

FENNOVOIMA

Electricity for the needs of Finns

IVO KOUKLIK
4.10.2018
DUKOVANY



JÄÄ JÄÄ, JOS VÄLITÄT

Ilmastonmuutoksen pysäyttäminen
on maailman tärkein asia.
Kysy vaikka lapsiltasi.

Haluamme olla osa ratkaisua.

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Fennovoima is a Finnish nuclear power company,

which produces climate friendly electricity to fill the needs of Finnish households and industry.



Owners:

- 66 % Voimaosakeyhtiö SF
- 34 % RAOS Voima

Size of the investment:

6.5-7 billion euros of which
1.8-2.7 billion euros domestic

We are part of the solution.

HANHIKIVI 1

FH1-nuclear power plant will be built

 **Pyhäjoki, Finland**



Capacity
1200 MW



No
greenhouse
gas emission

Third generation
pressurized water
reactor

VVER-1200

Life time of the
power plant:
at least

60 years

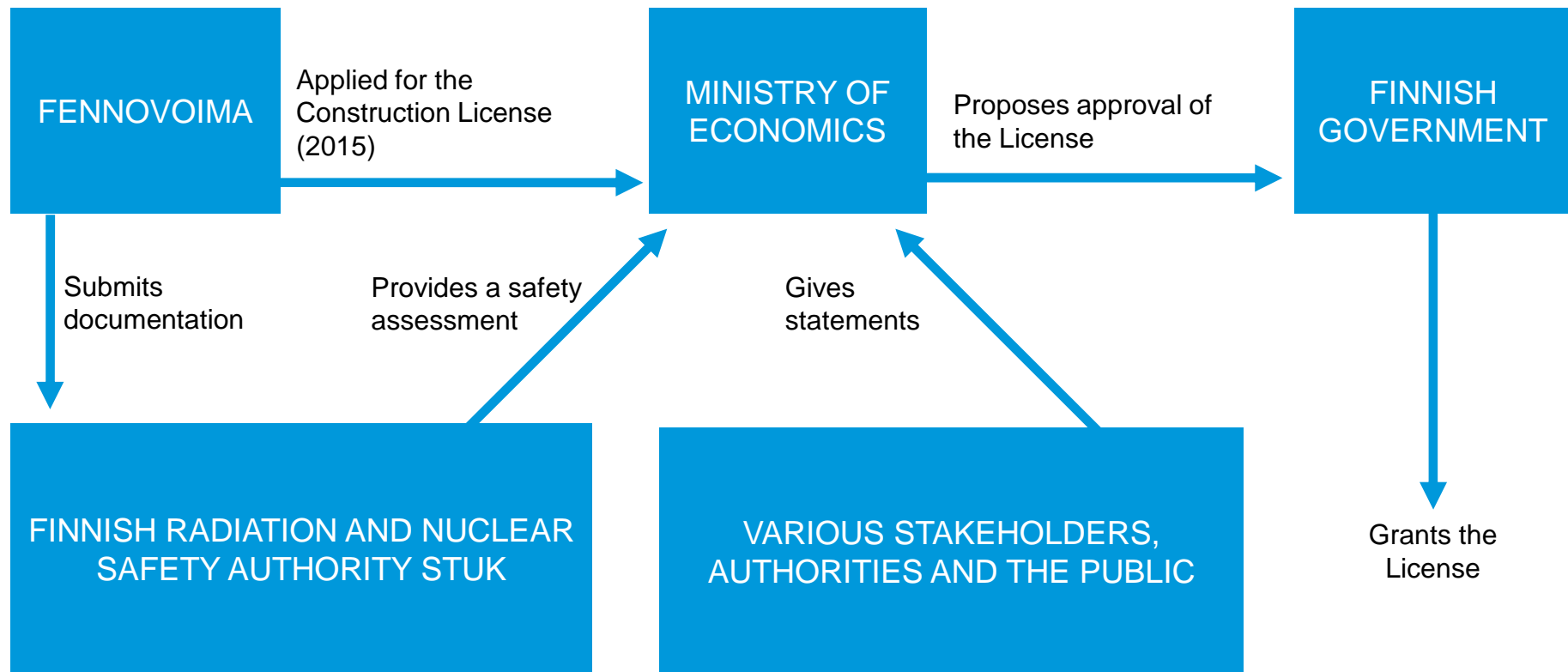
fennovoima.com | fennonen.fi/en | [#fennovoima](https://twitter.com/fennovoima)

Focus in 2018



- Main focus is on review and delivery of Construction License documentation
- Starting the production of long lead items
- Development of supply chain
- Preparatory works ongoing at the Hanhikivi 1 site
- Recruitments
 - Currently over 370 professionals from 20 different countries working at Fennovoima

Applying for a Construction License



FH1 project is in Licensing Phase



- Russian partners play a big role in actually producing the CLA documents
- Fennovoima reviews and delivers the documents to STUK
- STUK reviews, comments, makes additional requirements and approves
- All materials and plans follow YVL-guides*
- STUK also approves major components, management systems etc.

