

*Environmental Information 2003*



## To the reader

The effects of energy production on the environment increased in 2003. In the Nordic countries, the production of hydropower was small owing to the drought, and the deficit in production was mainly covered by condensing power. Furthermore, the sale of two large biofuel-fired power plants to Stora Enso Oyj at the end of 2002 also weakens Pohjolan Voima's environmental parameters. From the environmental and national points of view, the change in ownership is of no importance.

Society's values and attitudes towards energy production have changed over the decades, which are also reflected in Pohjolan Voima's production capacity. The hydropower company has grown into a versatile energy producer. From the viewpoint of both the Group and society, it is important that all forms of energy production maintain their social acceptability despite the changes in values. Management of the power plants' environmental issues is an essential precondition for this.

Pohjolan Voima's active, self-motivated work for the benefit of the environment was launched in the hydropower production areas in the 1980s. Since then, environmental issues have manifested themselves in completely new ways. The threat of climate change is the most significant of them, being also the most difficult to address. The utilization and disposal of by-products from power plants involve complicated matters in terms of legislation. Acidifying emissions are currently controlled fairly well by technological means.

Pohjolan Voima celebrated its 60th anniversary in 2003. All the power plants built by Pohjolan Voima continue to be in operation and in good condition. This proves the long range of power plant investments.

During the past ten years, Pohjolan Voima's investments in power plants and in bioenergy, refuse-derived fuels and wind power have been aimed at upgrading the Group's production structure in an environmentally sound manner. The most significant separate project is the new nuclear power plant unit, which is scheduled for completion in 2009.

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## *Pohjolan Voima – our operating procedure*

### *Business idea*

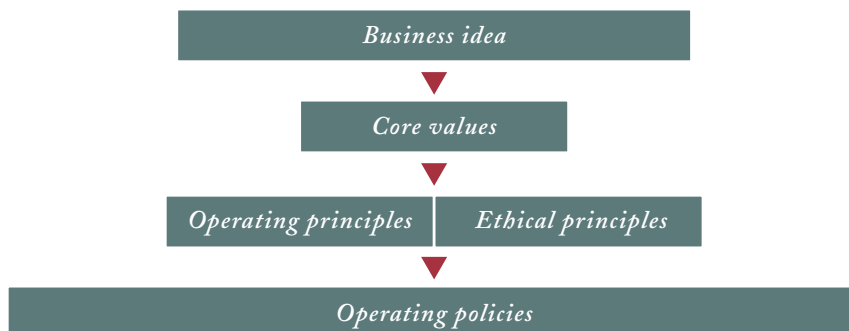
Pohjolan Voima is a privately owned group of companies in the energy sector, which produces electricity and heat for its shareholders in Finland. The Group also develops and maintains technology and services in its sector.

### *Basic values*

Responsibility • Reliability • Competence

### *The environmental policy* (see back cover)

forms a part of the set of principles and rules entitled “The Pohjolan Voima Way – sound operating practise” approved by Pohjolan Voima’s Executive Officers, which includes the operating principles, the ethical principles and five operating policies. Environmental information is also available on Pohjolan Voima’s and Teollisuuden Voima’s Internet pages [www.pohjolanvoima.fi](http://www.pohjolanvoima.fi) and [www.tvo.fi](http://www.tvo.fi).



### *Calculation limits*

This report considers Pohjolan Voima’s own energy production. In addition to the Group’s own power plants, the Group’s parameters (e.g. fuels, emissions) include all power plant shares in the respect that Pohjolan Voima obtains electricity from them on the basis of its shareholding. Purchased and imported electricity is not included in the examination.

The heat production volumes are shown as a whole, without taking account of the shareholdings.

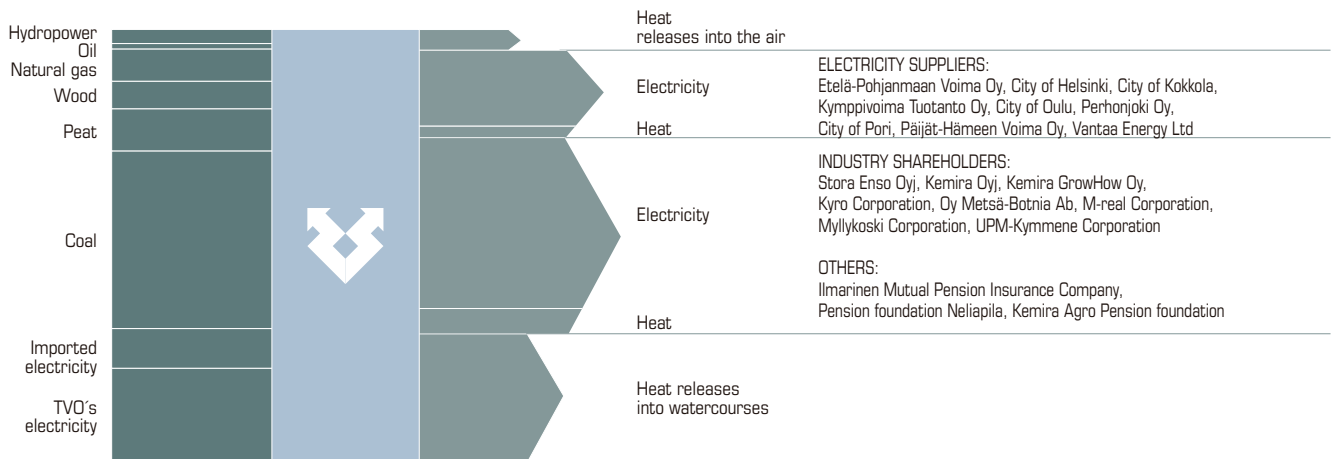
The calculation limits used in this report differ from the scope of the consolidated financial statements. However, these calculation limits describe the environmental burden placed by the whole of Pohjolan Voima’s own energy production in the best possible manner.

## Electricity and heat production

The dry autumn and the cold winter weather in Finland essentially affected the electricity market situation during the winter season 2002/2003. Exceptionally little electricity was generated by hydropower in the Nordic countries. The deficit was covered by increasing the production of condensing power and by importing electricity from Russia, Germany and Poland.

