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HALDEN PROJECT HTO

The energy and nuclear situation in Norway

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Divison Director IFE Nuclear

ESRA Norge, 22.5.2025

Demand for electricity in Norway is growing by 60% from today to 2040

FIGURE 1

Norway electricity demand by sector

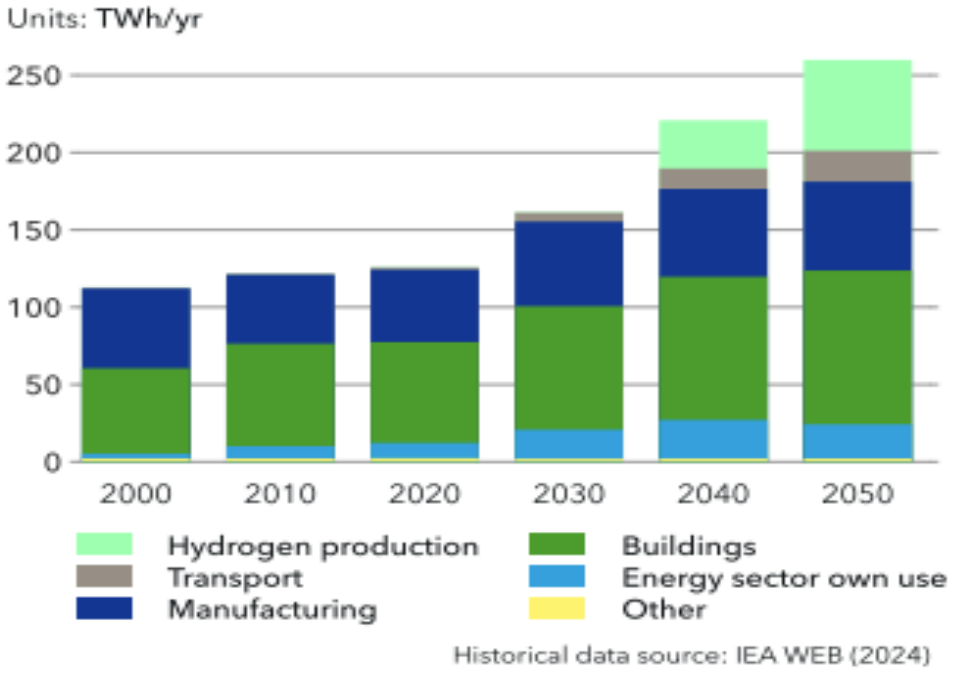
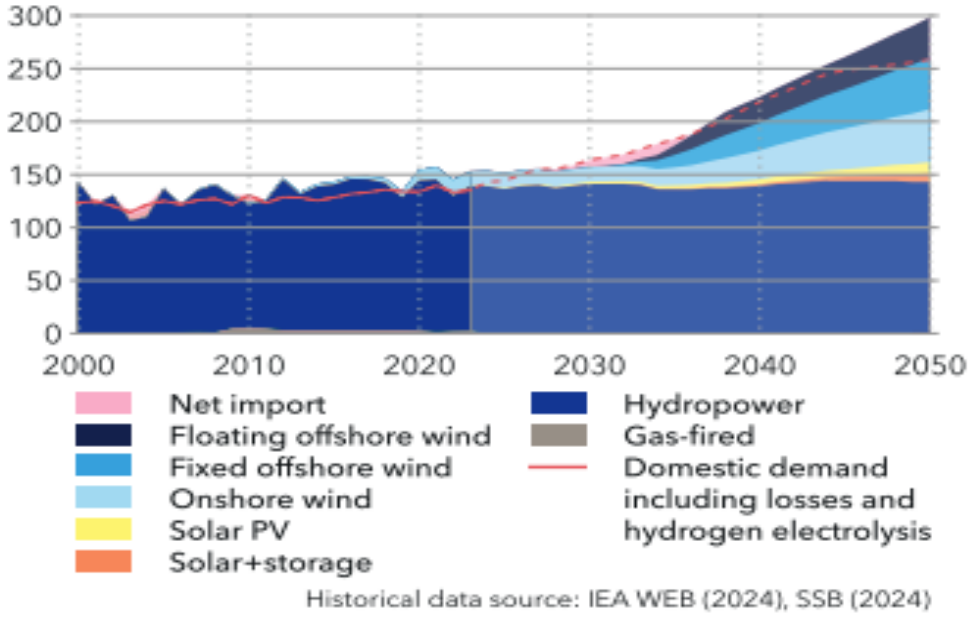


FIGURE 2

Norway electricity supply by power station and net imports



Ref: DNV Energy Transition Outlook Norway 2024
energy-transition-norway-2024.pdf

Nuclear power was considered relevant in Norway until the end of the 1970s

NVE informs about nuclear power plants, 1973:

Elektrisitets-forsyningen i Norge

Denne del omhandler behovet for elektrisk energi og hvordan dette kan dekkes.

