during a crisis on the basis of tested plans drawn up in advance. The government of Finland grants these organisations the authority to manage related duties during exceptional circumstances. The Pool is responsible for providing its own organisation with training so that it will be able to fulfil its duties during exceptional circumstances.

Contingency planning encompasses 100 electricity distribution companies and 200 district heating companies, each with an appointed Contingency Manager and a specific contingency and preparedness plan. In practice, the plan contains several different sub-plans which cover all the functions having a bearing on the continuity of corporate operations.

The responsible authority in Finland is the Ministry of Trade and Industry, with the National Board of Economic Defence working under it. The main task of the National Board of Economic Defence is to analyse what types of risks a modern networked society is exposed to. The Board provides plans and guidelines, which the administration will implement during exceptional circumstances. The Board also promotes contingency planning within companies. The Board does not have any direct authority, but the expertise it represents is a significant resource in national security matters.

The regional organisation of the Power Supplier’s Pool is composed of five power regions which correspond to the TSO’s operational regions. The regions can adopt measures which are aimed at supporting a company or region exposed to exceptional circumstances. The regions can also assist provincial and local administrations and rescue authorities. The companies or power regions can request assistance from the police and rescue authorities (and subsequently also from the defence forces) under certain conditions.
3. Organisation for contingency planning

The TSO is responsible for managing the rectification of serious disruptions during normal conditions. In such situations, the action taken is based on the national guidelines for major disruptions and plans drawn up within the individual network companies.

Iceland

The Civil Defence, a department of the National Commissioner of the Icelandic Police (Almannavarnir) is responsible for contingency operations throughout the country.

At the Civil Defence Crisis Centre a representative of the electrical emergency management team will be located with all necessary communication and monitoring systems.

The Civil Defence can obligate companies to adopt a special level of preparedness due to a crisis.

During a civil crisis, or during wartime, the Civil Defence is principally responsible for all operations. The companies' responsibilities are continuous.

In Iceland, there is as yet no special organisation that is responsible for preparedness in the event of severe operational disruptions, or crises, in the electricity industry. The companies themselves must take care of all their contingency planning. Landsnet's responsibility is also continuous during severe operational disruptions during peacetime.

Some Icelandic electricity producers have contingency plans for crises, e.g. Landsvirkjun, Orkuveita, Reykjavíkur and Landsnet.

On 24th of May 2005, representatives of all the major Icelandic companies in the electricity industry and representatives of Orkustofnun met with the National Commissioner of Police and all of major industry to discuss establishing an organisation for Electric Power contingency planning. All those participating had a positive attitude and wanted to take part in this collaboration. One can see a great need of and an advantage in such an organisation in the future for the electricity industry's preparedness planning in Iceland and in Nordic collaboration.

The objective is to formally establish this organisation in 2005.

Norway

In the Energy Act, it is stated that, during wartime, the power supply industry will be under the control of the Power System Contingency Planning Organisation (KBO). KBO is a dedicated national organisation that consists of Norwegian Water Resources and Energy Directorate (NVE), Statnett and all units involved in the production of electrical energy, watercourse regulation associated with hydroelectricity, and the transmission and distribution of electrical energy or district heating. NVE is responsible for coordinating contingency planning and governs the power industry during emergencies and wartime. The Ministry’s responsibility is to determine the duties of KBO during peacetime, if major damage occurs to the power system or there are energy shortages (rationing).

When KBO is formally established, NVE will form an administrative board, that also includes TSO Statnett, in order to manage KBO.

A regulation governing contingency planning in the energy sector came into force on 1 January 2003. It contains provisions regarding the following:

- Systematic approach; analysis of risk and vulnerability, contingency planning and training
- Organisational matters; duties and responsibility
- Resources; personnel, expertise, information, recovery procedures
- Security; acquisition procedures, admittance restrictions
- Protective provisions; classification, supervising and guarding
- Security regarding Information and Communication Technology protection of information, protective measures for SCADA systems, radio systems, relay protection
- Inspection of companies’ preparations regarding preparedness and crisis management; their responsibility regarding the reporting of critical incidents

Sweden

The electricity companies themselves are responsible for maintaining the level of preparedness required to cope with normal operational disruptions. In order to improve the prerequisites for coping with major operational disruptions, the network companies have created seven electricity coordination zones with coordination management by voluntary agreement. This organisation is also planned to form the basis for the regional contingency organisation.

