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FLEXIBLE ENERGY SOLUTIONS

The Åland Islands - A piloting area and testing platform for a smart energy system

EnergyWeek 2019 **Future Grid seminar** 20.3.2019

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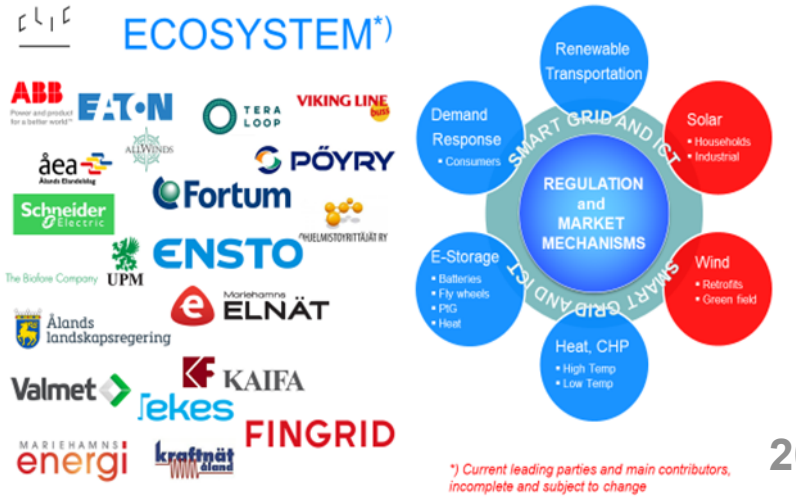
Smart Energy Åland
– From research to implementation



Today

2017-2018

Designing a smart and flexible energy system

2017

Flexe-demo conceptualisation

2016

Åland Smart Energy Platform - roadmap

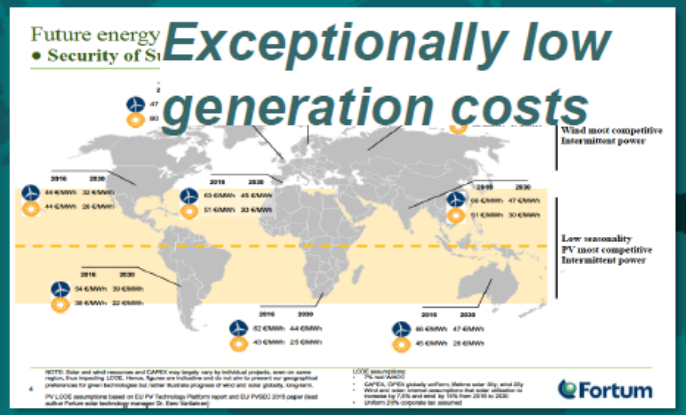
2014

“Aloitetaan Energiakäänne Ahvenanmaalta”

Preceding research programs:
2010-2015 Smart Grids and Energy Markets
2010-2014 Future Combustion Engine Power Plants
2012-2016 Efficient Energy Use
2015-2016 Future Flexible Energy Systems

The challenge

- Integration: Smart and Efficient Use of Renewable Energy

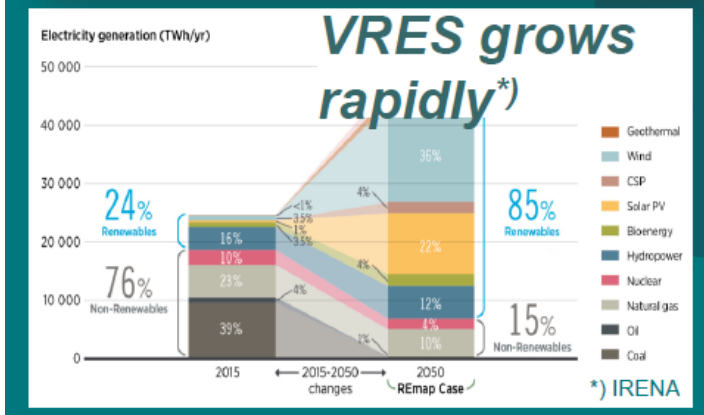


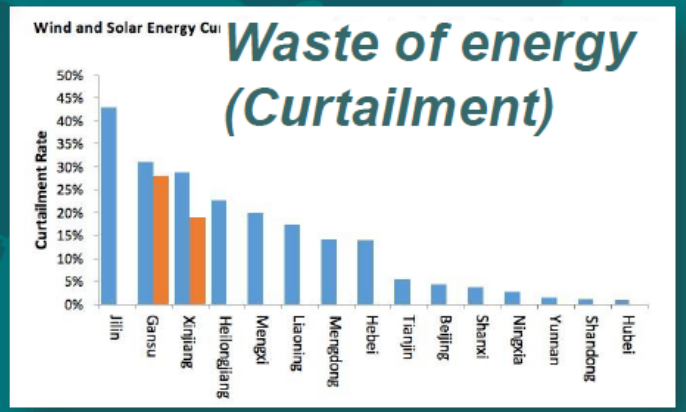
2022*)