*YVL stands for Finnish nuclear safety guidelines

Progress of licensing process



- The design documentation includes e.g.:
 - Plant site design data, quality systems, documentation relating to the nuclear power plant's technology and safety
- The plant supplier has found the Finnish design practices challenging. However, the plant supplier is familiar with the upcoming more technically-oriented design phase
- Good progress has been made in document content preparation – formal completion, ensuring of design integrity, and gaining of approval take time
- The target is to receive the construction license in 2019

Materials are submitted to STUK in batches

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- Materials submitted in 2015 - 2017:
 - General description of the nuclear power plant
 - Description of the plant site and reports on the environmental conditions
 - Documents on the Fennovoima Management System and quality plans
 - Basic safety design principles of the nuclear power plant
 - Descriptions of the design procedures
 - Documents pertaining to the software used in the safety analyses
 - First system description for piloting purposes
 - Plant conceptual design plan materials

- Materials submitted in 2018:
 - Deterministic safety analyses
 - Preliminary probabilistic risk assessment
 - Reactor core and primary circuit licensing materials
 - System design materials
 - Final design phase safety analyses

Reference plant LAES-2 was connected to grid

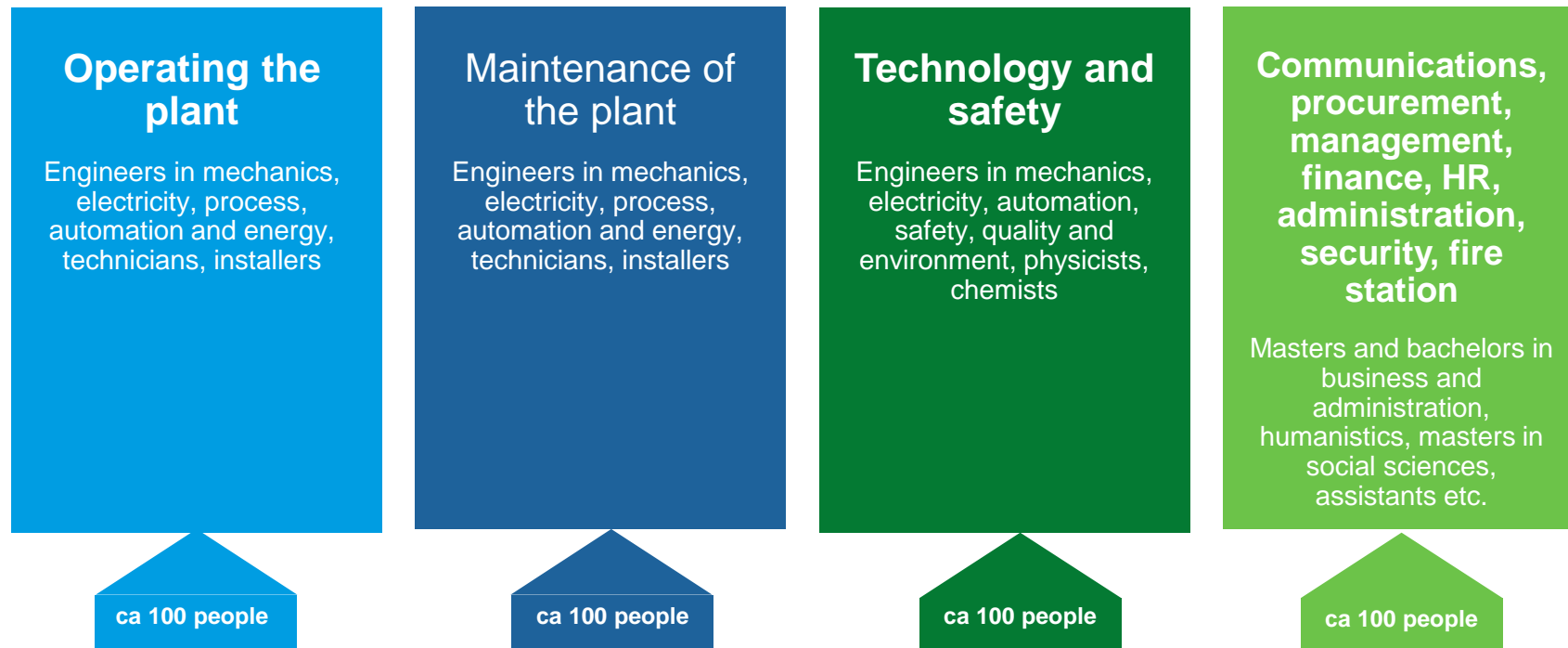
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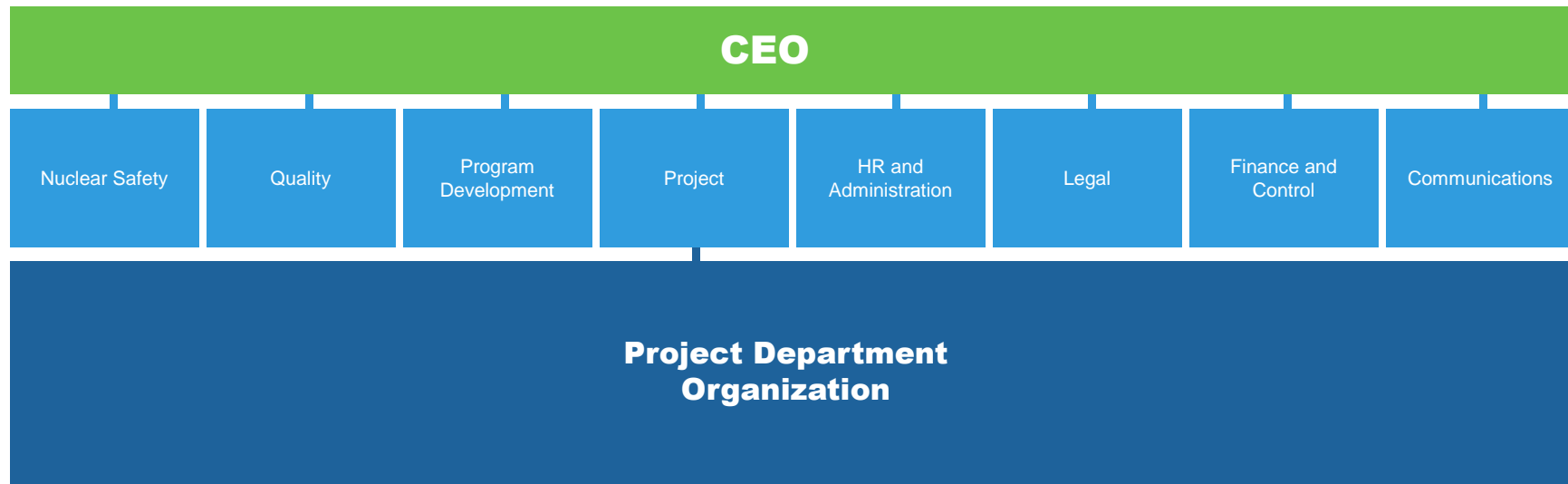
- Hanhikivi 1's reference plant in Sosnovy Bor, Russia, was connected to grid in March
- The commissioning of the plant will be completed by the end of 2018