During a crisis, Svenska Kraftnät must keep the government informed about the course of events and the status of the electricity supply, as well as with regard to implemented and planned measures.

Svenska Kraftnät must plan and implement the measures necessary to maintain the production, transmission, and trading of electricity in the event of a heightened state of preparedness. The authority will judge whether or not contingency measures need to be taken and will make decisions in respect of these.

During wartime, or when the government otherwise decrees, it will be Svenska Kraftnät's task to plan, lead, and coordinate the resources of the electricity supply.

The Swedish Energy Authority (SEA) must be able to manage and implement measures in connection with a situation where there are energy shortages. For this purpose, the authority has a trained and practiced wartime organisation.
4. Economic prerequisites for preparedness

There are great differences between the Nordic countries regarding how economic prerequisites for preparedness are organised.

**Denmark**

All costs relating to contingency planning and crisis management in the power sector are borne by the respective companies.

**Iceland**

As there is as yet no formal organisation taking care of joint preparedness, there is no joint financing. The companies in question still have to take care of the financing of preparedness measures themselves. Joint financing is one of the issues that the planned organisation for Electric Power contingency planning must take care of in the future.
4. Economic prerequisites for preparedness

**Finland**

The cost of preparedness efforts is financed by the emergency supply fund or by individual companies. The fund, which is detached from the national budget, is managed by the National Emergency Supply Agency, and obtains its revenues from contingency fees levied on energy products and electricity consumption pursuant to the Act governing the securing of the supply. These revenues total approx. 50 million € annually. In certain cases, budget financing of individual ministries has also been used. It is also possible to enact a law stipulating that the fund can provide interest subsidies and contributions, as well as furnish loans or pay certain fees that are incurred by maintaining the security of the supply. If necessary, the National Emergency Supply Agency can finance investments raising the level of preparedness of companies. By law, private companies are not obligated to make investments relating to the security of the supply. The obligatory storage of imported fuels is financed by individual importers or agencies obligated to store such fuels.

**Norway**

The respective company bears all costs relating to contingency planning and crisis management in the power sector. Norwegian Water Resources and Energy Directorate, instructs the companies as regards which level of security measures is imperative. Based on the installed capacity, companies pay an annual fee covering all of NVE’s expenses related to contingency issues.

**Sweden**

Holders of network concessions must pay a preparedness fee for financing contingency measures adopted by the authority for electric power contingency planning and for the activities of the authority. The fee is based on the number of subscribers connected to the network of the fee-payer. The equivalent of the preparedness fee paid in by the network owners is paid out as an annual subsidy to Svenska Kraftnät. The Swedish Energy Authority (SEA), preparedness activities are also financed using funds from the national budget.
5. The Nordic Power System

5.1 General characteristics

The Nordic countries, except for Denmark, are situated far to the north in harsh climatic conditions. Populations often live in small communities widely spread over large areas. Living in modern society, their dependence on an uninterrupted electricity supply is of major importance. This fact and the climatic conditions set strict requirements regarding reliable and smoothly functioning power systems. As consumption is higher than production, the Nordic nations as a whole are net importers of electrical energy from their neighbouring countries. The table shows the principal characteristics.

<table>
<thead>
<tr>
<th>Nordic data</th>
<th>Denmark</th>
<th>Finland</th>
<th>Iceland</th>
<th>Norway</th>
<th>Sweden</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area [1,000 km²]</td>
<td>43</td>
<td>337</td>
<td>103</td>
<td>324</td>
<td>450</td>
<td>1,257</td>
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<tr>
<td>Inhabitants [million]</td>
<td>5.4</td>
<td>5.2</td>
<td>0.3</td>
<td>4.6</td>
<td>9.0</td>
<td>24.5</td>
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<tr>
<td>Installed capacity [GW]</td>
<td>12.7</td>
<td>16.5</td>
<td>1.5</td>
<td>28.3</td>
<td>33.6</td>
<td>92.6</td>
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<tr>
<td>Consumption [TWh]</td>
<td>35.5</td>
<td>86.9</td>
<td>8.6</td>
<td>122.0</td>
<td>146.4</td>
<td>400</td>
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<td>Production [TWh]</td>
<td>38.4</td>
<td>81.9</td>
<td>8.6</td>
<td>110.5</td>
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<tr>
<td>Hydroelectric [%]</td>
<td>0</td>
<td>18</td>
<td>83</td>
<td>99</td>
<td>40</td>
<td>49</td>
</tr>
<tr>
<td>Nuclear [%]</td>
<td>-</td>
<td>26</td>
<td>-</td>
<td>-</td>
<td>50</td>
<td>25</td>
</tr>
<tr>
<td>Other thermal [%]</td>
<td>76</td>
<td>42</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>18</td>
</tr>
<tr>
<td>Renewable [%]</td>
<td>24</td>
<td>14</td>
<td>17</td>
<td>1</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Consumption per capita [kWh]</td>
<td>6,600</td>
<td>16,700</td>
<td>28,700</td>
<td>26,500</td>
<td>16,300</td>
<td>16,300</td>
</tr>
</tbody>
</table>