RES generation grow by more than 30% to over 8 000 TWh

Wind and solar is 80% of renewable capacity growth

China, India and Brazil, share of VRES generation is to double to over 10%





System integration becomes increasingly important

Simultaneous increase in system flexibility

Market and policy frameworks have to evolve

**) Renewables 2017 Analysis and Forecasts to 2022, International Energy Agency 2017*

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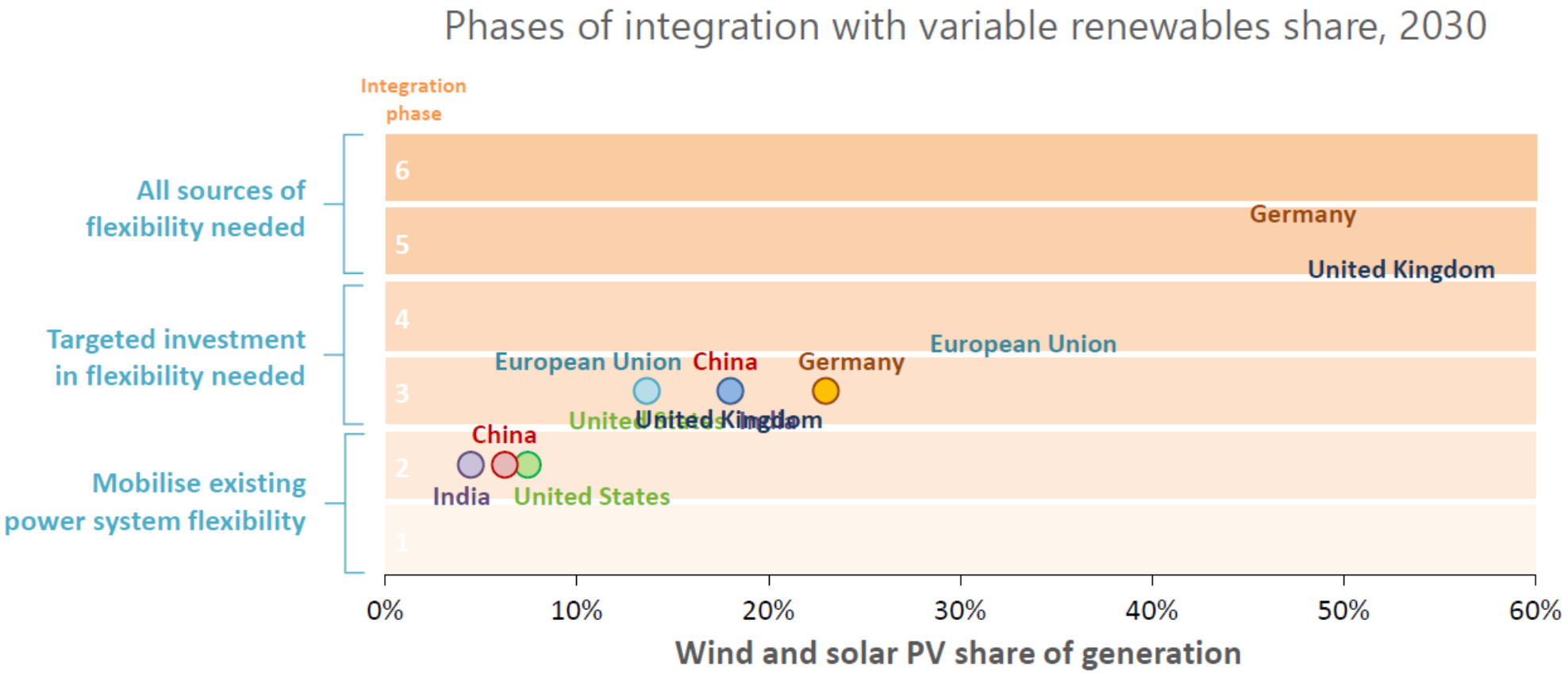
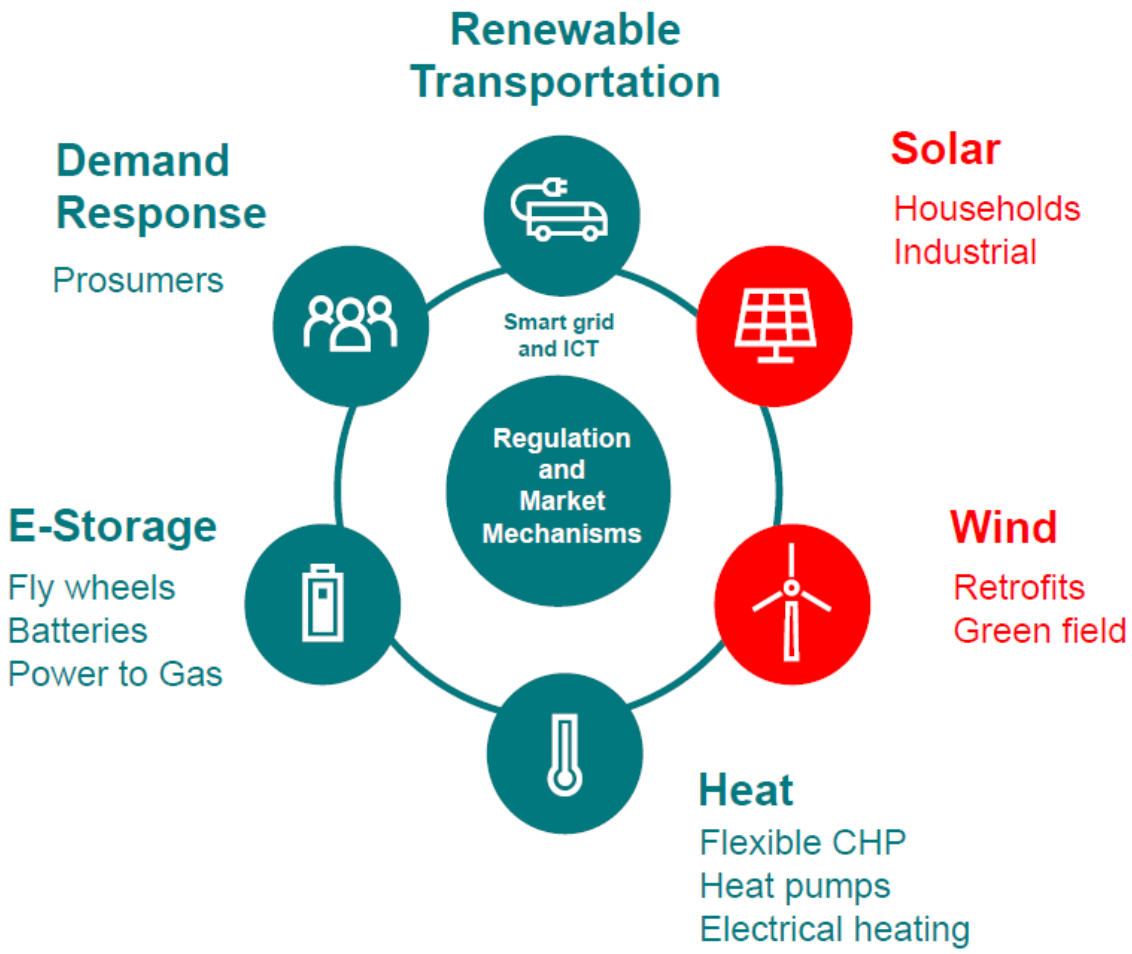
Flexibility: the cornerstone of tomorrow's power systems



