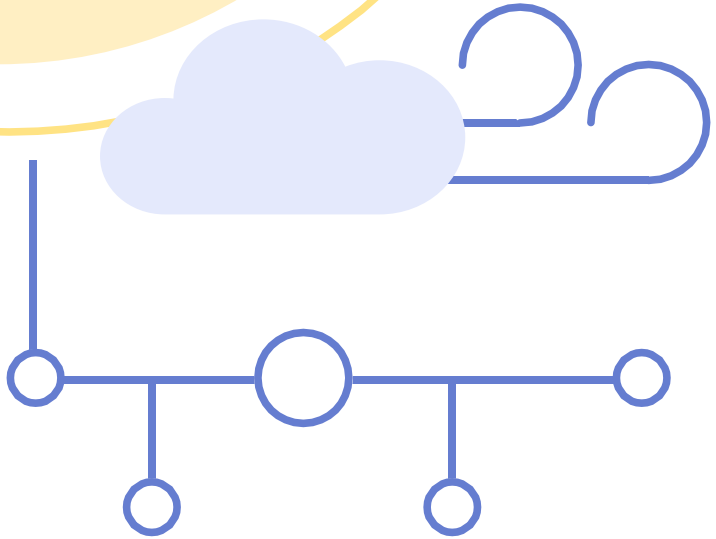
SMART ENERGY °ALAND



A world leading demonstration of a 100% renewable energy system

Background

From research to implementation

SMART ENERGY ÅLAND

2010	2014	2018	2019	2020 -
Preceding national research programs in Finland (2010 – 2016)	**Åland identified as demo site**	**Project development company founded**	**Smart Energy Åland implementation**	**Company growth**
• Smart Grids and Energy Markets • Future Combustion Engine Power Plants • Efficient Energy Use • Future Flexible Energy Systems	Studying a 100% renewable and self-sufficient energy system in Åland	Business Finland funding secured	Project development activities started, aiming towards a 100% renewable and self-sufficient energy system in Åland	Leverage best practices from Åland demo and scale operations on a global market