Operating plant employs some 450-500 employees

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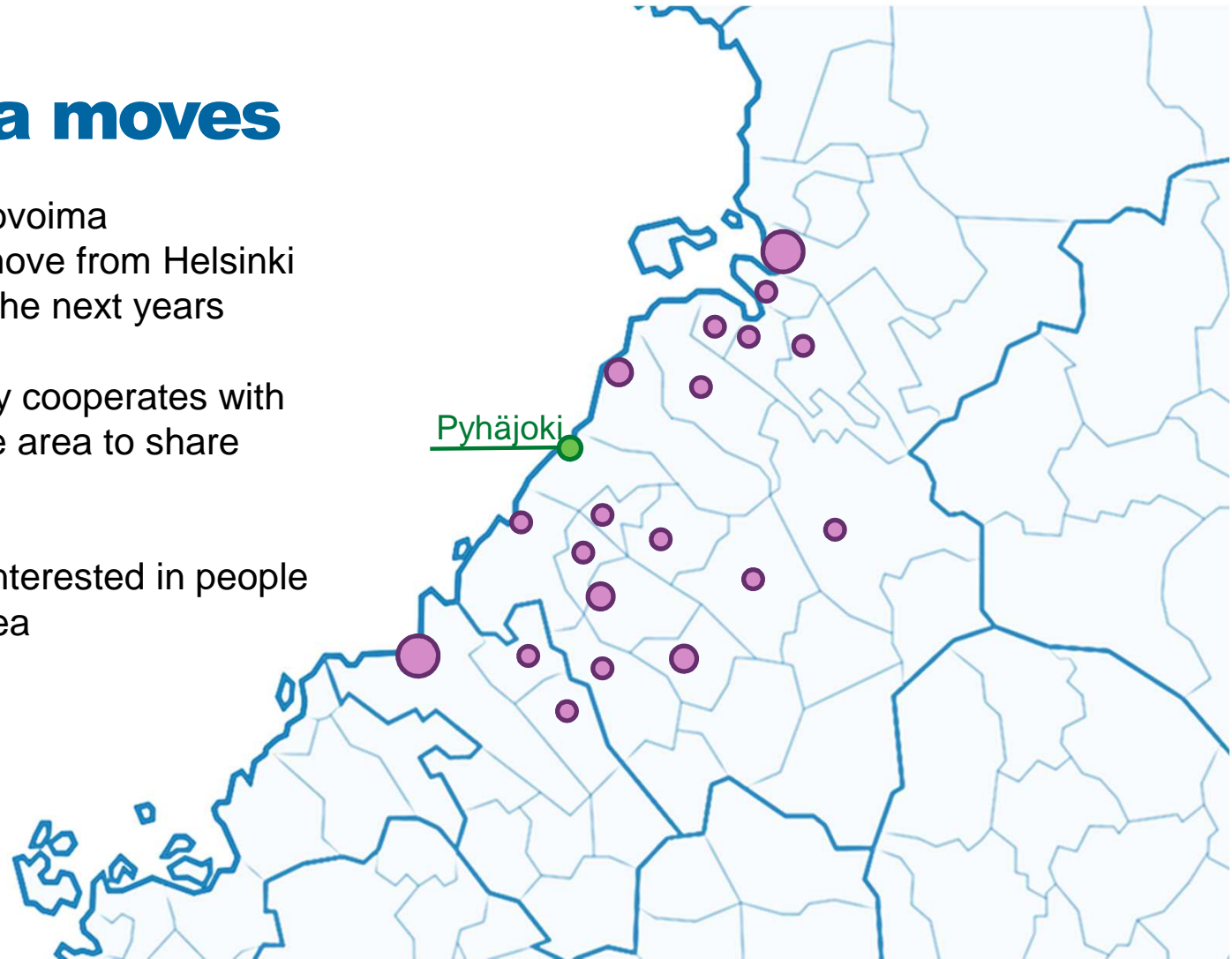