Higher shares of variable renewables raise flexibility needs and call for reforms to deliver investment in power plants, grids & energy storage, and unlock demand-side response

The solution

- An integrated renewable energy system with sector coupling and system integration in focus



The key is managing the interdependencies between subsystems – the renewables integration challenge

To create a cost efficient energy system the integration must comprise all major subsystems

- Electricity
- Heating / cooling
- Transportation

Intro

- The key challenge in increasing variable renewable production in energy systems towards 100% is the total system level flexibility – especially in open market environments
- **Flexens Oy Ab** is founded to be a company that offers multiparty solutions to the challenge of affordable renewables integration initially based on a full society scale demo built on the Åland Islands under the brand **“Smart Energy Åland”**
- Flexens core competence is to combine the offerings, skills and knowledge of companies participating in the ecosystem built around Flexens in a high level system integrator role
- The whole ecosystem will benefit from cooperating closely with Flexens – the growth engine platform company

Key to success is the demo
- Smart Energy Åland

- By pooling a full set of demonstrations and pilots into one location and one managed project the impact of demonstrating technologies and solutions is greatly improved offering a open market multiparty model and the following benefits and activities:

- Learning- and innovation platform
- Visibility
- Access to innovative SME/Start-up community
- Access to international partnerships
- The solutions knowledge base
- Lead database for international expansion
- Go to market cooperation
- R&D coordination
- Fostering strategic partnerships

Smart Energy Åland

An archipelago in the middle of the Baltic Sea

Åland – the ideal place

Best wind and solar conditions in the region
Self-governed (own energy market regulation) and own grid area

Full society scale

30.000 inhabitants, industry & service sector - Results applicable to large markets
Operating in a deregulated environment connected to the efficient Nordpool market

Adopting future EU regulation

Current and future market models enabling investments in flexibility sources in focus

In the tempered climate zone

Heating and cooling central part of the energy mix

A platform supporting open innovation

Cooperation with leading R&D&I operator

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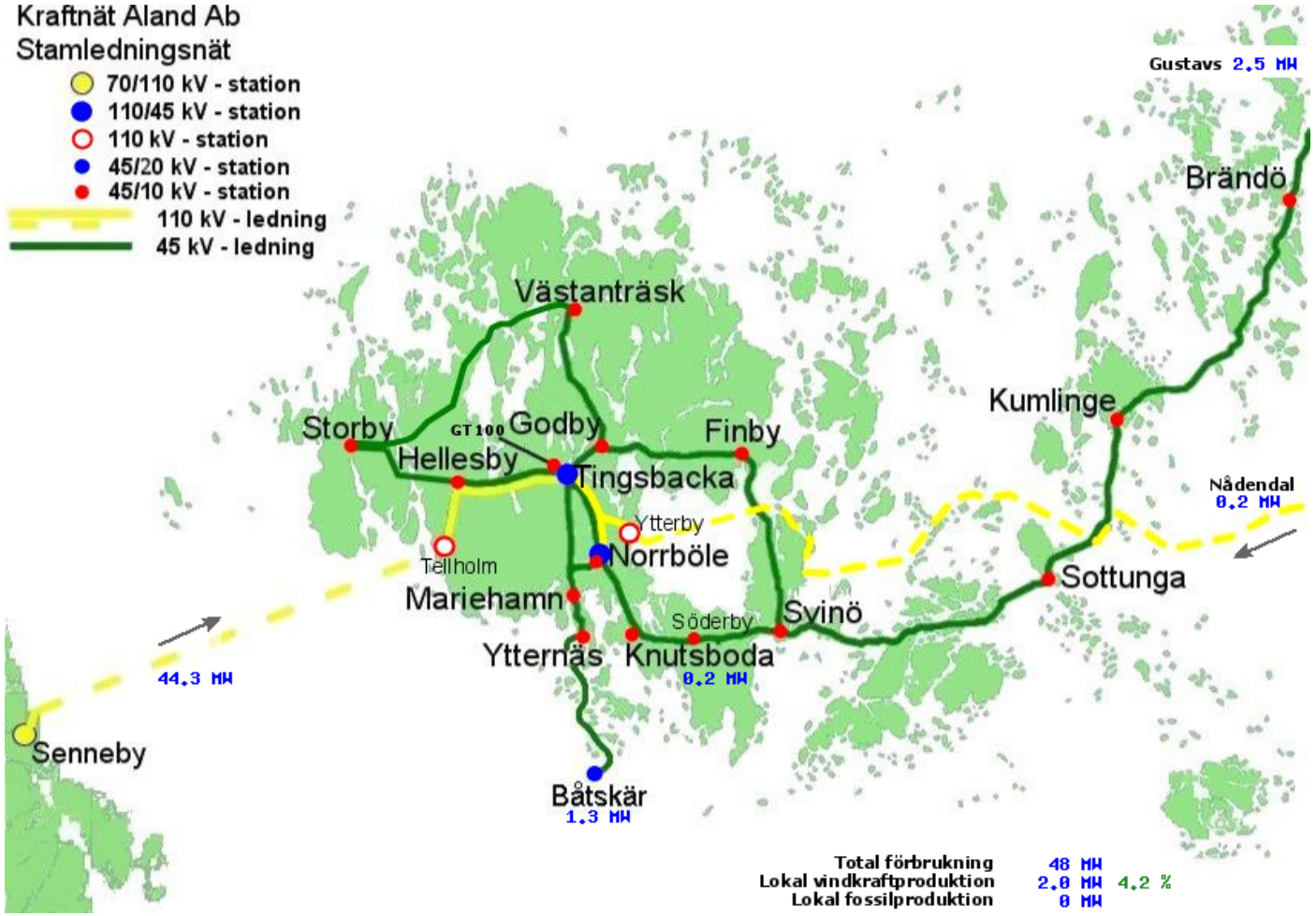
Current grid structure



