

Integrated mapping of energy requirements and geologic knowledge into optimal tailored system design in Norway

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Agenda

- Motivation and the big picture
- The integrated energy planning tool developed by Asplan Viak
- Example: The Nedre Glomma study
- Further development

Asplan Viak is nationwide and has interdisciplinary expertise

- Asplan Viak is one of Norway's leading consulting firms in the fields of planning, architecture, and engineering.
- We bring highly skilled people together to solve some of the most demanding challenges of our time.
- Together with our clients, our more than 1300 employees use their insight and competence to create lasting value for a changing society.
- Norway's largest consultant in ground source heat pump projects and involved in approx. 100 major projects each year, as well as some GeoThermos-projects (high temperature borehole energy storages). Developed services since 2008.



Why?

"Lack of capacity in the power grid is probably the biggest obstacle to achieving the climate goals for 2030, and to establishing new industry in Norway"

Tone S. Endal, ZERO



Heating is the elephant in the green energy transition...

- Renewable heating is necessary to achieve climate goals and energy security
- Norway is among leading countries in the world's using electricity, and we use a lot of electricity for heating*

* Bøeng 2022: Heat pumps reduce expenses for electricitydependent Norwegians (ssb.no)



The energy requirements of a building

- Possible to calculate energy demand with tools developed by SINTEF and NTNU (PROFet)
- Calculates climate according to standard NS 3031

Outside air temperature from Norwegian standard, NS3031





Energy and power requirements



Key Info

Project owner: Asplan Viak

Category: IPN, Innovation Project for the Industrial Sector, Value Creation

Total budget: NOK 22 million

Support from the Research Council of Norway: NOK 12 million

Number of partners: 12 (incl. Asplan Viak)

Period: 2021-2023

INTO-ZERO.no

INTO-ZERO

Integrated planning of zero-emission areas

Main goal:

Develop a new and integrated process with associated methodology, tools and business models for planning and designing cities and areas with minimal greenhouse gas emissions in a life cycle perspective.

Milestones:



Develop map basis and geographical data related to buildings, infrastructure, mobility, energy and power as well as energy flexibility. Develop a database with criteria and benchmarks for greenhouse gas emissions, energy and power, mobility, economy and site qualities.

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Develop planning and design strategies for zeroemission areas.

Develop calculation modules and guides to address greenhouse gas emissions in planning processes.

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Develop a data ecosystem with associated graphical user interface for coordinated visualization of criteria and values for zero-emission areas.

Results from INTO ZERO

Tools under development, working prototypes:

- 1. Auto Plan ZERO (APZ)
 - Digital map-based location and climate analysis
 - Output: klimagassutslipp (CO2 ekv)
- 2. Energy Plan ZERO (EPZ) energy planning
 - Digital map-based energy analysis
 - Output: energy and power (kWh and kW)
- 3. Sustainability programming qualitative tool for use in the planning phase
- 4. The market potential model for planning public transport services
- 5. Properate Operational solution/system for ground source heating systems (Energima)



Energy Plan ZERO - a dialogue tool for energy planning

Main features methodology

- Energy demand
 - Show the energy needs of the building stock
 - Changes to the building stock and building standards
 - Existing and new buildings
- Establish scenarios for different types of energy supply solutions
- Plan different scenarios that can be compared
- Plan the energy mix and show the energy production



Example: The Nedre Glomma region

asplan viak



Create scenarios

11 predefined scenarios

- The potential of individual measures
- Possible future scenarios with combinations of short- and long-term measures





Reference situation

District heating



Current situation (constructed)



Possible future situation in 2030



New future scenario 2030 in line with the Government's action plan for energy efficiency



Ground source heating



More local production



Solar PV

Air-air heat pumps



Upgraded building stock



Ground source heating and solar PV

District heating

Reference scenario:

- Based on the areas in Fredrikstad and Sarpsborg municipality that have licence for district heating, and buildings that have district heating.
- The calculations do not include industrial buildings

District heating scenario:

• All buildings except single-family houses within the area of licence will receive district heating.



Ground source heating





Measures that free up capacity in the power grid during the coldest hour



A future scenario for 2030 with a combination of these measures frees up capacity equivalent to 20% (117 MW)

Example – future scenario 2030



Measures that save electricity from the electricity grid in the form of energy over the year

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Les mer:

Web view





Effect duration curves



Moving average over a week



Read more: Energieffektivisering og lokal energiproduksjon kan frigjøre kapasitet i strømnettet – Systemsmart Energibruk Map application: Systemsmart Nedre Glomma 2.0

Summary and findings of the study

- A great potential for saving electricity both in the coldest winter hour and energy throughout the year.
- Many single-family houses. In order for it to be effective, measures must be directed at this segment.
- The geographical perspective is important
- Electric heating for space heating puts a major strain on the power grid. We need to replace the panel heaters with waterborne heating systems (low temperature).
- The energy system must be built from the bottom up, i.e. based on the needs of the end user.

Summary of the method and the way forward

- Quantifies and localizes the effect of different measures in an area. Calculate for each individual building.
- Flexible and well suited for further development, detailing and scale, also nationally.
- Industry and wood burning/bioenergy are not included in the study.
- Further work on comparing actual electricity consumption with calculated values for a smaller area in Fredrikstad municipality.
- Further work on implementing more detailed geological features (thermal conductivity, geotechnical aspects and soil cover), as well as more detailed design of ground source heat pump and GeoThermos-systems.



Thank you for your attention!



AV-Energiplanlegging.no An energy planning tool from Asplan Viak



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