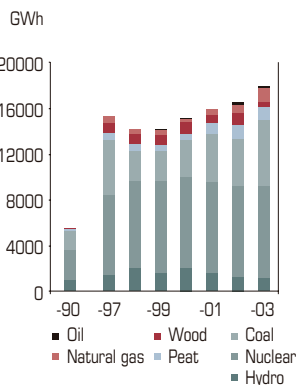
Pohjolan Voima set a new record for electricity production, 18.0 TWh (billion kWh), which represents about a quarter of the electricity generated in Finland. The production of hydropower continued to fall, accounting only for 70% of production in a year of normal precipitation. The production of condensing power increased 55%.

Pohjolan Voima's energy balance in 2003

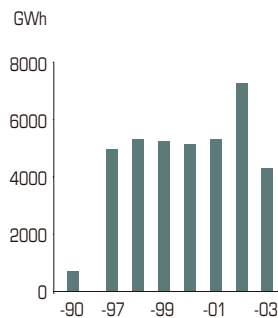


Pohjolan Voima utilizes a wide range of energy sources. The growth in condensing power production increased heat releases into watercourses.

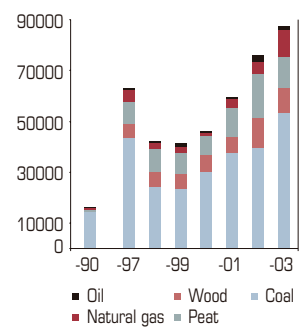
Pohjolan Voima's electricity generation



Heat production



Pohjolan Voima's fuel consumption



## Pohjolan Voima's power plants

### Hydropower

	Location	Electrical output MW*
Kaaranneskoski	Ylitornio	1.3
Jolmankoski	Pello, Ylitornio	0.3
Portimokoski	Ylitornio	5.3
Isohaara	Keminmaa	106
	Kemi	
Jumisko	Kemijärvi	30
	Posio, Salla	
Raasakka	Ii	58
Maalismaa	Yli-Ii	33
Kierikki	Yli-Ii	32
Pahkakoski	Yli-Ii	34
Haapakoski	Yli-Ii	28
	Pudasjärvi	
Melo	Nokia	67
Harjavalta	Harjavalta	14.5
Kosto (reg.)	Taivalkoski,	
	Posio	
Irni (reg.)	Kuusamo,	
	Taivalkoski	
<b>Total</b>		<b>409 MW</b>

### Wind power

	Location	Electrical output MW*
Kokkola	Kokkola	1
Oulunsalo	Oulunsalo	2
Kristiina	Kristiinankaupunki	2
<b>Total</b>		<b>5 MW</b>

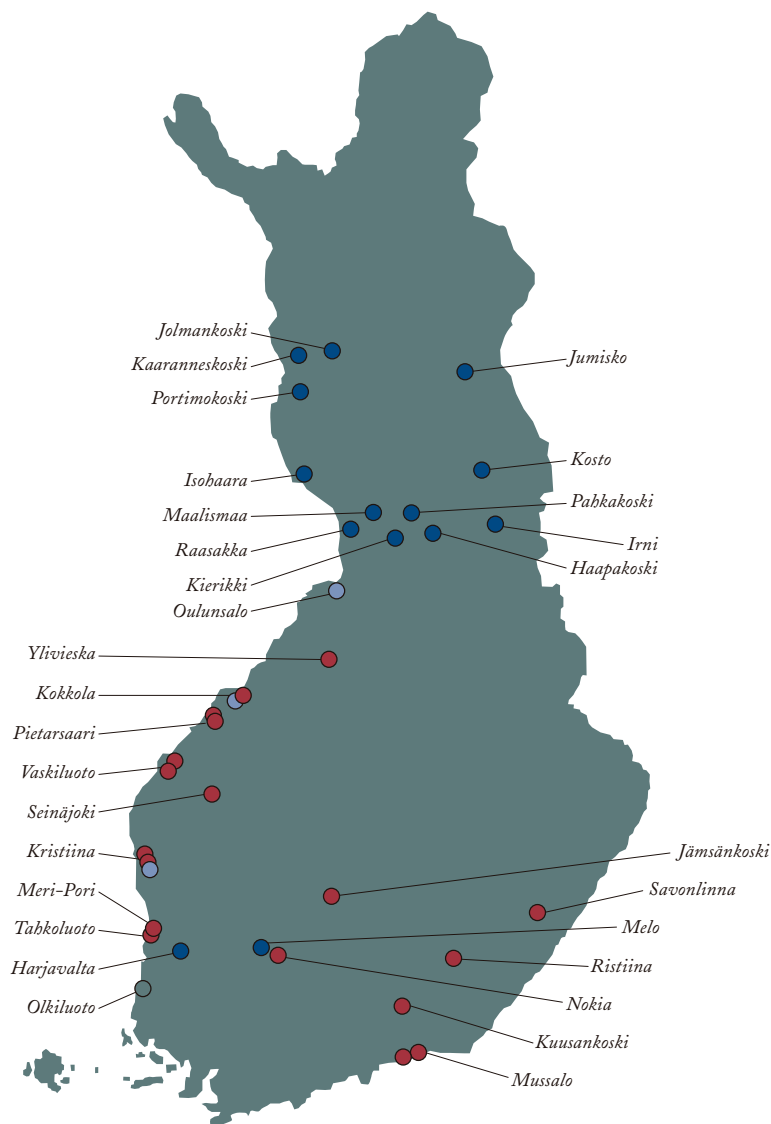
### Nuclear power

	Location	Electrical output MW*
Olkiluoto 1	Eurajoki	477
Olkiluoto 2	Eurajoki	477
<b>Total</b>		<b>954 MW</b>

### Thermal power

	Location	Electrical output MW*
Ylivieska	Ylivieska	6
Kokkola	Kokkola	20
Vaskiluoto 2	Vaasa	115
Vaskiluoto 3	Vaasa	160
Seinäjäki	Seinäjäki	63
Alholma 1	Pietarsaari	12
Alholma 2	Pietarsaari	120
Kristiina 1	Kristiinank.	210
Kristiina 2	Kristiinank.	242
Tahkoluoto	Pori	225
Meri-Pori	Pori	146
Jämsänkoski	Jämsänkoski	46
Nokia	Nokia	70
Savonlinna	Savonlinna	0
Ristiina	Ristiina	8
Mussalo 1	Kotka	75
Mussalo 2	Kotka	238
Kuusankoski	Kuusankoski	58
<b>Total</b>		<b>1814 MW</b>

\* Pohjolan Voima's share



# Environment

The near maximal operation of the condensing power plants increased emissions from Pohjolan Voima's plants on the previous year. The

sale of two large biofuel-fired power plants increased the specific emissions calculated per production unit.