Fennovoima Organization



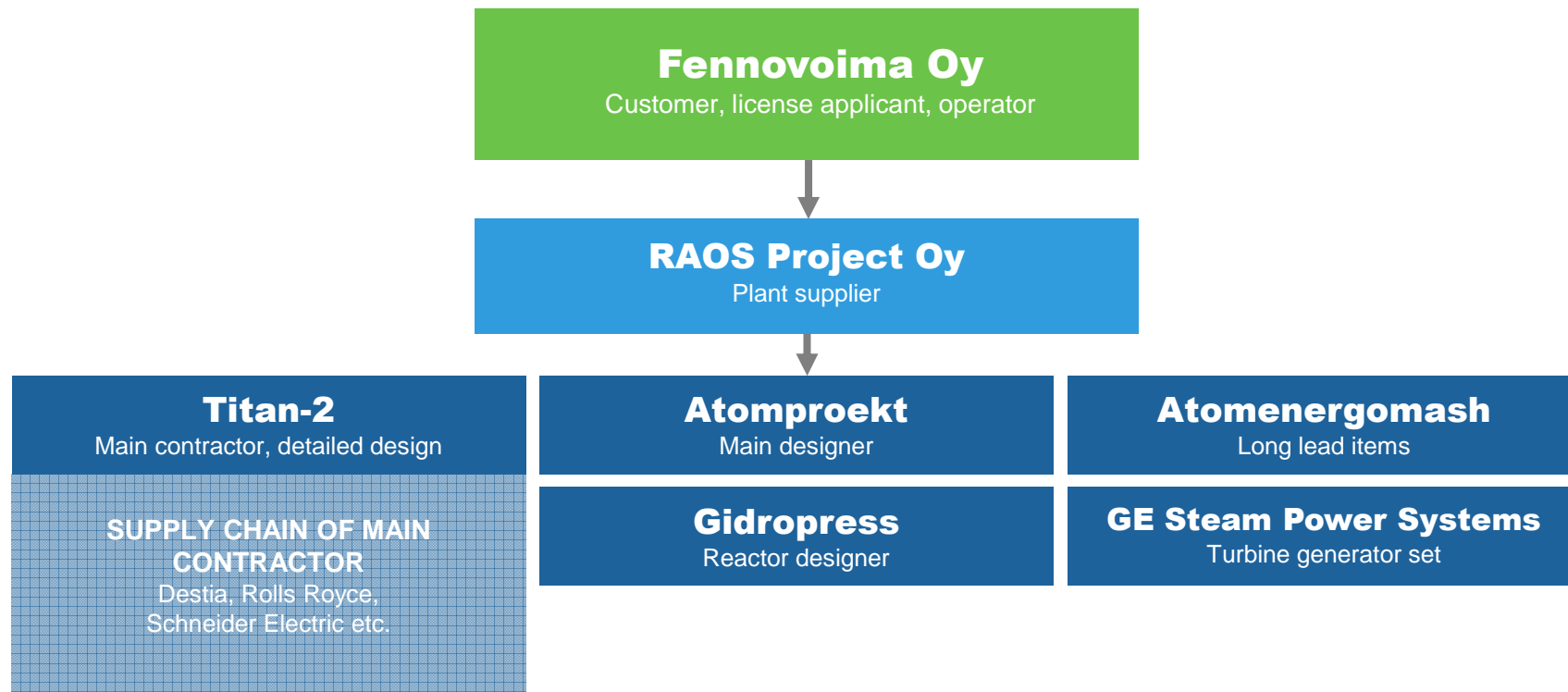
Fennovoima moves

- Personnel of Fennovoima headquarters will move from Helsinki to Pyhäjoki during the next years
- Fennovoima closely cooperates with municipalities in the area to share information
- Municipalities are interested in people moving in to the area



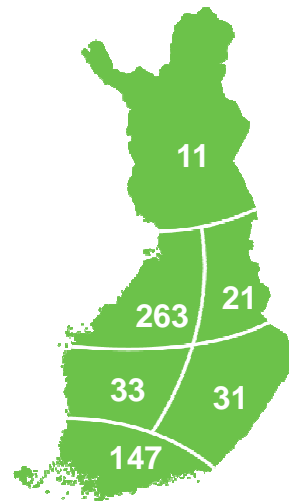
FH1 site today:
**Investments worth of
400 - 500 M€** before
the building of the
power plant begins

Project Participants



**Finnish rules and
requirements apply**
at the Hanhikivi 1
construction site

Construction site in numbers



Fennovoima's Scope



Administration building and plant office
Hundreds of Fennovoima experts will work at the administration building



Hanhikiventie road
About 4 km from the main road



Training building
Each new worker participate in site access training organised by Fennovoima



Weather mast
The weather mast is the highest point on site, 120 meters



Main gate building
The main gate building will house functions relating to site security and access control



RAOS Project's / Titan-2's scope



Plant excavation
Foundations of the plant will be cast in up to level -15 meters

Plant supplier's support functions
Support functions serve during the construction phase



Water works and dredging
Underwater blasts from May to October, taking the spawning season of fish into consideration



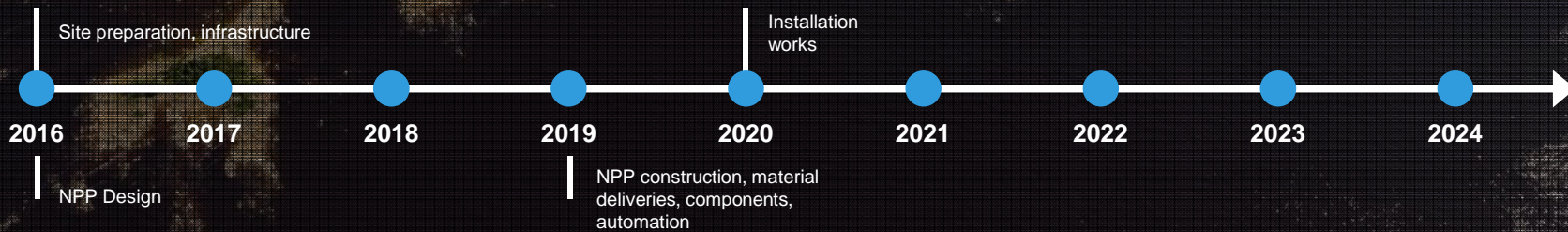
Accommodation village
Up to 4000 workers will be working at the site at the same time. The accommodation village provides housing for 1,000 workers



Concrete stations
The amount of concrete required to build the plant would fill the Finnish House of Parliament four times over



Waste assortment station
85 % of waste produced at the site will be sorted already at the site



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Training Building

- Site access trainings are arranged in the training building
- Site access training completed by over 2,500 persons



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Security Gate Building

- Completed in August 2017

An aerial photograph showing a tall, slender weather mast standing on a peninsula. The mast is positioned on a gravelly area. In the background, there is a paved road with a roundabout, a parking lot with several vehicles, and a dense forest. The sea is visible in the distance under a clear blue sky. The mast has a white base and a red section near the top.