(Source: Nordel 2004)

5.2 General principles

The Nordic power system and electricity market have undergone a comprehensive process of restructuring during recent years. Deregulation of the electricity markets in the Nordic countries commenced at the beginning of the 1990s. The single electricity market consists of Denmark, Finland, Norway, and Sweden. Iceland also takes part in Nordic co-operation, e.g. via Nordel (the collaboration agency of the Nordic TSOs), but is not interconnected with the other countries. The peak load for the interconnected system is slightly less than 70,000 MW, and the total consumption was 400 TWh in 2004.

In all the Nordic countries, an independent TSO solution has been chosen. This means that the TSO owns as well as operates the main national grid. The networks, as natural monopolies, are kept out of competitive activities. All networks have been opened up to third party access, regardless of connection point. This means free access to everyone, on an equal basis, to transmit power across all the Nordic transmission and distribution networks. All transmission charges have been removed between the Nordic countries.

Joint system responsibility tasks for all the TSOs include:
- ensuring the operational reliability of the power system
- maintaining the momentary balance between supply and demand
- ensuring and maintaining the adequacy of the transmission system in the long-term
- enhancing the efficient functioning of the electricity market

An important part of the evolution of the single Nordic electricity market is developing the Nord Pool power exchange. Nord Pool is organised as two separate companies - Nord Pool Spot for physical trading on the spot market, Elspot (day-ahead) and on an adjustment market, Elbas (delivery day), and long-term trading in financial instruments in the parent company, Nord Pool Group.
5. The Nordic Power System

5.3 Electricity market principles
When developing the Nordic electricity market, some fundamental requirements have been met in order for it to function well:
- All players must be treated equally and impartially and be allowed equal access to the grid
- Trade-stimulating tariffs and the efficient management of transmission capacity are essential
- Operations must ensure an instantaneous power balance and maintain a satisfactory level of operational reliability.

In the Nordic market model, all players have the opportunity to trade bilaterally as well as access to a smoothly functioning power exchange. Physical trading on a daily basis can be bilateral or conducted daily on the spot exchange. One of the basic functions of the spot exchange is to establish a public price reference for other forms of trading. After trade on the spot market has closed for the day, the players still have the opportunity to adjust their schedules using either the adjustment market (Elbas) or bilaterally very close to the hour of operation. During the hour of operation, the electricity balance is secured on the real time market (regulating power market). Long-term risk management can be conducted on the futures market or bilaterally. The basic roles of the market players are shown in the flowchart.

5.4 Reduction of consumption during power outages

Iceland

When the Electricity Act came into force in 2005, this was a revolution in the Icelandic electricity industry. The purpose of the Act is to enable competition in electricity trading, which will be divided into stages until 1 January 2006, when all customers will have the right to choose their electricity retailer.
5. The Nordic Power System

5.4 Reduction of consumption during power outages
The TSOs are responsible for maintaining a state of balance in the system. They all have systems and arrangements for reducing consumption in the event of a power outage. Both automatic and manual systems are used. Automatic systems react instantaneously to frequency drops in order to maintain a balance between production and consumption.

5.5 Energy and power shortages
There are two different kinds of shortages, energy shortages and power shortages:

- An energy shortage is a lack of energy in the form of the water in reservoirs, oil, natural gas etc. This problem will appear gradually and will be anticipated a long time before it forces a reduction in consumption.
- A power shortage is a lack of available generating capacity. It can be the effect of an energy shortage but it can also happen if several failures occur at the same time. Power shortages lead to curtailment.