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Åland Energy System Scenarios

Current situation:

- Wind capacity 21 MW
- Heat 20 MWe
- Peak 75 MW
- Total consumption 318 GWh
- Min load 16 MW
- Capacity mix
  - Import 80 %
  - Wind 20 %

Future 1:

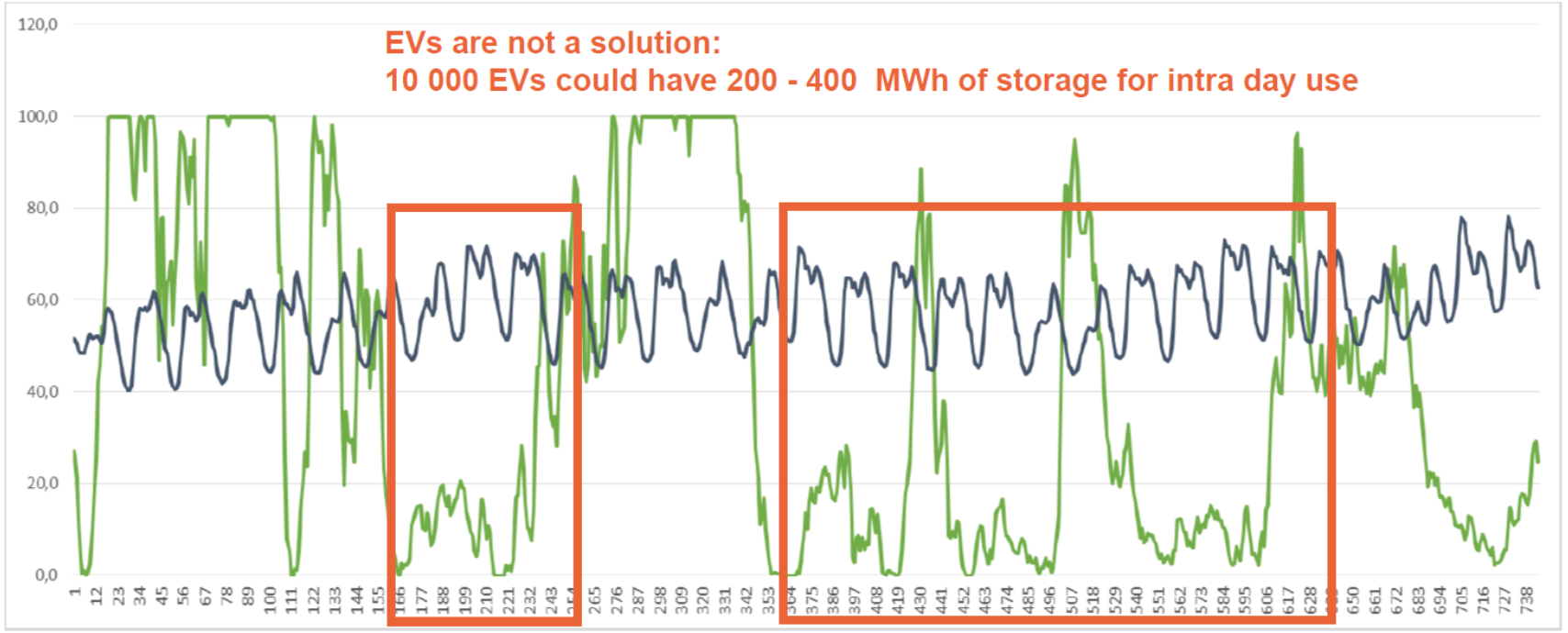
- Wind capacity 85 MW
- Heat CHP 20 MWe
- Solar 15 MW
- Peak 85 MW
- Total consumption 400 GWh
- Min load 16 MW
- Capacity mix
  - Wind 70 %
  - Solar 15 %
  - CHP 15 %

Future 2:

- Wind capacity 170 MW
- Heat CHP 0 MWe
- Solar 20 MW
- Peak 85 MW
- Total consumption 400 GWh
- Min load 16 MW
- Capacity mix