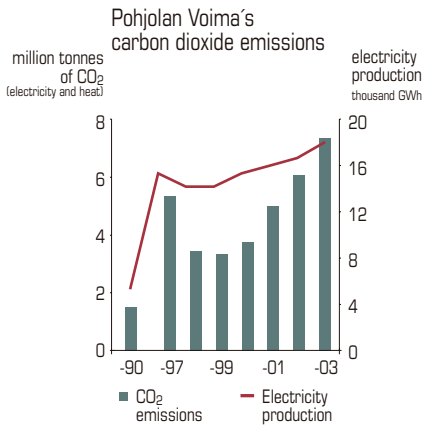
*The emissions from thermal power production* have various environmental effects. Carbon dioxide emissions are linked with the global greenhouse effect. Diluted emissions of sulfur and nitrogen oxides are deposited over a wide area and contribute to soil acidification. Particle emissions are linked with the healthiness of inhaled air.

Emissions are reduced with the aid of international agreements, which provide a basis for national legislation. The regulations are made binding on power plants through plant-specific permit decisions. No legislation exists so far for cutting carbon dioxide emissions. The EU-wide emissions trading is scheduled to begin in 2005 in accordance with the EU's Emissions Trading Directive.

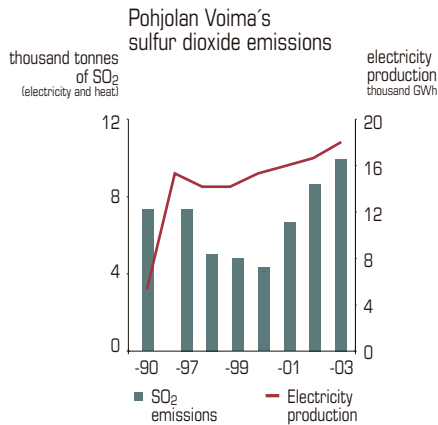
The emissions restricted by power plant permits and their effects are monitored in accordance with the plans validated by the authorities. The emissions from outside Finnish borders place the greatest burden on Finnish soil. Power plants account for a small proportion of the particles and other impurities present in urban air, of the order of a few per cent at most.

Pohjolan Voima curbs its carbon dioxide emissions by increasing carbon-free forms of production, by conducting studies into alternative fuels and by increasing energy efficiency. The most important measures include the biofuel programme, utilization of refuse-derived fuel and construction of the new nuclear power plant unit.

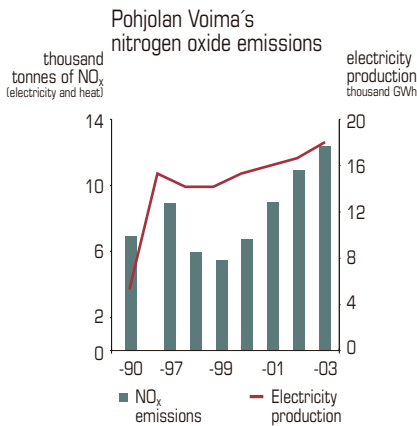
Sulfur emissions are controlled by the choice of fuel and desulfurization technology. The emissions of nitrogen oxides are mainly reduced by combustion technology. Particle emissions are cut by means of electrostatic precipitators.



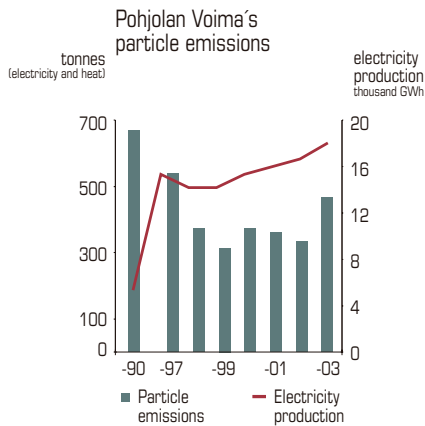
The emissions accounted for 8% of the emissions in Finland. The specific emissions increased 28%. The permits have set no limits for the emissions.



The emissions were 67% of the permissible amounts and accounted for 11% of the emissions in Finland. The specific emissions increased 18%.

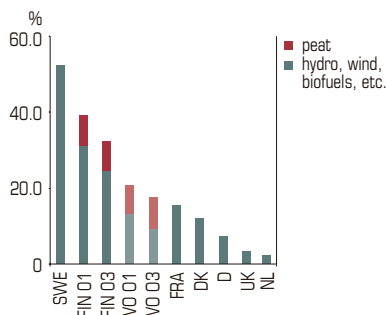


The emissions were 85% of the permissible amounts and accounted for 6% of the emissions in Finland. The specific emissions increased 19%.



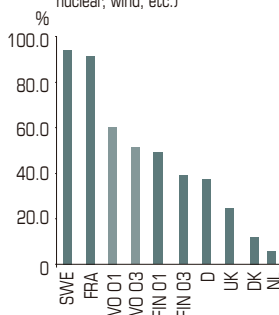
The emissions were 28% of the permissible amounts and accounted for 0.6% of the emissions in Finland. The specific emissions increased 38%.

Electricity generation structure 2001 (renewables and peat)

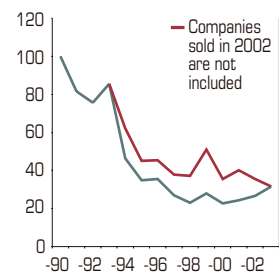


Of Pohjolan Voima's electricity generation, 51% originates from emission-free energy sources. The proportion of renewable energy sources was reduced as a result of the sale of two large biofuel-fired power plants and the small amount of hydropower production. The consumption of logging residue and other new energy sources increased.