Flexens

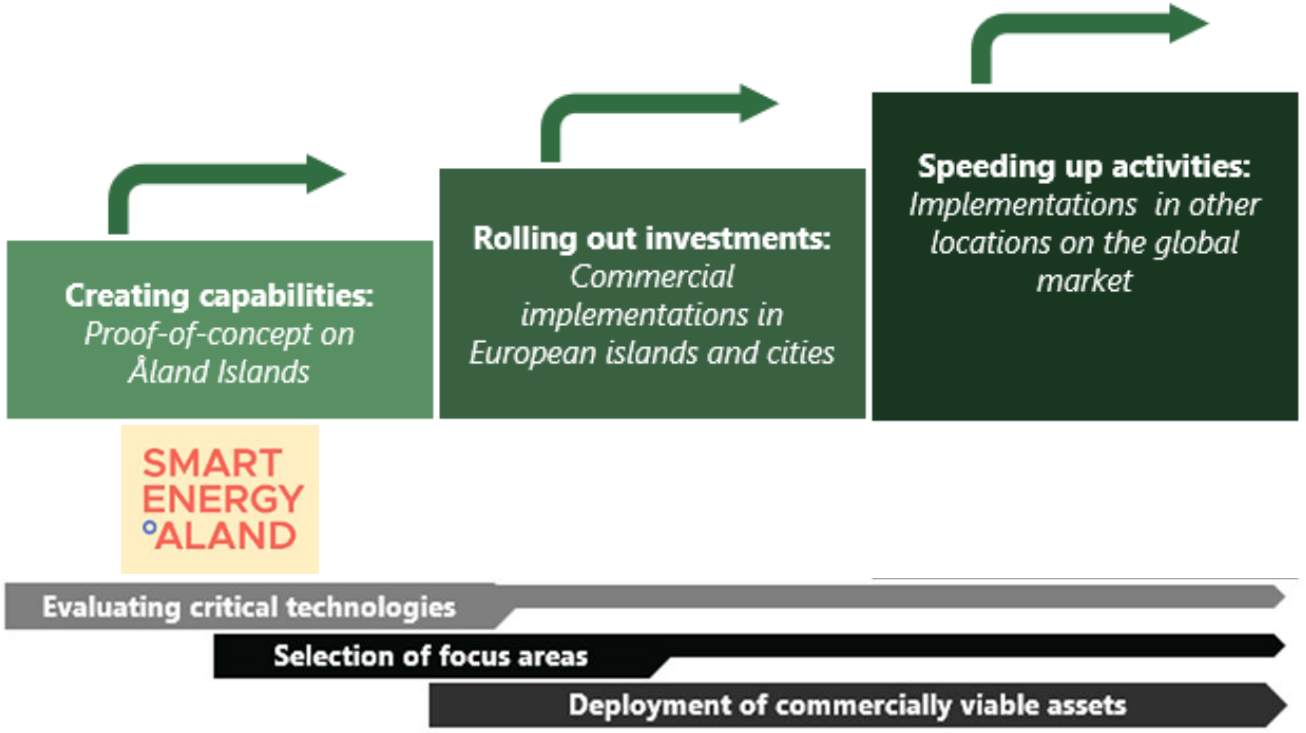
Åland as the test and demo location

- **Åland – the ideal place**
  - Best wind and solar conditions in the region
  - Self-governed (own energy market regulation) and own grid area
  - Ambitious and rewarded sustainability agenda
- **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

Business plan overview

Replicating solutions created in a world leading demonstration

- The company was founded in 2018 to capitalise on the capabilities accumulated in the world leading Smart Energy Åland testbed and demonstration
- With this unique background Flexens plans to become a significant player in the RES project development market globally
- Flexens is already an ideal partner for renewable investors, project developers and communities seeking renewable energy solutions



Society scale energy transition roadmap

ENERGY TRANSITION AGENDA

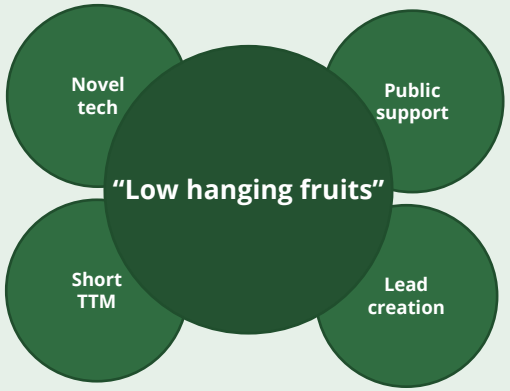
1. Status of the current energy system
2. Energy transition targets
3. Transition strategy

ENERGY TRANSITION MASTERPLAN

CITIZEN ENGAGEMENT

KEY SUCCESS FACTOR

LAUNCH INITIAL DEMO PROJECTS

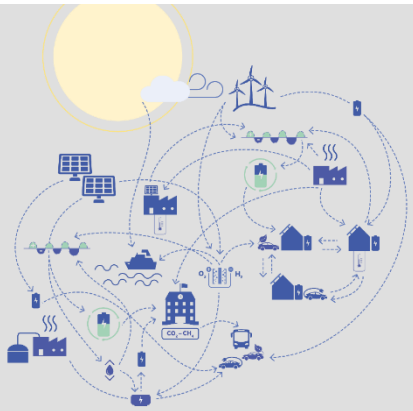


BUILD SUBSYSTEM ASSETS

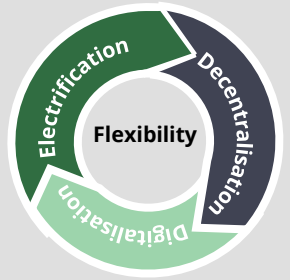
Flexibility resources	Transportation	Carbon sinks
Flexibility marketplace	Energy efficiency	Wind & solar rollout