During energy shortages, it is necessary to reduce general consumption, remove all unnecessary consumption, and take control of generating resources. The first step is to inform consumers about the situation and appeal for a reduction in consumption.

Power shortages are managed in accordance with the “System Operation Agreement” (governing operation of the interconnected Nordic power system), which lays down rules regarding alerting about and managing the situation. The different countries have their own legislation regarding stricter orders e.g. rationing by means of quotas and ultimately enforcing supply restrictions by physical disconnection.

Iceland
In the event of energy shortages, Landsnet has drawn up rationing plans together with industry. In the event of rationing and shortages, actions are taken in compliance with a rationing plan. This rationing plan covers electricity generation and transmission, as well as deliveries to customers. Non-secured energy is the first to be disconnected. Then secured energy from major industry proportionally from all customers is disconnected. High-tension lines will only be disconnected if there is a crisis.

Finland
Finland’s rationing plan covers electricity generation, transmission, and distribution to consumers, as well as the generation of district heating and its delivery to consumers. Rationing aims to save the fuels used for electricity and district heat generation.

Controlled and obligatory rationing can only be implemented during exceptional circumstances on the basis of additional powers obtained by the authorities pursuant to the Emergency Powers Act. The application of quota-based restrictions to electricity consumption pre-requires the need for electricity rationing to have been in force for a long period of time and that there has been sufficient time to confirm the quotas, inform consumers of them, and read electricity meters. Companies and institutions vital to the functioning of society will obtain the energy they need regardless of rationing.

Denmark
Normally, the Danish power sector has sufficient stocks of energy in the form of coal and oil, as well as supplies of natural gas and biomass. Several power plants are capable of switching from one type of fuel to another, typically from coal to oil. At present, Denmark has no rationing plans for electricity, but in the event of a crisis that results in power shortages, the authorities will decide how to use the resources available.
Norway

The relevant legislation is the Energy Act and regulations governing rationing. During extraordinary situations, when there is a shortage of energy, the Ministry can initiate energy rationing (based on advice from Statnett and Norwegian Water Resources and Energy Directorate (NVE). This is done in order to ensure that the power system and power market will function as smoothly as possible while ensuring that particularly sensitive consumer groups and civil functions obtain sufficient supplies of electricity. Rationing consists of planning and enforcing the implementation of supply restrictions, and the requisitioning of electrical energy. The Ministry has appointed a rationing authority, NVE, which is responsible for both administrative implementation and measures related to rationing and curtailment.

Sweden

In the event of energy shortages, The Swedish Energy Authority (SEA), has the designated responsibility for the planning and preparation of consumption-reducing measures. As regards informative checks and balances, an information campaign has been prepared which can be launched immediately following a government decision. The SEA must also be able to implement rationing and other controls applicable to the consumption of energy.

It will probably be both possible and useful to establish collaboration within this area with the aim of jointly preparing harmonized and effective measures in the Nordic countries.

In the event of energy shortages, or more long-lasting power shortages, energy saving campaigns, followed by rationing of various forms, could come under consideration.
6. Resources

Resources in this context are the staff, equipment, and materials available for loan across national boundaries in a contingency planning situation. There are different information systems and databases providing an overview of the staff, preparedness materials, and equipment that are available for loan during a crisis. Transportation of heavy components, e.g. transformers, requires special haulage equipment. The chapter describes what is available as regards this type of haulage equipment in the Nordic area.

6.1 Information and communications

In a crisis, it is important to have access to information. To ensure this, each Nordic country has established its own communications system for contingency situations. These are used to gather information about the crisis, and to provide the public with information.

Iceland

As a possible means of crisis communication, there is the Iridium satellite telephony system which links Landsnet’s operations centre with 7 of Landsvirkjun’s power stations. Landsvirkjun and Landsnet are linked to the country’s second largest telecommunications system, owned by Fjarski Telecommunication Company. Fjarski is owned by Landsvirkjun. This system links the operations centre with all of Landsvirkjun’s power stations, independently of the public telephone system. The planning of a radio telephony system linking Landsnet, Landsvirkjun and RARIK is ongoing and this will cover the entire country.