Electricity generation structure 2001 (Emission-free, hydro, nuclear, wind, etc.)



Environmental index of thermal power



The index includes the specific emissions of carbon dioxide, sulfur dioxide, nitrogen oxides and particles, and the volume of by-products stored at disposal sites. All factors carry the same weight.

*Teollisuuden Voima*, which produces nuclear power, has operated in accordance with the environmental permits and the environmental management system. No serious deviations from regulatory compliance were detected in the company during 2003.

The heat load carried with cooling-waters into the sea totalled 27.8 (27.9) TWh. In winter, the cooling-water brings about changes in the ice conditions. The place of discharge of cooling-waters remains open. The size of the open area varies between 3 and 20 km<sup>2</sup>, depending on the winter. Monitoring has shown that operation of the power plant has no major harmful effects on the fish stock and fishing in the surrounding sea area.

Releases from the Olkiluoto nuclear power plant into the air were extremely small. Radioactive releases into the sea are caused by fission and activation products. Their releases into the sea continued to be reduced, and represented 0.2% of the release limits set by the authorities. Tritium releases into the sea were 1.15 TBq, which constitutes 6.3% of the official limit.

The radiation situation in the environment has been normal. During the year under review, the individual radiation dose caused to the population in the sphere of influence of the plant was 0.16 microSv, while the average annual dose received by Finns is 3 700 microSv. No signs of activity originating from the power plant have been detected in nutrients, tap water or air in the power plant environment.

The average occupational radiation doses received by the people working at the Olkiluoto power plant were 0.97 (1.09) mSv per person. The highest single personal dose was 7.9 mSv, which is less than one-fifth of the maximum value of 50 mSv in a single year set by the authorities.

The combined radiation dose received by staff working at Olkiluoto was 1.03 (1.12) manSv. By international standards, the total dose received by staff working at Olkiluoto is fairly low.

Teollisuuden Voima's environmental investments amounted to EUR 0.5 million. The company paid EUR 11.4 million to the State Nuclear Waste Management Fund.

Pohjolan Voima's shareholding in Teollisuuden Voima is 57%.

*The production of hydropower* has regional and local effects on the watercourses and fish stocks. Pohjolan Voima has carried out systematic management and restoration measures of the aquatic environments from the 1980s, mostly voluntarily and jointly with the Regional Environment Centres, municipalities, fishery associations and other interested parties. Since 1992, the co-operation partners' share of the financing for this work has totalled EUR 3.5 million. Landscaping work on the riverbeds previously drained during construction of the Iijoki hydropower plants was completed. The project was launched in 1991.

The environmental costs of hydropower production amounted to EUR 3 million. These costs mostly consisted of environmental management work, management of the fish stocks and monitoring of the dam safety.

Pohjolan Voima invests heavily in the management and monitoring of fishing grounds. In 2003, the costs of fish stock management totalled EUR 1.6 million. Most of the fish is stocked in the mouths of rivers to compensate for prevention of the natural spawning of migratory fish. Fish stocking in inland waters is also extensive.

The stocking of fish succeeded almost according to plan. However, the exceptional conditions hampered the farming of grayling and the transfer of lamprey over dams. Owing to the unusual water conditions, the voluntary regulation instructions drawn up for the lakes at the upper course of the Iijoki River could not be followed. The binding permit regulations were complied with.

Compensation for the damage and harm caused by the use of hydropower up to 2003

Clearing and landscaping of shores *)	988 km
Protection against erosion of shores	1887 areas of real estate
Deepening and shaping of shores	25 locations
Boat-moving ramps	115 pcs
Boat harbours *)	398 areas of real estate
Drainage ditches *)	117 km
Tap water *)	445 households
Roads *)	794 areas of real estate
Landscaping weirs *)	42 pcs
Beaches	36 pcs
Clearing of fishing grounds	470 pcs
Migration barriers for fish *)	6 pcs
Fish stocking (required by the authorities)	3.8 million individuals/year

*Environmental management* is implemented as part of the operational management with the aid of certified environmental management systems. The certificate of hydropower production in accordance with the ISO 14001 standard is valid until 2005. The certificate of thermal power production will be renewed in 2004. Teollisuuden Voima's certificate is valid until 2005. Teollisuuden Voima has also been accepted into the EMAS register.

The Environmental Division, which is part of the Group's parent company, is responsible for co-ordinating the Group's environmental issues, except for nuclear power production. Its tasks include monitoring the operating environment and supervising the interests, updating the Group's environmental policy and strategy, and assisting the production companies in matters related to the environment, such as data acquisition, licensing and development activities.

The implementation of the environmental management systems is ensured with the aid of audits. These include internal auditing, audits by the certification authority and annual reviews by Group management.

In 2003, there were no deviations from regulatory compliance of the power plants. Seventeen licensing issues or EIA procedures were pending. Furthermore, several permit applications concerning peat bogs were under consideration.

Pohjolan Voima has published an Environmental Report since 1994. Pohjolan Voima reports on the most significant environmental issues to its shareholders in the board meetings, in the Group-internal environmental reviews drawn up at fixed intervals, and in reports that describe the environmental quality of electricity.

*\* Some of them joint projects (PVO-Vesivoima Oy/municipalities/local fishery associations)*

## Power plant-specific information

The information on emissions and by-products given below include the combined amounts of all units by power plant. On the basis of its participation, Pohjolan Voima also obtains electricity from the Meri-Pori power plant located at Tahkoluoto in Pori, which is owned by Fortum. Emissions from the Meri-Pori power plant are not included in the emission figures of the Tahkoluoto plant, however.

Information on the specific emissions is given by power plant unit with regard to the

principal emission sources. In most cases, the emissions regulations issued for the power plants concern specific emissions, which have been defined per volume of energy fed into the boiler (mg/MJ). Annual quotas have been fixed for some plants. Emissions and their effects are monitored and the data is reported to the authorities in accordance with the regulations imposed by the permits.