Slik situasjonen fortoner seg i dag, vil kjernekraften komme til å dekke en vesentlig del av økningen i vårt kraftforbruk etter hvert som vannkraftressursene blir utbygd. Olje og gass fra Nordsjøen kan også komme til å spille en viss rolle, men her står det enda igjen å avklare en rekke åpne spørsmål.

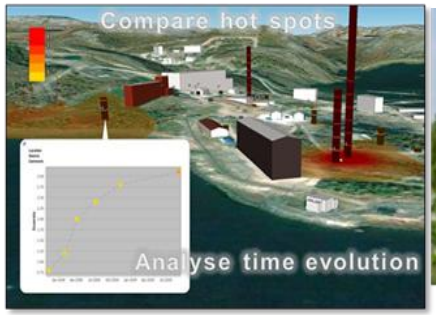
Det tas nå sikte på å få det første kjernekraftverket i Norge i drift omkring 1982, og de forberedende arbeider for dette prosjektet er allerede så smått igang.

The Norwegian Nuclear Action Plan

- The Institute for Energy (IFE) is one of the key stakeholders
  - Involved in projects since establishment of the Nuclear Action Plan. About 100 projects performed successfully
  - Main focus from the start on nuclear safety and security projects at nuclear power plants
  - Since 2014, Norway has prioritized collaboration on preparations for decommissioning of “old reactors” and IFE’s role extended to involvement in decommissioning projects

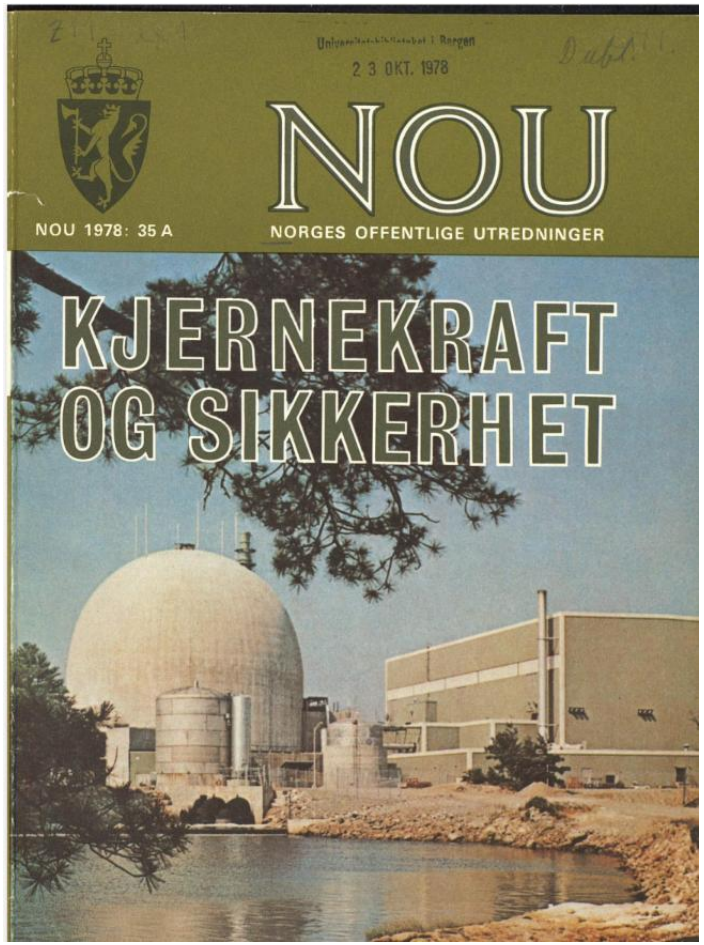
  - IFE’s competence/experience is utilized within:
    - Supply of equipment for safety enhancements
    - Operator Support Systems related to safety
    - Improved training programs/upgrade training simulators
    - Digitalization of information (analogue, procedures etc.)
    - Virtual Reality (VR) in planning, training and presentation
    - Decommissioning