Denmark

On the transmission and regional levels, telephone systems have been established for operational facilities which are dependent on the public telephone network. The electricity sector is included, according to requirements, directly in the Regional Coordinating Staffs where the combined social effort is coordinated, under the electricity supply and any aid to this.

Finland

Communications are arranged via a secure Tetra-based telephone system available to the authorities and electricity companies.

Norway

There is no dedicated communications system for crisis management today. A national emergency communications system will be available in the near future. Each company however is obliged to have its own independent communication system to cover their own needs.
6. Resources

Sweden

A mobile command and control centre (MOLOS) for crisis communications will improve the command and control capability during severe disruptions to the power and communications systems.

A national web-based crisis portal is being set up where authorities post crisis information and links to relevant specific information.

6.2 Staff

The power sector is dependent on a range of more or less specialised staff groups. During the day-to-day work, staff resources match an economically acceptable level at the different companies in the different Nordic countries. These groups include specialists in building and maintaining overhead lines and substations in the distribution and transmission networks, with the necessary management needed to coordinate the work.

The power companies have organised their construction and maintenance staff either in-house or, more frequently, to rely on independent contractors. Contingency plans often include arrangements or agreements with contractors to deliver ancillary staff in the event of a crisis.

During a crisis, the need for staff can rise to levels that are impossible for any single company or country to meet. This is especially true for network companies. The number of incidents in distribution and transmission power networks during a crisis will often be equivalent to years of normal workload.

Because the topology of the power networks is the same throughout the Nordic countries, there are good opportunities for staff from one country or company to work in another. Language, which can be a potential obstacle, is no problem here since most Nordic power staff speak a Scandinavian language.
6.3 Materials and equipment
There are differences between the Nordic countries regarding how contingency materials are organised. A common characteristic is that the individual companies are responsible for having sufficient stocks of spare parts and materials in order to keep their operations going.

Finland
The Power companies include in their contingency plans reserved resources (such as special machinery) which the defence forces cannot use during a crisis. The emergency organisations of the transportation and construction industries support the energy supply. The Emergency Powers Act gives authorities an opportunity to impose additional regulations if necessary. The National Emergency Supply Agency of Finland can decide that certain contingency reserves will be used, if the need arises. The use of state owned contingency reserves is only possible during exceptional circumstances, pursuant to a decision made by the government of Finland.

Iceland
No special contingency stocks exist in Iceland but there is a central spare parts stock in Reykjavik and minor contingency supply stocks in the country. Some spare parts have to be ordered from other countries, mainly in Europe (Sweden, Finland, France, Germany), but dispatching these rarely takes more than 24 hours. The organisation for electric power contingency planning in Iceland is anticipating a joint database containing information regarding the staff and spare parts in all the major companies in the electricity industry in the country.
6. Resources

**Norway**

All power companies must have access to workforce, spare parts, repair equipment, and other resources necessary for rectifying faults in a reliable and efficient way. The companies must have the necessary reserves of materials and other necessary resources to restore functionality following faults and breakdowns. Part of the reserve and contingency equipment has been purchased with the support of Norwegian Water Resources and Energy Directorate. Such equipment may be used by all other power companies when needed. In order to provide an overview of the available materials, the resource database eBeredskap has been set up.

**Denmark**

All companies in the Danish power sector are responsible for keeping sufficient stock of critical spare parts. Some companies share common stocks of expensive or rarely used critical spare parts. There are no dedicated state-owned preparedness resources for the power sector.

**Sweden**

Svenska Kraftnät has built up a contingency organisation in order to be able to issue contingency materials from a central store in connection with severe operational disruptions. Routines for subordering and listing stocked materials and equipment etc. can be retrieved from the web-based tool SUSIE. The workforce engaged in repair and operational resources which resides with the power companies and contractors, agreements can be reached regarding augmentation with civil duty trained staff.
6. Resources

6.4 Heavy haulage
All companies must have adequate transportation preparedness in order to be able to cope with extraordinary situations, and quickly be able to restore functionality. This applies to methods of transportation with the necessary equipment and staff that can handle this. All countries have access to this type of transportation. Some power companies own their own heavy haulage equipment. Others have access to hauliers who can carry out this type of haulage.

6.5 Other support systems

Denmark
The power sector is represented in the Regional Coordinating Staff and the National Operative Staff. The Regional and National staffs are coordinating the society’s overall efforts in a crises situation.