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Weather mast

- A weather mast was set up in December 2017
- Purpose-built for the Hanhikivi peninsula

An aerial photograph of a power plant construction site. In the foreground, there are two large yellow cylindrical silos with multiple smaller silos on top, connected by a red metal structure. To the right, there are several red shipping containers stacked together. A blue container is visible in the lower right. In the background, there is a white building, a road, and a body of water under a clear blue sky. The word 'FENNOVOIMA' is written in white capital letters in the top right corner.

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Concrete Stations

- Concrete required for the construction of the plant will be supplied by Ruskon Betoni
- Two stations set up on Hanhikivi peninsula



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Excavation for plant foundation

- Excavation and mining now at level -2 meters



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Hydraulic engineering

- Sea channel dredging, construction of harbour structures, cooling water intake and discharge structures

Next auxiliary buildings

- Temporary accommodation for 1,000 persons during the construction phase
- Site offices and social facilities
- Canteen and medical center



Administration building

- Office building for Fennovoima employees



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VIRKKUNEN & CO
ARCHITECTS

FV Public



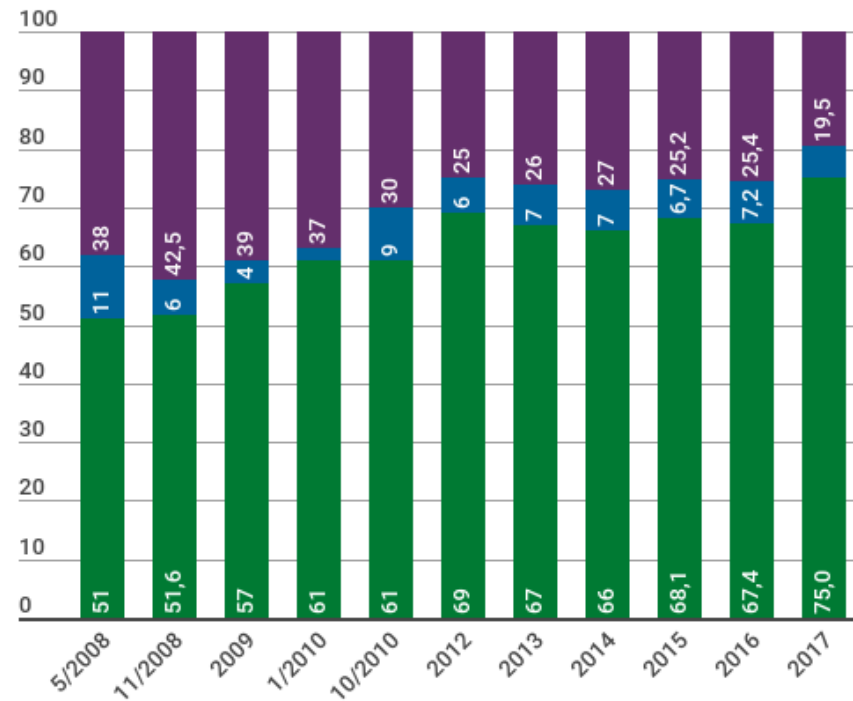
Project based on local support

What is your opinion about Fennovoima building a nuclear power plant to Pyhäjoki?

Pyhäjoki



Lähde: Norstat



Nuclear fuel



- For the first 10 years, the fuel will be supplied by TVEL
- The fuel will be of the reprocessed uranium type
- Hanhikivi 1 will require approximately 25 metric tons – which amounts to a few truckloads – of fresh nuclear fuel per year
- A single fuel element has a diameter of 20 centimeters and a length of 4 meters

Final Disposal



- Fennovoima submitted its Environmental Impact Assessment program (EIA) regarding final disposal to the Ministry of Employment and Economy (MEE) in 2016, fulfilling the requirement of the Decision-in-Principle
- A service agreement was signed with Posiva Solutions. Posiva's know-how can be used in Fennovoima's final disposal project

2090

Final disposal of Fennovoima's spent nuclear fuel will begin earliest in the 2090's.