  - IFE involved in projects at the following nuclear sites
    - Kola NPP (Russia)
    - Leningrad NPP (Russia)
    - Andreeva Bay (Russia)
    - FSUE Atomflot (Russia)
    - Chernobyl NPP (Ukraine)
    - Rivne NPP (Ukraine)
    - South Ukraine NPP (Ukraine)
    - Khmelnytskyi NPP (Ukraine)



Investigations

1978



NOU: planned for 1. April 2026

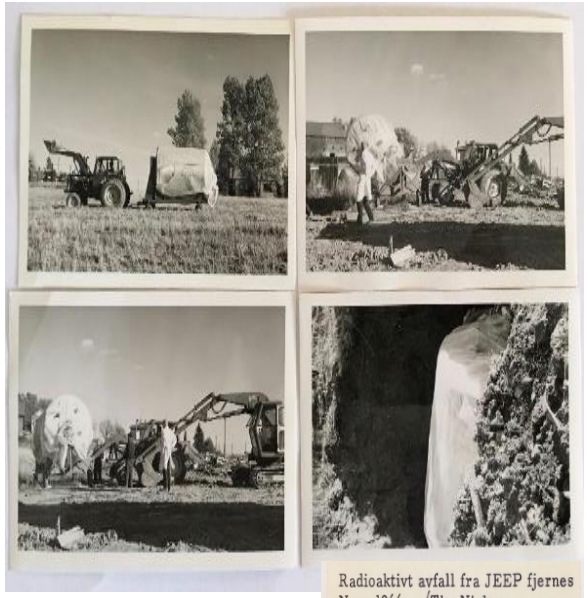
Topics to be evaluated

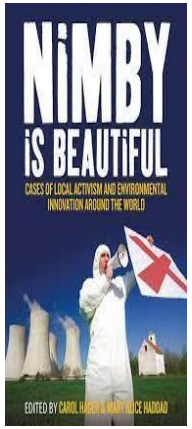
- Technology and costs
- The energy systems
- Area usage and environmental
- Safety and emergency
- Regulations
- Competence
- International collaboration

Member of Committee: Atle Valseth, IFE

Prerequisites for nuclear power in Norway

According to IFE:



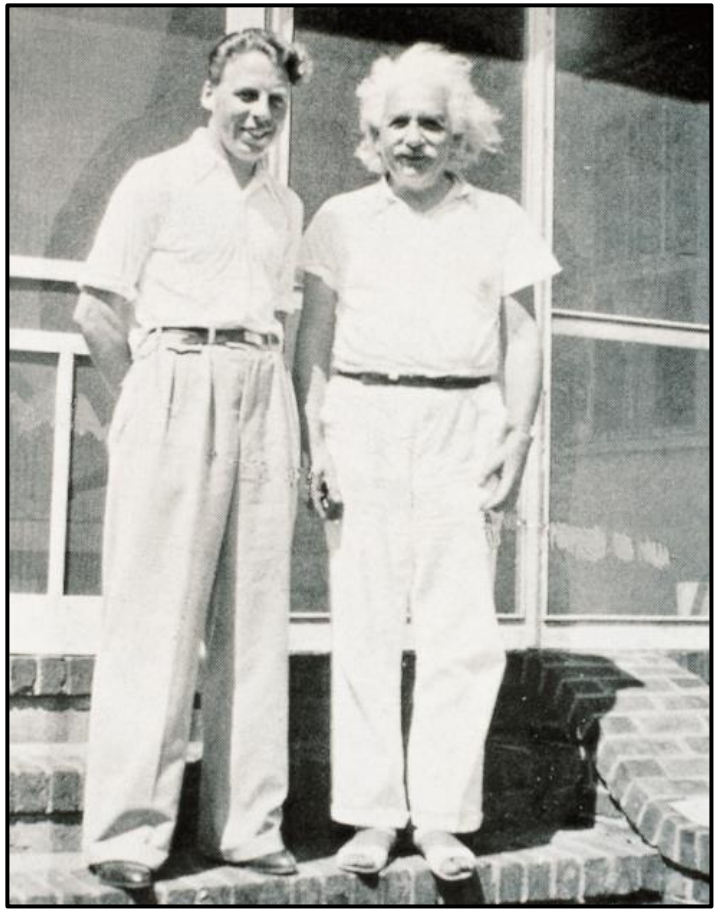


- **Requires a plan for waste landfill**
  - Includes both interim storage and long-term landfill
  - Is complex to plan and build
- **Technology commercially available and profitable**
  - As of now 80+ different designs
  - Some lack a supply chain, others do not
  - Large overruns at some large power plants
  - SMR power plants are very large in a Norwegian context
- **Regulatory conditions**
  - What is required in Norway to obtain a licence (Atomenergiloven, Energiloven, Plan og bygningsloven, ….)
- **Concept for safe and efficient operation**
  - Multi-unit operation?
  - In combination with other energy sources/energy mix?
  - What about the heat produced?
- **Legitimacy and support**
  - Is it rooted in the population? Jobs.
  - Landfill is safe, but it feels wrong to have the bed on top
- **Knowledge and expertise**
  - IFE is Norway's nuclear research institute
  - However, there is great competition internationally for projects and personnel

- **Government actors:**
  - DSA
  - DSB
  - NSM
  - PST
  - Politiet
  - SKM
  - NFD
  - ED
  - HOD
  - KLD
  - UD
  - NVE
  - Municipalities

  Key stakeholders:
  - Neighbours and neighbouring enterprises of nuclear facilities
  - Civil society
  - Environmental organizations

IFE is **the** nuclear research institute in Norway



IFEs founder, Gunnar Randers, and Albert Einstein, Long Island, 1942

- IFE has built and operated four research reactors from 1951-2019:
  - JEEP I, Kjeller: 1951 – 1967
  - NORA, Kjeller: 1961 – 1968
  - HBWR, Halden: 1959 – 2018
  - JEEP II, Kjeller: 1966 – 2019
- The Halden Reactor: Nuclear safety & fuel and materials research
- IFE at Kjeller: Neutron Research, Physics and Materials
- Nuclear research activities at IFE today:
  - Hosting the OECD NEA Halden HTO project
  - Partner in Norwegian Nuclear Research Centre (IFE, UiO, NMBU)
  - Participant in Committee on Nuclear Power (NOU)
  - Participant in development of nuclear chemistry and nuclear physics in the Oslo region
  - Member of EU Industrial Alliance on SMRs
  - Providing Nuclear Safety support to Ukraine
  - Providing nuclear services to several Clients

IFE – Key role in energy development for over 70 years

The Halden Project

HTO

Petroleum

Renewable energy

1948

1951
JEEP 1

1958
The Halden Reactor

1979

1998

2018, 2019
Shutting down the reactors

Neutron technology and materials research

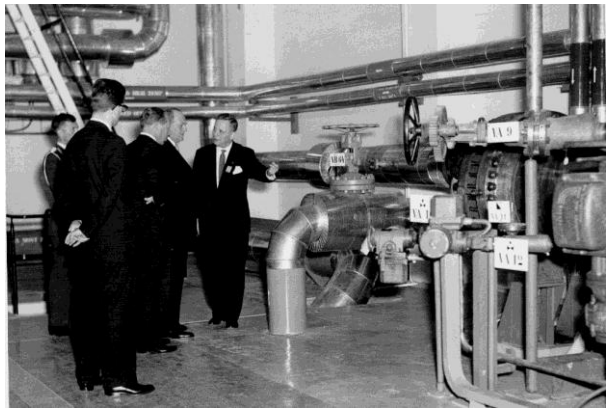
Institutt for atomenergi (IFA)

1980 Institutt for energiteknikk (IFE)

Today

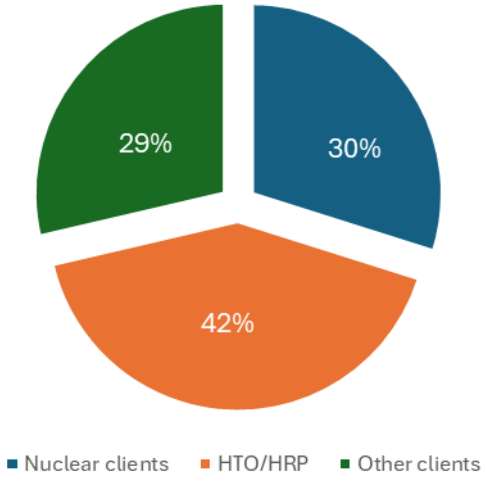
Transfer of the nuclear facilities to Norwegian Nuclear Decommissioning (NND)