The need for storage

January RE production vs. consumption.
System needs to overcome days of minimal RE production and have storage or DR in +3000 MWh class*



*Figures are based on rough estimation only and not including hourly simulation

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Other estimates put the need at up to 6 GWh

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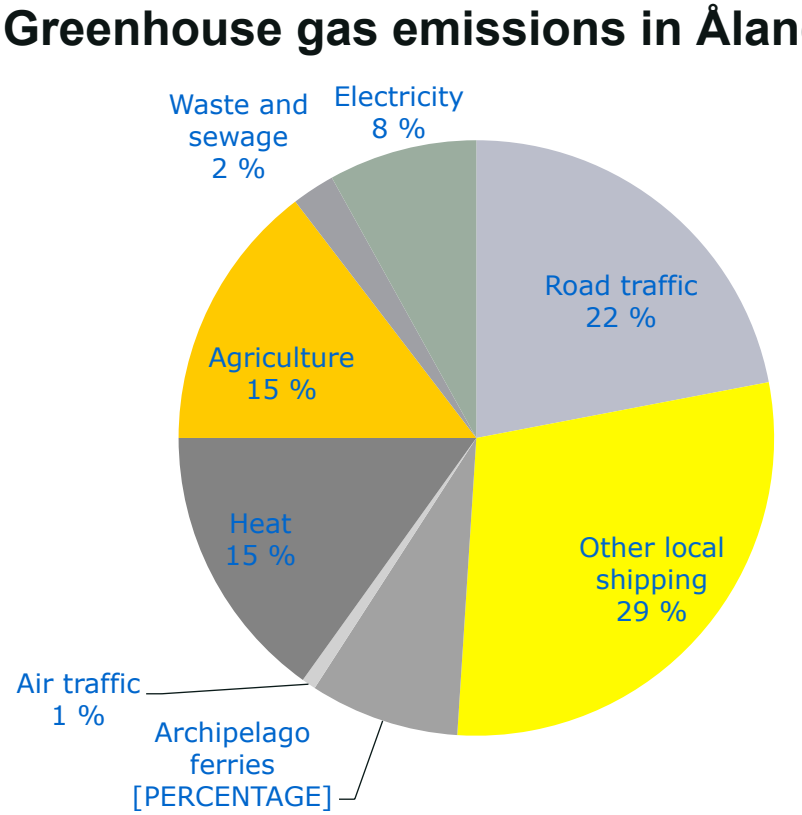
A CO2 free energy system

Electrical power needed; but up to 6 GWh seasonal storage need

Too minimise CO2 emissions transportation sector use is attractive

With radically diminishing solar and wind generation costs the most cost efficient route to reduced CO2 emissions may be P2X

250 000 ton CO2-eq



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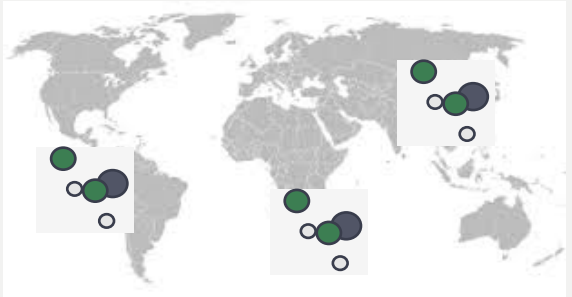
Flexens role in the ecosystem

Access to international partnerships

Foreign investments

Direct export revenue
To companies involved

Linking Corporations, SMEs and startups to mutual and international co-operation and business