Fennovoima supports Finland's competitiveness



Mankala: Energy at Cost Price

Mankala companies are limited companies, which produce energy for their shareholders at cost price

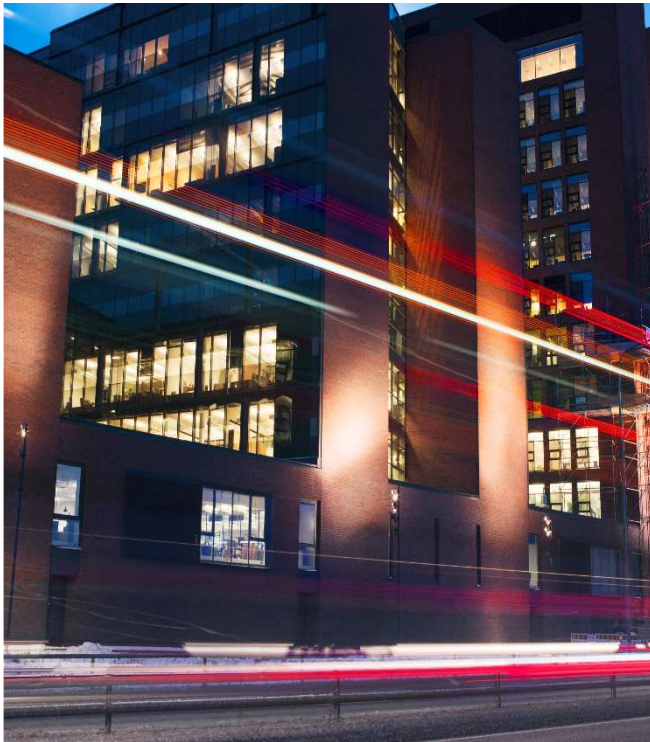
- The mankala-model has enabled a large variety of different types and sizes of actors to invest in energy projects. This increases the number of actors in the energy market and improves competition.

40%

Mankala companies produce over 40 per cent of Finland's electricity.

Value of domestic investments
EUR 1.8–2.7 billion

Impacts on national economy



According to Technical Research Centre of Finland's (VTT) macro-economic impact analysis:

- The benefits of the reduction of imported electricity, improvement of the trade balance and increasing household purchasing power to the national economy will be approximately half a billion euros annually
- Hanhikivi 1 will bring significant additional investments to the energy sector, construction and other sectors producing investment commodities
- Total investments will increase in the 2020's by nearly 1 % and the gross national product by over **0.25 %**

Source: VTT's research paper
VTT-R-0370414, 08/2014 (in Finnish)

Impact on regional economy



- Construction phase of Hanhikivi 1
 - 24,000 to 36,000 person years
 - Approximately 20,000 construction site access permits
 - The peak number of persons working on the site will be around 4,000

- Operational phase of Hanhikivi 1
 - 450 to 500 direct employees + annual outage personnel
 - 1,000 new inhabitants in the economic area

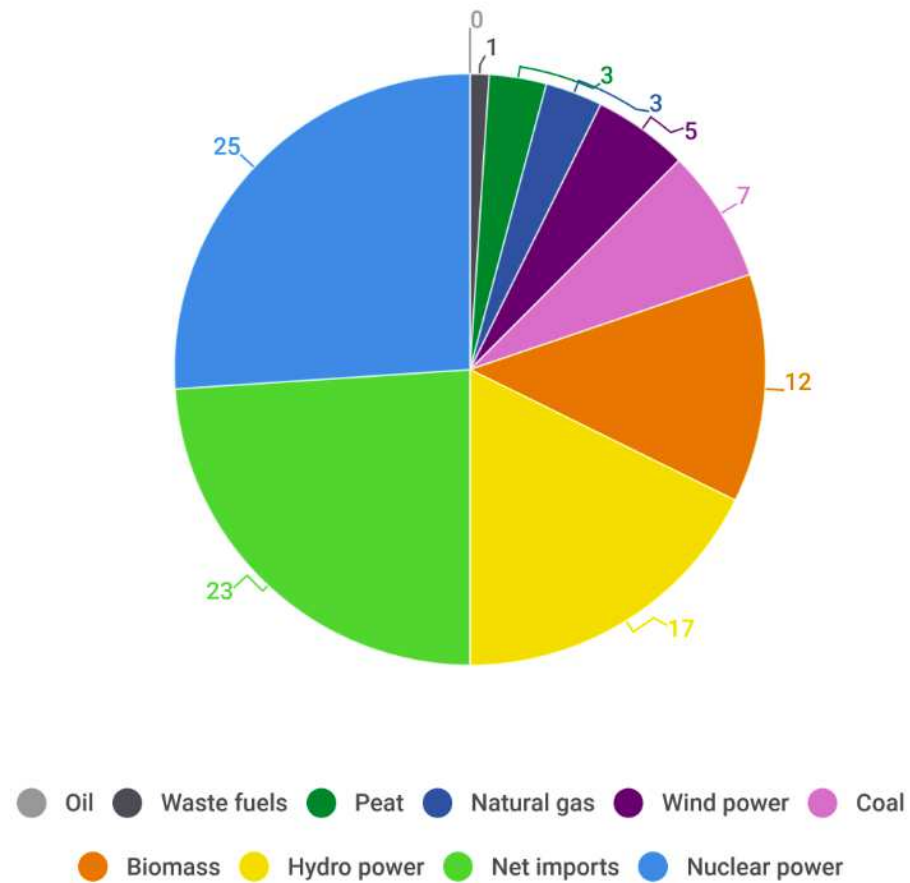
- Areas of impact at regional level
 - Infrastructure, housing market, logistics, business, operations of authorities, tourism, public services, etc.