Finland
Finland has a databank maintained by the relevant body, containing centralised information on the necessary spare parts needed in the industry, especially those required during the production and distribution of electricity and district heating.

Norway
eBeRedskap is a database for preparedness materials, expertise etc. It has been established by 52 power companies. The database is accessible via the Internet at www.ebereedskap.no.

Sweden
SUSIE is a national, web-based tool which is used to facilitate collaboration between electricity network companies during disruptions to the electricity supply. Using the system, companies report events, forecasts, the electricity supply situation, and the available and required resources. To make it easier for companies to get hold of the materials needed to restore electricity supply facilities to a serviceable condition, a computer program connected to SUSIE has been developed. The program contains pre-completed forms which are adapted to different types of components, as well as registers of materials suppliers and electricity companies which can supply the components that may be required. Using the tool, Svenska Kraftnät also reports on which contingency materials are in stock, as well as which rules apply to lending and the cost of this.
7. Collaboration agencies

In what follows, there is a summarizing description of the various collaboration agencies which have a clear connection with the ongoing preparedness effort within The Nordic Forum for Emergency Matters Regarding the Power Sector (NEF).

7.1 Europe

The Community Mechanism

The mechanism is intended to provide support in the event of major incidents occurring within the context of crisis management. The mechanism is intended to ensure improved protection of people, the environment, and property. The objective is to be achieved by facilitating the mobilisation of relief effort teams, experts, and other resources which a country can request in the event of a major incident or catastrophe. Requests for help are sent to the mechanism’s Monitoring Information Centre (MIC). The Community Mechanism’s participating countries are all of the member states of the EU, the EEA countries, and the EU applicant countries. Participation entails that these countries will be able to offer and request resources in the event of a major incident or catastrophe.

European Transmission System Operators (ETSO)

ETSO is an international association with direct membership of 37 independent TSO companies from the European Union plus Norway, Switzerland, and Romania.

Upon the emergence of the Internal Electricity Market (IEM) within the EU, leaders of some regional organisations recognised the need for EU-wide harmonisation of network access and the conditions of use, especially for the cross-border electricity trade.

The networks represented by ETSO supply about 490 million people with electric energy. The consumption of electric energy amounts to approx. 3200 TWh per year. The length of HV (400 and 220 kV) lines covered by ETSO is of more than 290 000 km.

Electricity companies have been co-operating for decades, mainly in order to maximise system reliability and quality of supply, while optimising the use of primary energy and capacity resources. Against this background, ETSO’s experience and preparedness aspects should be utilized during future work.

The Union of the Electricity Industry (Eurelectric)

Eurelectric is the professional body representing the common interests of the electricity industry on the pan-European level, as well as its affiliates and associates on several other continents. The association was formed as a result of a merger between sister bodies Unipede and Eurelectric. Eurelectric’s mission is to contribute to the evolution and competitiveness of the electricity industry and to promote the role of electricity in the advancement of society. Eurelectric is conducting work in the field of “Security of Supply”, the focus of which is strongly linked with the ongoing work being conducted within The Nordic Forum for Emergency Matters Regarding the Power Sector (NEF).

The European association of distribution (Cired)

The company is Eurelectric’s partner in technical issues concerning electricity distribution.

CIRED covers the whole field of Electricity Distribution and associated services and the technical aspects of Electricity Supply. CIRED offers a biennial conference and exhibition where developments and best practices in technology and management of the technical side of electricity distribution are presented and reported. Between conferences CIRED organises specific working groups on current subjects of key interest to the electricity distribution community. The result of their work is not only presented at the next conference, but is also published and widely distributed as CIRED reports.

CIRED’s activities are addressed to experienced technical staff primarily at utilities, manufacturers and laboratories, active in every aspect of the technical side of electricity distribution.

The European Committee for Standardization (CEN)

The CEN works with drawing up voluntary technical standards within the EU and the EEA.

The CEN has embarked upon a European project of inquiry named “the Protection and Security of the Citizen”. The objective is to coordinate standardisation activities in the field of protection and safety, to prepare for future standardisation activities, and to ensure that the European Commission’s and other international players’ interests are taken into account.

Sweden, through The Swedish Energy Authority (SEA), is responsible for leading the expert group “Critical infrastructure – Energy Supply”.