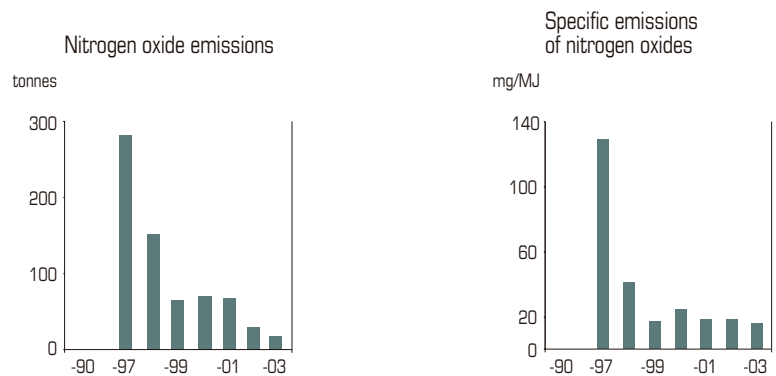
The amounts of ash shown in the graphs concerning the use and final disposal of ash

do not correspond to the accumulation of ash, since some of the ash may have been taken to interim stores.

Pohjolan Voima provides its shareholders with separate information on emissions related to the environmental quality of electricity by series of shares to be used, for instance, in life-cycle calculations.

Information on the environmental quality of electricity generated by Pohjolan Voima is available on the Group's Internet pages.

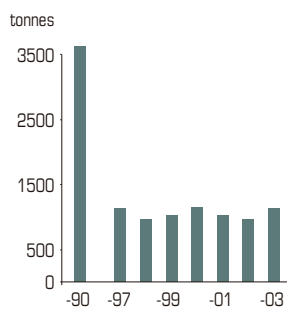
## Pohjolan Voima's plant-specific data > Nokia