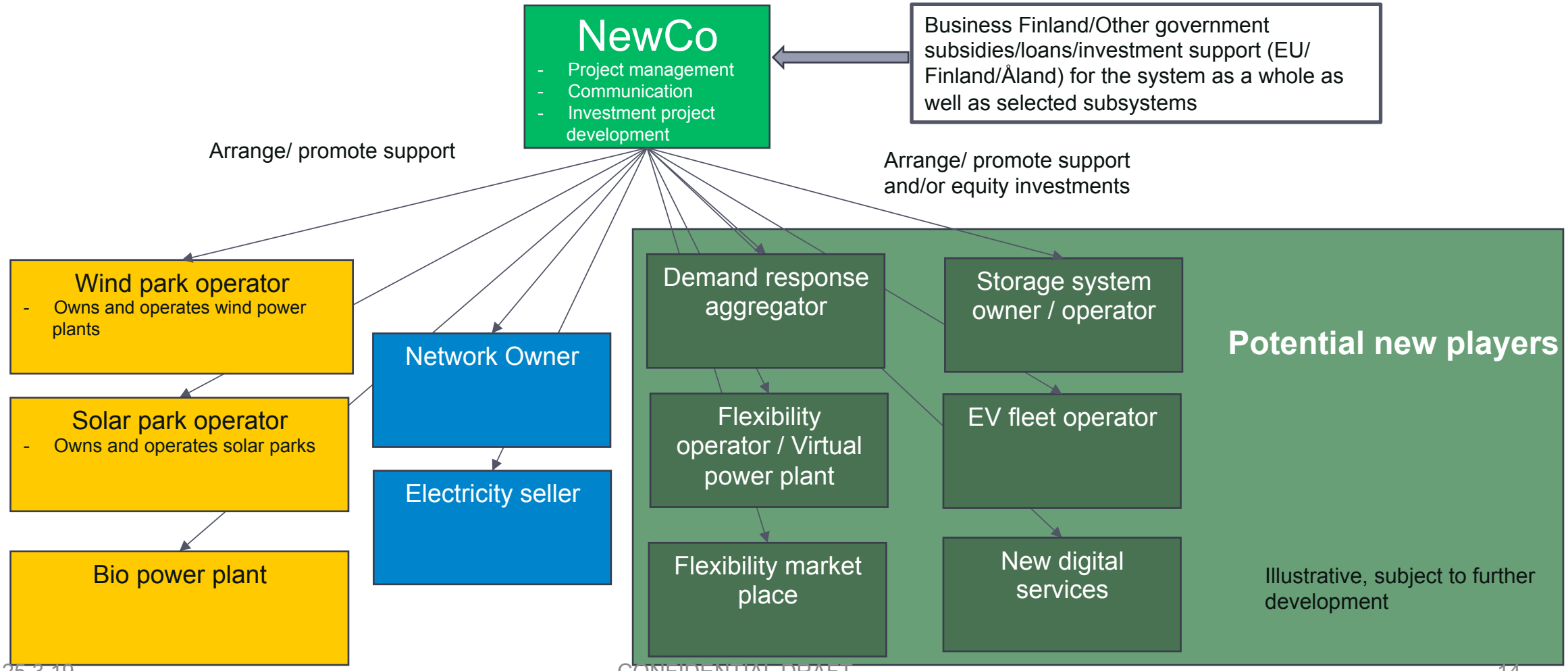


Enabling setup of flexible energy systems demoed on Åland in international locations

FLEXENS LEARNING, INNOVATION AND CO-OPERATION PLATFORM

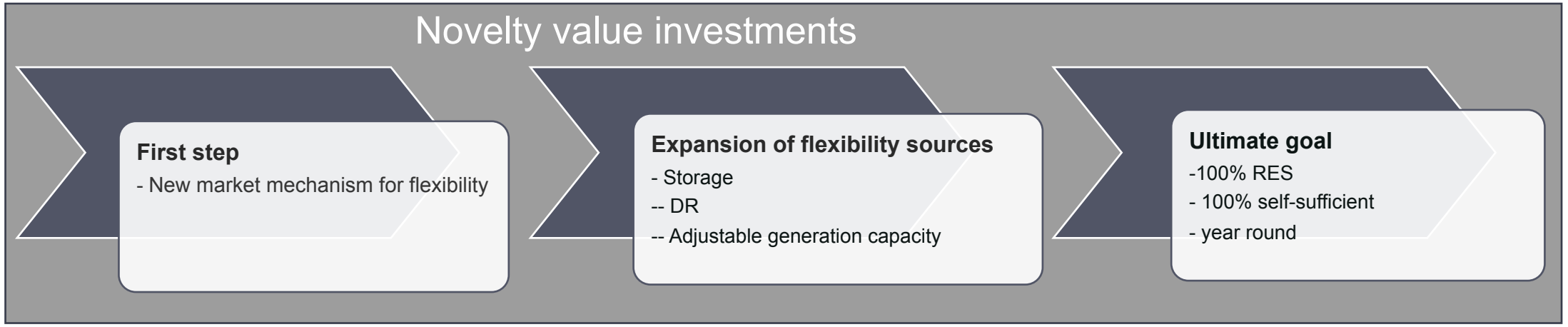
Smart Energy Åland

- Flexens role in the energy system on the island



The Roll Out of Novelty Value Investments

We start with the demonstration of a new market mechanism for flexibility



Measure of progress: relative share of locally produced renewable energy
Key driver: Citizen Engagement