Energy production in Finland



Electricity supply in Finland

Year 2017 (in total 85,5 TWh)



Source: Energiategollisuus ry.

Nuclear power production in Finland

Loviisa 1–2 (Fortum)

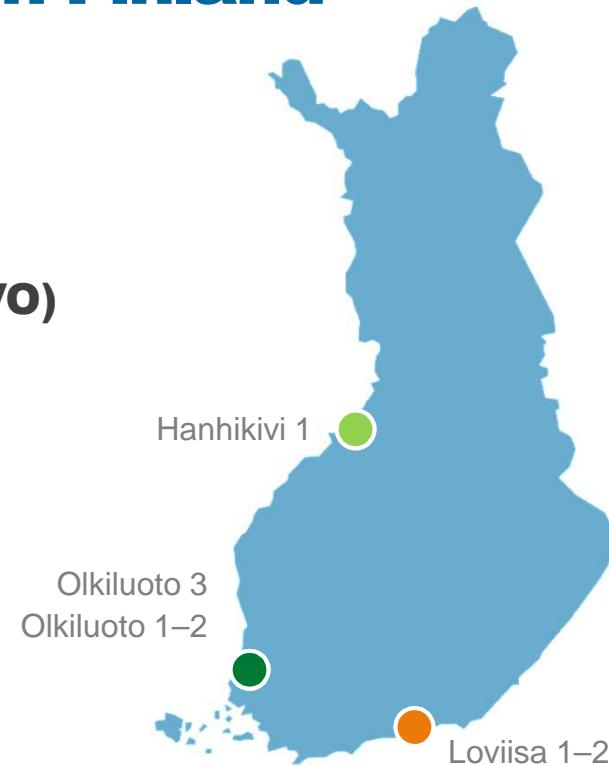
- LO1–2: 2x502 MW

Olkiluoto 1–2 and Olkiluoto 3 Eurajoki (TVO)

- OL1–2: 2x880 MW
- OL3: 1600 MW, under construction

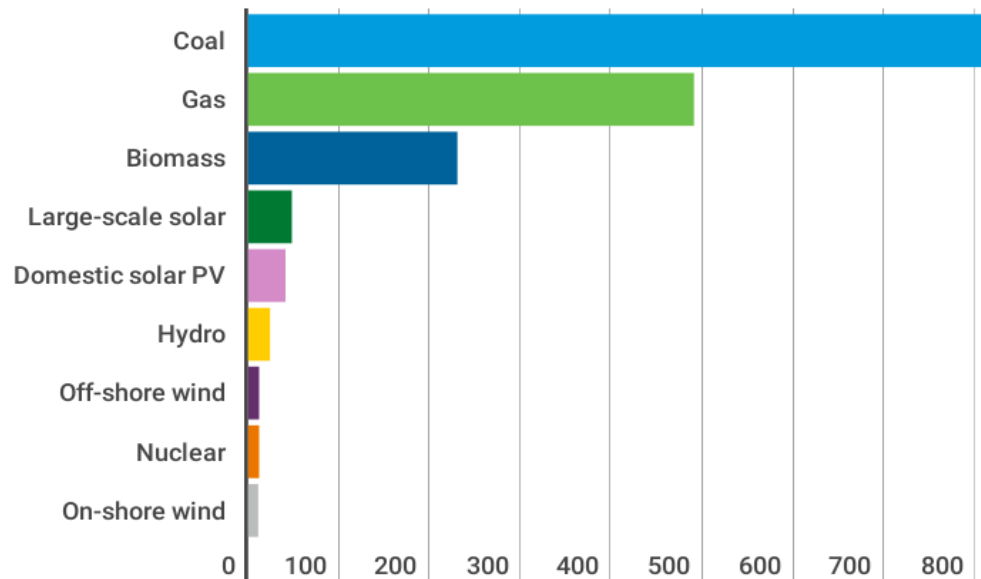
Hanhikivi 1, Pyhäjoki (Fennovoima)

- FH1: 1200 MW, in preparation



Life cycle emissions from generation of electricity

gCO₂ / KWh



The average carbon balance of different ways to produce electricity according to the IPCC (Life-Cycle Assessment, LCA).

Nuclear power includes uranium mining, enrichment and fuel fabrication, plant construction, use, decommissioning and long-term waste management.