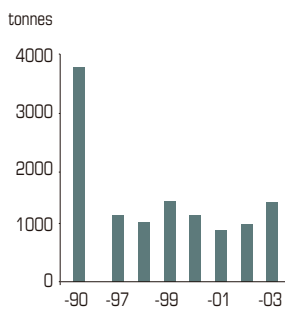


## Pohjolan Voima's plant-specific data > Mussalo 1 and 2

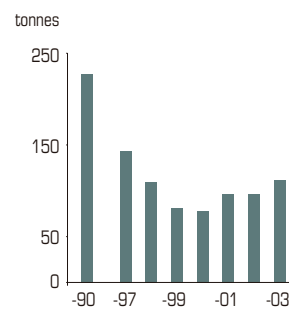
Sulfur dioxide emissions



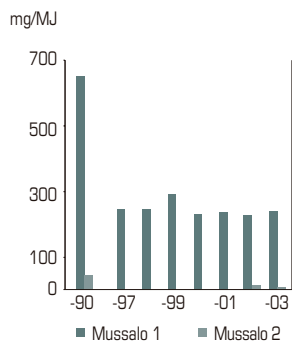
Nitrogen oxide emissions



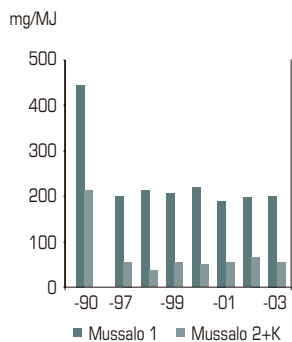
Particle emissions



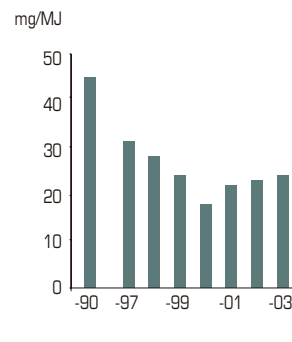
Specific emissions of sulfur dioxide



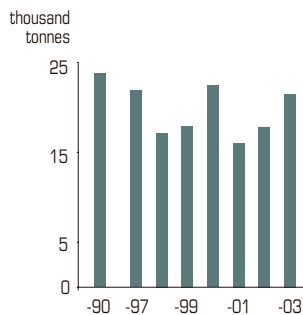
Specific emissions of nitrogen oxides



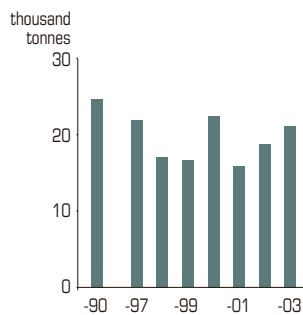
Specific emissions of particles



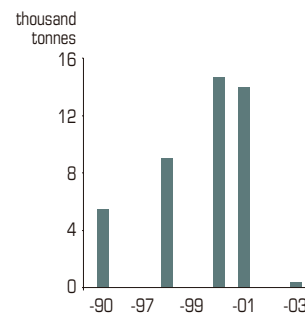
Accumulation of ash



Use of fly ash

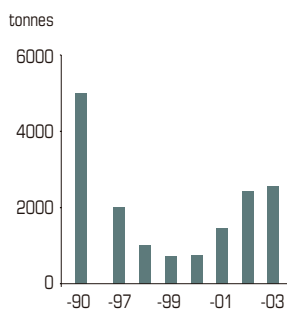


Disposal of ash

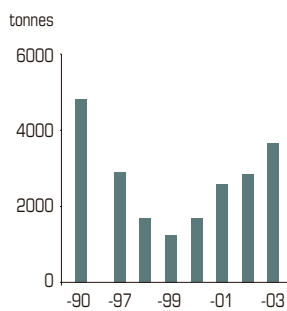


## *Pohjolan Voima's plant-specific data > Kristiina*

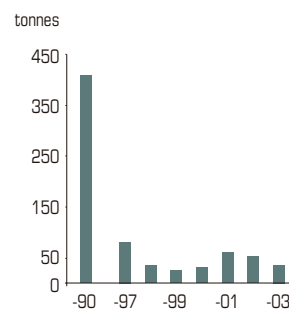
Sulfur dioxide emissions



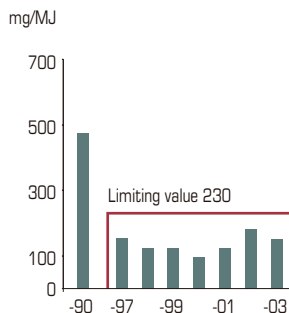
Nitrogen oxide emissions



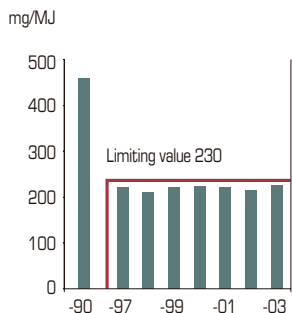
Particle emissions



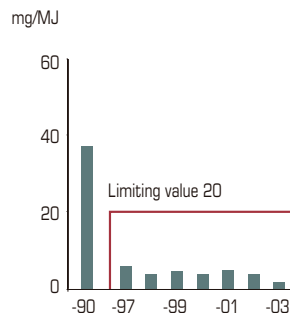
Kristiina 2, specific emissions of sulfur dioxide



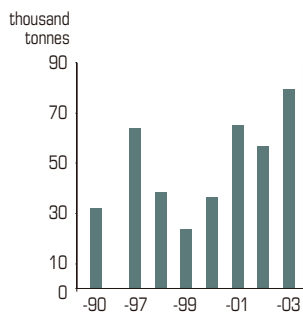
Kristiina 2, specific emissions of nitrogen oxides



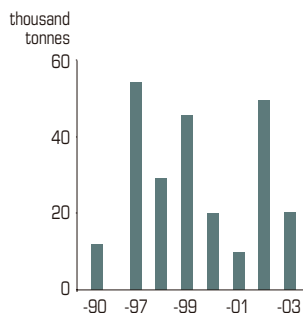
Kristiina 2, specific emissions of particles