Historic and ongoing renewable energy investments

- Åland has been a pioneer in wind power with the first investments over 20 years ago
- Roll-out of small scale solar systems
- EV's and electrification of public transport

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Summary of Start-up phase work packages

WP1 Flexens Business Model Development

Task Description: Developing the business operations of Flexens

Objective: To develop a sustainable business model for Flexens that boosts the growth of Flexens and all the companies involved in the growth engine ecosystem

WP2 Communication and Visibility

Task Description: Promote the project and its participating companies to a wide global audience; Organize events and visits to the pilot locations for foreign delegates including an info/meeting point in Åland

Objective: To gain visibility for the project to attract the interest of companies, investors, customers and citizens.

WP3 Citizen Engagement

Task Description: Develop new solutions for two-way communication between Flexens and all key stakeholders on Åland, including energy market “Ecosystem”, private citizens, small and large businesses, property owners, public sector, third sector actors; The project will cover traditional activities as well as new digital tools;

Evaluate new crowdfunding platforms for investments in the energy system; Evaluate incentivisation of participation in carbon sink solutions

Objective: To engage citizens to actively take part in the project as consumers, producers and financiers.

WP4 Flexibility marketplace

Task Description: Flexibility platform is vital for the success of flexibility sources in large-scale energy systems, and therefore required to enable the demo platform on Åland and in all future locations; Evaluate existing and under development technology platforms, e.g. Nodes, Greensync, “Fleximar” project, EU Horizon Interreg project (in cooperation with Fingrid) and the Dutch Energy Trading Platform Amsterdam (ETPA); Prepare and develop flexibility marketplace pilot installation(s)

Objective: To create a functioning flexibility marketplace ecosystem, and create new development and growth opportunities for related companies

WP5 Energy Software Solutions

Task Description: Evaluate grid related ICT solutions: energy data management and network management tools, energy consumption/generation visualization tools; Promote the implementation of such solutions and tools within the project community

Objective: To enable the creation and demonstration of new software solutions to the industry, and new development and growth opportunities for related companies.

WP6 Initiating Technology Pilots - Storage

Task Description: From the Åland energy system point of view, based on the analysis carried out in the FLEXe Demo project, the main challenges are related to the energy storage solutions feasible in the tempered climate zone conditions; The task will include evaluation of the most feasible solutions, including

- Use of district heating system as a energy storage and flexibility source
- Heat storage and heat pump solutions
- Battery and flywheel systems
- Power to X

Objective: To find and enable the demonstration of best solutions and technology partners for energy storage, and create new development and growth opportunities for related companies

WP7 Initiating Technology Pilots - Energy Efficiency, Demand Response and Micro Production

Task Description: Evaluate different technologies and companies working on demand response and energy efficiency in buildings; Initiate piloting of new smart solutions enabling prosumer (producer-consumer) model, such as Micro CHP

Objective: To find and enable the demonstration of best solutions and technology partners for building to participate in the energy market (demand response, energy efficiency, micro production), and create new development and growth opportunities for related companies

WP8 Initiating Technology Pilots – E-transport

Task Description: Initiate piloting of new smart EV charging concepts, including but not limited to Vehicle to Grid (V2G); Initiate E-Bus, E-ferry and Hydrogen ferry pilots (& link to Power-to-X pilots),

Objective: To enable the creation of a diverse e-transport ecosystem, and create new development and growth opportunities for related companies

WP9 Increasing Renewable Energy Production Capacity and Initiating New Energy Creation Methods

Task Description: In order to create suitable conditions for the demonstration of novel ways to build a 100% RES energy system, the capacity of the energy production on Åland must be boosted. i.e. the task is to accelerate the increase in production capacity of existing sources including wind and solar production by promoting the project as a whole (WP2, WP3); Evaluate and accelerate pilots and implementations of other new distributed and adjustable energy production methods, such as waste to energy technologies, and novel waste heat to energy concepts and technologies

Objective: To increase the renewable energy production on the island, and to create new development and growth opportunities for related companies; To create suitable conditions for the demonstration of novel ways to build a 100% RES energy system

WP10 Next Steps - Growth and Internationalization

Task Description: Market, customer and partner studies to plan for internationalization: choose the next location; Prepare a go-to-market strategy for international expansion; Update and clarify the business plan; Secure funding for growth, including taking part in the competitive bidding on growth engines

Objective: To come up with a plan and secure funding to grow the company internationally

Thank You !

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