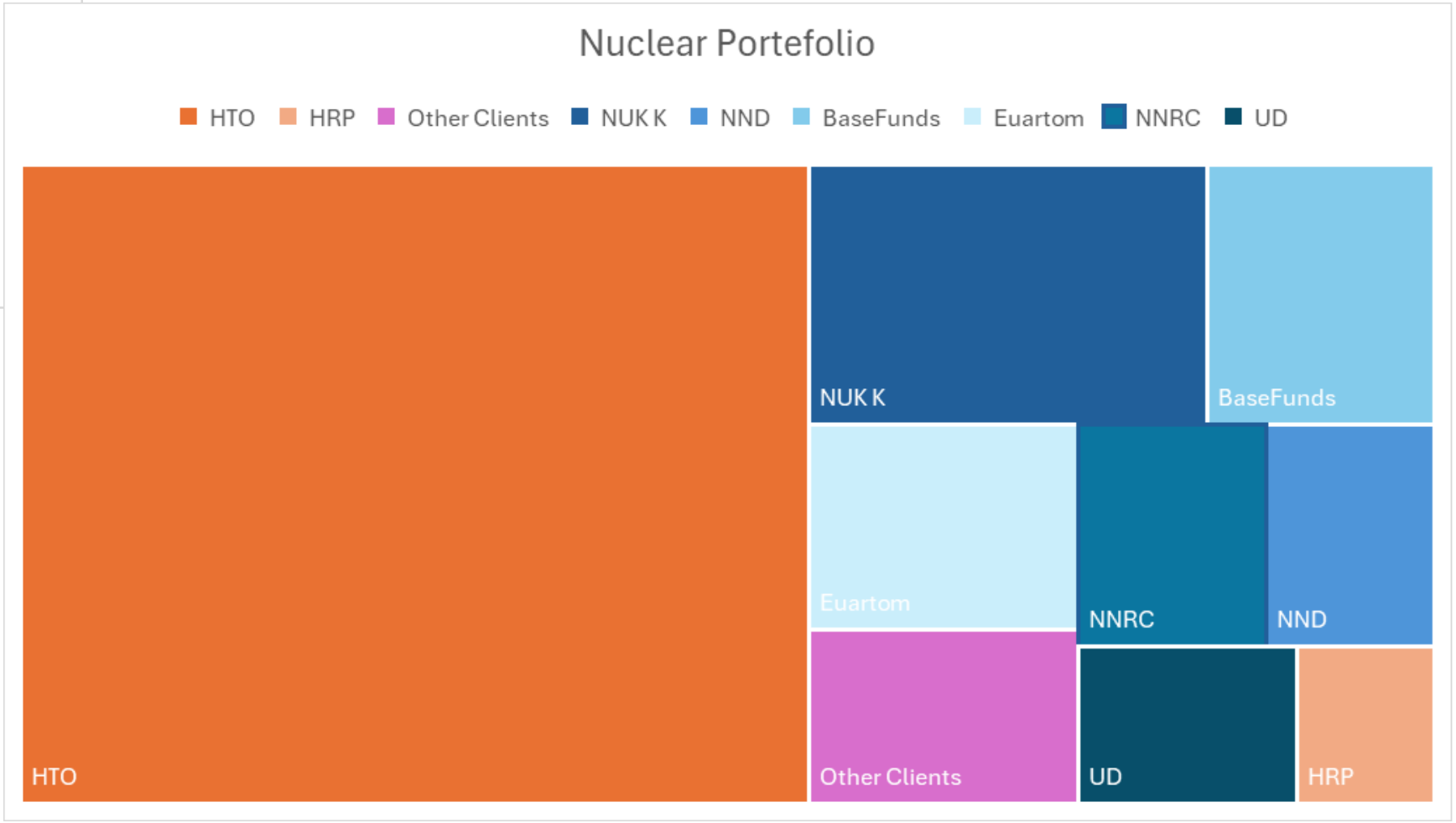
IFE → NND
NORSK NUKLEÆR DEKOMMISJONERING



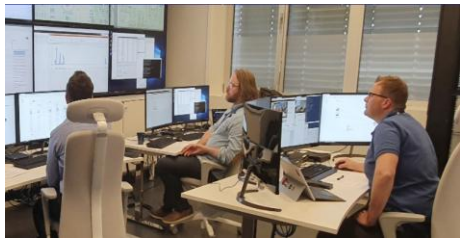
- The Halden reactor with approx. 120 employees was transferred from IFE in Halden to NND 01.04.
- The combined storage and disposal for low- and intermediate radioactive waste is planned to be transferred to NND during 2025
- It is now being investigated by IFE and NND, when the nuclear facilities at Kjeller with the remaining 100 employees in IFE's nuclear operations can be transferred to NND. The report will be submitted to the NFD by 1 July 2025