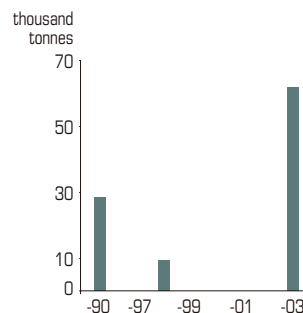
Accumulation of ash



Use of fly ash

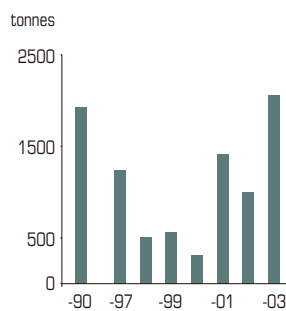


Disposal of ash

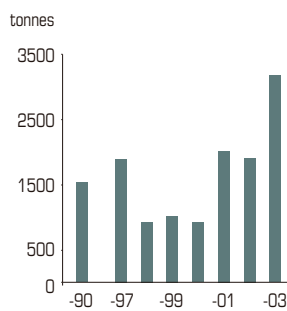


## Pohjolan Voima's plant-specific data > Taikkoluoto

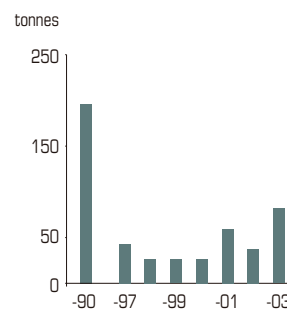
Sulfur dioxide emissions



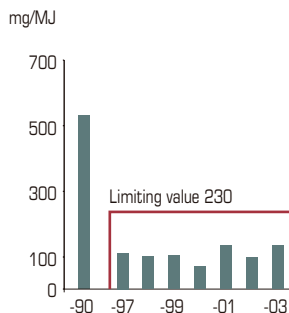
Nitrogen oxide emissions



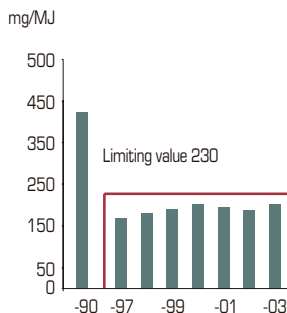
Particle emissions



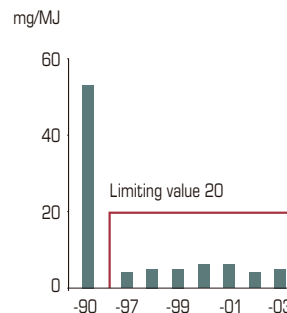
Specific emissions of sulfur dioxide



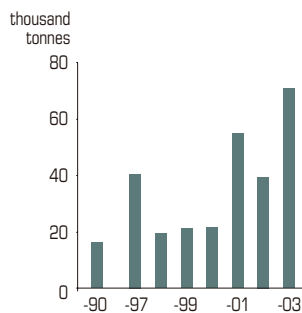
Specific emissions of nitrogen oxides



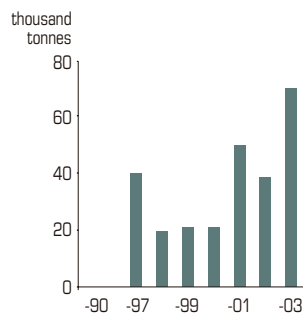
Specific emissions of particles



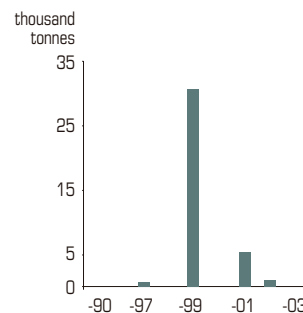
Accumulation of ash



Use of fly ash

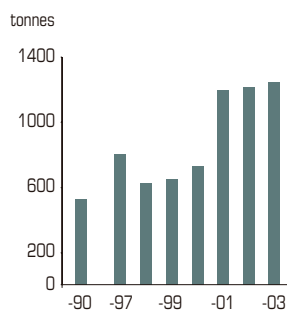


Disposal of ash

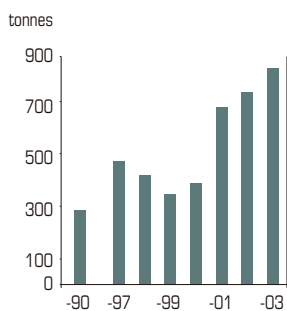


## Pohjolan Voima's plant-specific data > Seinäjoki

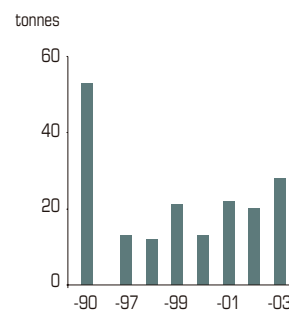
Sulfur dioxide emissions



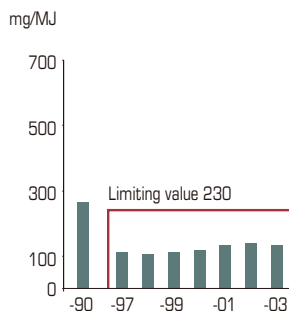
Nitrogen oxide emissions



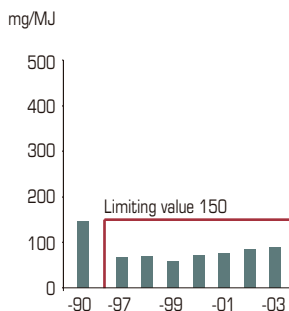
Particle emissions



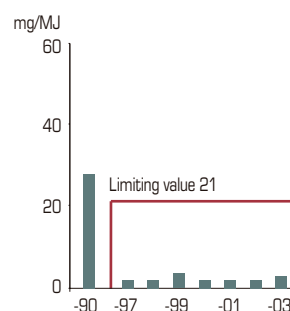
Specific emissions of sulfur dioxide



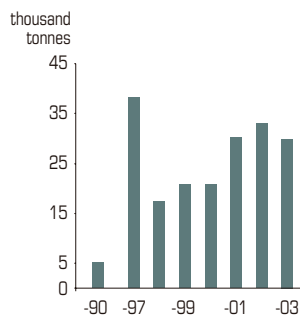
Specific emissions of nitrogen oxides



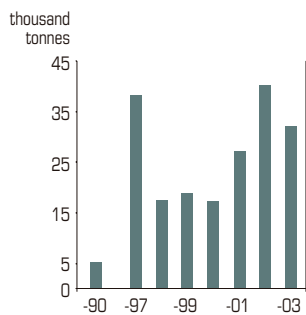
Specific emissions of particles



Accumulation of ash

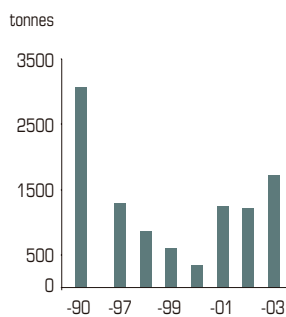


Use of fly ash

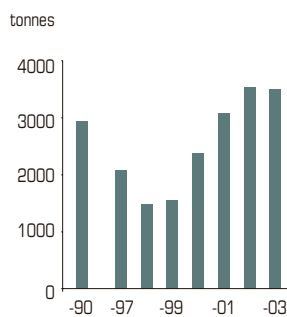


## Pohjolan Voima's plant-specific data > Vaskiluoto

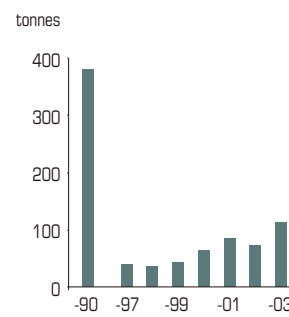
Sulfur dioxide emissions



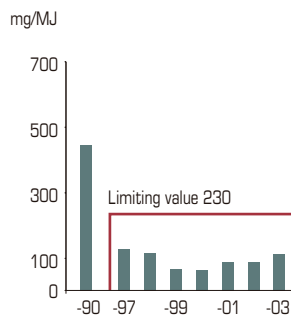
Nitrogen oxide emissions



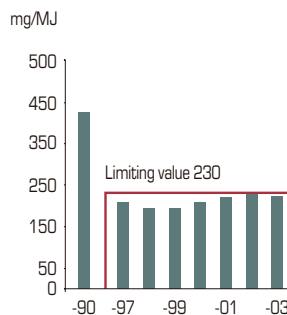
Particle emissions



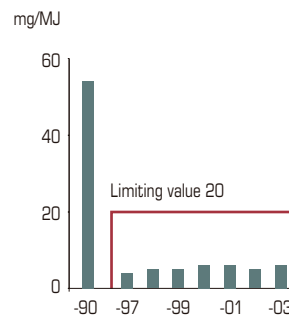
Vaskiluoto 2, specific emissions of sulfur dioxide



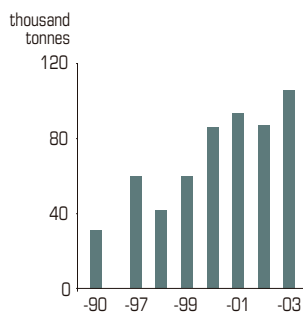
Vaskiluoto 2, specific emissions of nitrogen oxides



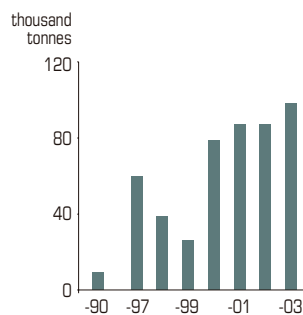
Vaskiluoto 2, specific emissions of particles



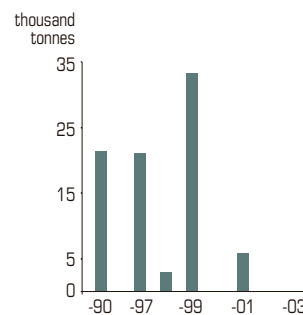
Accumulation of ash



Use of fly ash

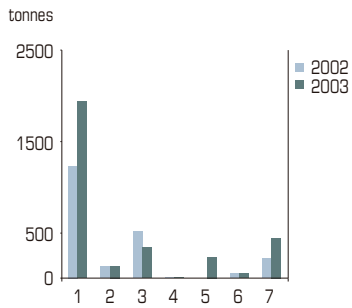


Disposal of ash



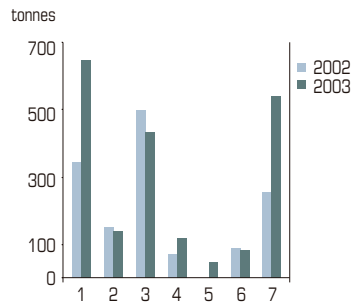
## Pohjolan Voima's plant-specific data > New CHP plants