7.2 The Nordic Area

The Nordic Council of Ministers

The Nordic Council of Ministers is the collaboration body of the Nordic governments. One minister from each country is responsible for the collaboration between the governments. These Collaboration Ministers meet at the Council of Ministers. The Council of Ministers can also consist of Departmental Ministers. The Council of Ministers has the decision-making power and the responsibility for Nordic collaboration.

The Nordic Council and the Council of Ministers collaborate in energy policy, among other things. After the Nordic Energy Ministers, during their meeting in Gothenburg (2003), emphasized the importance of Nordic public agency collaboration in the energy industry, collaboration has been facilitated between the preparedness agencies (See NMK/NEF)
7. Collaboration agencies

The Nordic Energy Authorities’ Group for Emergency Matters in the Power Sector (NMK)
Nordic co-operation in contingency planning and management in the Nordic power sectors centres on two interconnected forums. The key forum is the Nordic Energy Authorities’ Group for Emergency Matters in the Power Sector (NMK), which consists of the energy authorities. This group meets biannually. This co-operation is mostly in the form of information exchange and experience sharing between the authorities, but can also take the form of joint projects.

The Nordic Forum for Emergency Matters regarding the Power Sector (NEF)
In order for the Nordic Energy Authorities’ Group for Emergency Matters in the Power Sector (NMK) to reach out to other parties within the power sector, this group has been extended to include the TSOs and other significant parties of the Nordic power sectors. Thus, a larger group has been established based on NMK and called the Nordic Forum for Emergency Matters regarding the Power Sector (NEF), consisting of NMK plus the TSOs and organizations of the power industry. The forum is open to other relevant parties within the power sector. The objective of the forum is to conduct a dialogue between the involved parties concerning contingency planning and management in the power sector. NEF deals with issues which are not managed via TSO cooperation through Nordel.

Nordel
Nordel is a collaboration agency for the system-responsible transmission companies of Denmark, Finland, Iceland, Norway, and Sweden. The purpose of Nordel is to create and maintain the prerequisites for an efficient and harmonised Nordic electricity market, independently of national boundaries. Nordel is also the forum of contact between the system-responsible transmission companies and representatives of the market players of the Nordic countries.

Forum of Nordic Energy Regulators (NordREG)
Forum of Nordic Energy Regulators (NordREG) was established through a Memorandum of Understanding, which was signed in 2002. In the document, the objectives and the modes of co-operation were agreed. Prior to a formal agreement, the tradition of bi-annual meetings and a rotating chairmanship started in 1999.

NordREG launched a strategy project in autumn 2004. The project resulted in formulating the mission, vision and strategic priorities for the organisation. Based on the strategic priorities, the Work Programme for the year 2005 was created.

The basis for the NordREG co-operation is exchange of views, working together to map and analyse energy market issues, producing reports and statements and taking common action to influence either Nordic or European development.

The mission for NordREG is as follows: “In cooperation, we actively promote legal and institutional framework and conditions necessary for developing the Nordic and European electricity markets”

In the course of the strategy work, the NordREG drafted a vision for the electricity market for the year 2010. “In 2010 all customers in the Nordic electricity market will enjoy free choice of suppliers, efficient and competitive prices and reliable supply through the common Nordic electricity market which also interacts smoothly with other regional electricity markets in the EU”

Nordenergi
Nordenergi is a collaboration agency for the electricity industry’s national organisations—Samorka in Iceland, the Norwegian Electricity Industry Association (EBL), Finnish Energy Industries, and the Association of Danish Energy Companies and Swedenergy—which purpose is to stimulate the development and harmonisation of the Nordic electricity market.

Nordenergi is active in the field of “Security of Supply”. This work also has a preparedness aspect, which should be followed in more detail.

7.3 Other collaboration agencies

The North Atlantic Treaty Organisation (NATO) and the Euro-Atlantic Partnership Council (EAPC)
NATO is a defensive alliance. Today, it has 19 member states. Sweden and Finland are not members. NATO’s organisation can be said to be divided up into a civil or political part and a military part. The civil agencies make the crucial decisions regarding NATO policy.

Via “Industrial Planning Committee (IPC) in EAPC format”, NATO and its partners have entered into collaboration regarding the protection of energy-related critical infrastructure. The committee is currently discussing how the countries’ industries can support the infrastructure of the electricity supply during a crisis.
Work team

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The transmission grid in the Nordic countries