IFE Nuclear Portefolio of today





OECD NEA Halden HTO Project



- International collaborative research for the safe and reliable operation of Nuclear Power Plants, focusing on Human-Technology-Organisation
- 20 Parties from 12 member countries
- Empirical focus: Operates several simulation labs
- Budget: 2024-2026: 14.6 MEUR
- The following topics are addressed:
  - Human Performance (control room crews, digital control rooms, teamwork)
  - Digital I&C – Safety assurance (methods for ensuring safety and reliability of digital I&C)
  - Control Room Design & Evaluation (Control room validation, design of overview displays)
  - Human-Automation Collaboration (SMRs, multi-unit operation, higher levels of automation)
  - Digital Systems for Operations and Maintenance (Condition monitoring, outage)
  - Sustainable Decommissioning (VR, AR, Robotics)
  - Cyber Security for Main Control Rooms (Handling of cyber threats and attacks)
- IFE in Norway is the operating agent
- Norwegian members: Equinor and Kongsberg Maritime

OECD-driven project membership

IFE Host

Norway | Canada | China | Check Rep. | Germany | Japan | Korea | Netherlands | Sweden | UAE | UK | USA

Norwegian Nuclear Research Centre

Norsk Nukleært Forskningssenter
Norwegian Nuclear Research Centre

NCNR consortium and associates

Academia

UiO
NTNU
Universitetet i Stavanger
Høgskulen på Vestlandet
CHALMERS
Berkeley
iThemba LABS

Research & Application Sector

IFE
SYKLOTRON
BAYER
NORSAR
Norwegian Meteorological Institute
SINTEF
FFI Forsvarets forskningsinstitutt
NILU

Other Fagskolen i Viken NND, Halden Municipality, ...

NCNR affiliations

IAEA Institute for Energy Technology (IFE) IAEA Collaborating Centre
NCNR
HALDEN PROJECT HTO
DECOM
ELINDER
dScience
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CCSE
INTPART

Other international partners & networks ...

Nuclear plans in Norway

NORSK KJERNEKRAFT

Established in 2022

- will identify suitable areas for small, modular nuclear power plants (SMRs) in collaboration with power-intensive industry.
- will prepare licence applications in accordance with national regulations and international standards.
- Part owner in other Norwegian nuclear companies
- Frame Agreements with providers and suppliers

Upcoming events in Norway

International Conference on Nuclear Shipping

- June 3rd and 4th, NTNU Ålesund
- International Conference on Nuclear Shipping – NTNU
  - The nuclear case, Jan Emblemsvåg, NTNU
  - The maritime market outlook, Eirik Ovrum DNV
  - The challenges of nuclear law, Ian Salter, Burges-Salmon
  - Liquid Metal Reactor, Janne Wallenius, LeadCold
  - Molten Salt Reactor, Per Peterson, Kairos Power
  - Helium Gas-cooled Reactor, Francesco Venneri, USNC
  - Encrypted communication with ships, Rob Spalding, Sempre
  - Strøm; infrastruktur eller kommersiell vare? Hogne Hongset
  - Aure som industrikommune, Hanne-Berit Brekken
  - Omlegging av norsk energipolitikk, Ola Borten Moe
  - Den nye bølgen kjernekraft i Sverige, Jan Blomgren
  - Kjernekraft i det norske kraftsystemet, Jonas K. Nøland & Martin Hjelmeland
  - Kjernekraft i Norge, Øyvind Aas-Hansen

DigiDECOM's NuclearNEXT 2025

- November 17th – 21st, Halden
- DigiDECOM's NuclearNEXT 2025 – IFE
  - AI, digital twins, robotics, and Human Technology Organization (HTO) aspects.
  - Updates from Euratom and other major projects
  - Discussions on developing trends in stakeholder engagement and social acceptance in the nuclear field.
  - Demonstrations of Relevant Technologies and Methods, and Laboratories
  - Hands-On Experience with VRdose

IFE IAEA Institute for Energy Technology IAEA Collaborating Centre · HALDEN KOMMUNE · HALDEN PROJECT HTO · NUKLEÆRSENTERET · NORWEGIAN NUCLEAR ASSOCIATION

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Thanks for the attention!