### Sulfur dioxide emissions

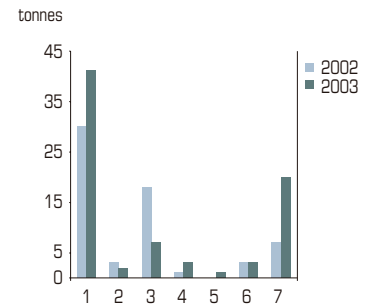


1. Alholma
2. Kokkolan Voima
3. Jämsänkosken Voima
4. Järvi-Suomen Voima, Ristiina
5. Järvi-Suomen Voima, Savonlinna
6. Vieskan Voima
7. Kymin Voima

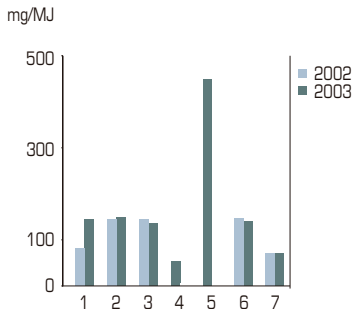
### Nitrogen oxide emissions



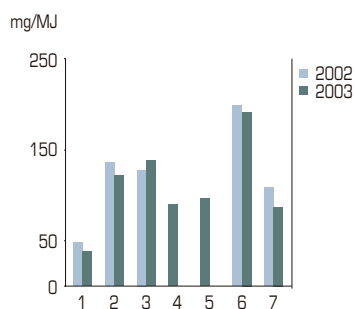
### Particle emissions



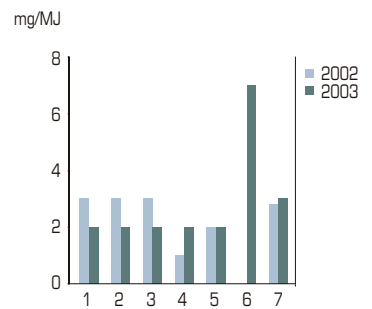
### Specific emissions of sulfur dioxide



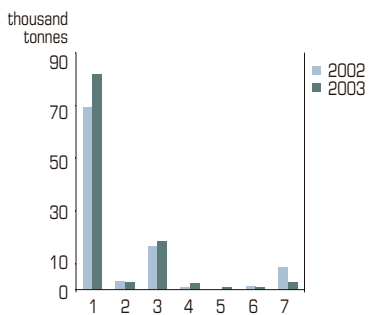
### Specific emissions of nitrogen oxides



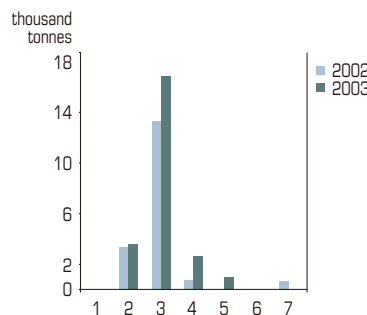
### Specific emissions of particles



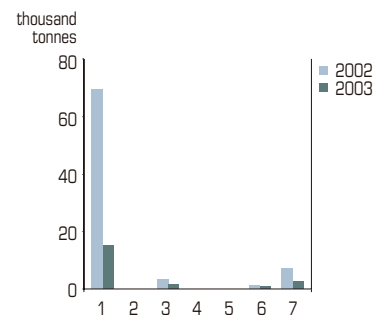
### Accumulation of ash



### Use of fly ash



### Disposal of ash



## *Environmental policy*

Pohjolan Voima conducts long-range energy business. One of the prerequisites for this is the preservation of a safe, healthy and diverse living environment. Pohjolan Voima, for its part, bears the responsibility for this. The operations are guided by this environmental policy, which is based on the Group's core values, responsibility, reliability and competence. The Group companies set their own environmental objectives and targets on the basis of the principles of the Group's environmental policy.

### *Pohjolan Voima is aware of the environmental effects of its operations*

Pohjolan Voima is aware of the effects its operations may have on the environment and of the risks they may pose. The identification and analysis of these effects and risks are also essential elements in planning new projects. The life-cycle aspect is also taken into account in assessing these effects.

### *Efficient environmental protection is based on the management of all aspects of operations*

Environmental protection and management are based on the fulfilment of the requirements set by laws, licences and other binding regulations. Pohjolan Voima also considers it important that energy is generated and raw materials are used efficiently with respect to the whole system while conserving the environment. This means, first of all, that power plants and other systems for which Pohjolan Voima is responsible are operated and maintained carefully and appropriately. The management of all aspects of the operations also involves utilizing, handling and disposing of by-products and waste safely. In the event of accidents and malfunctions, everything that is possible will be done to prevent pollution of the environment.

### *Personnel play a key role in environmental protection*

All work tasks in the entire Group involve due consideration of the environment. By training and guidance, and through encouraging its

personnel, Pohjolan Voima sees to it that the personnel are aware of the principles of the environmental policy as well as their own responsibility. Every employee must recognize the environmental aspects connected with his/her own operations and the ways of affecting them. Pohjolan Voima also requires that every employee is capable and willing to act in a responsible and professional manner in his/her own work.

### *Pohjolan Voima takes stakeholder groups into account*

Pohjolan Voima maintains an open dialogue with the authorities, associations and residents in the power plant locations, and other stakeholder groups. An important target for this co-operation is to find environmentally friendly and cost-efficient solutions.

### *Pohjolan Voima continues to develop its operations*

Pohjolan Voima monitors changes in its operating environment and takes environmental aspects into account in developing its operations. Suitable management and monitoring methods ensure continuous progress. Sustainable development is also promoted through research operations.

*Pohjolan Voima's Executive Officers have approved this environmental policy, which is binding on the entire Group, on 10 November 2003.*