Private funding

Public subsidies



ENERGY ECOSYSTEM



Managing the interdependencies between subsystems

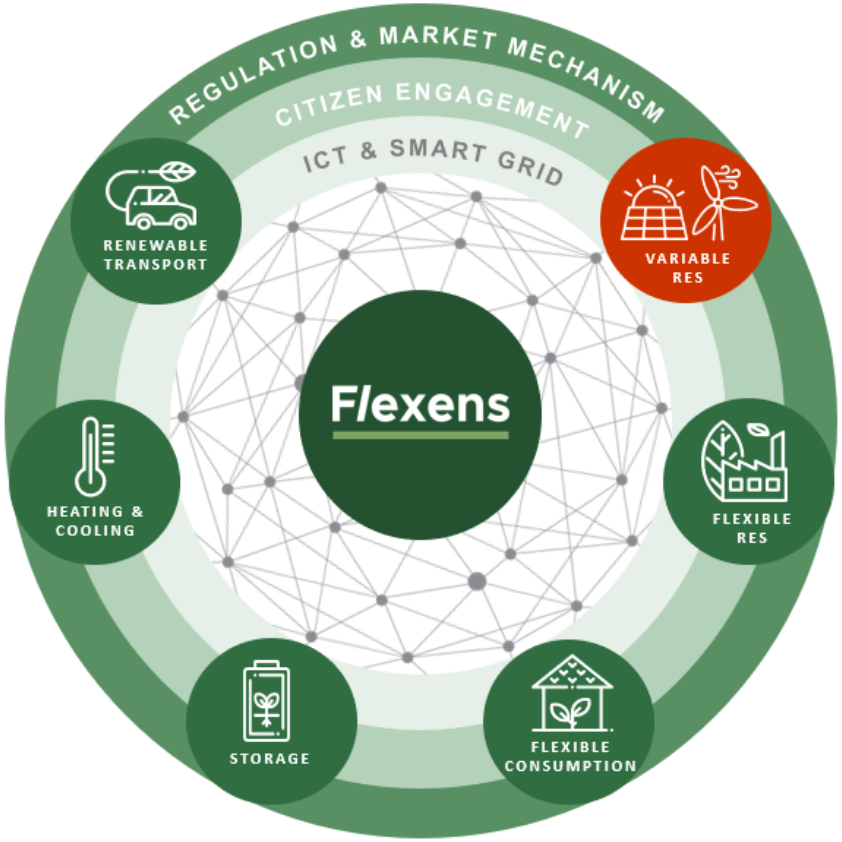
Rethinking the integration of renewable energy sources

Time to delivery

SMART ENERGY ÅLAND

Our solution

System integration and sector coupling



As variable energy sources is growing rapidly, the key is managing the interdependencies between subsystems – rethinking the integration of renewable energy sources.

100% renewable and distributed energy systems require novel paradigms and technologies for system management and optimization. These integrated energy systems must comprise all major subsystems:

- Electricity
- Heating / Cooling
- Transportation

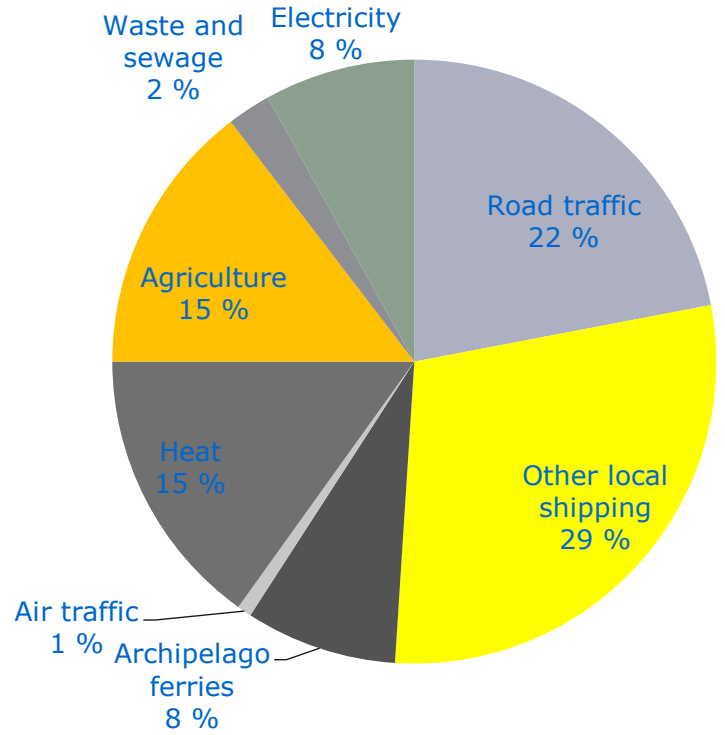
As a global project developer, Flexens offers a unique integration process for implementing society-scale, multi-technology energy system-of-systems based on renewable energy sources.

A CO2 free energy system

The Åland view

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

Greenhouse gas emissions in Åland 2015



250 000 ton CO2-eq

Key findings and concept

Solar and Wind 70-90%

- As the availability of bioenergy is limited, and geothermal energy typically is costly to convert to electricity or fuels most of the primary renewable energy in any society must come from solar and wind

Bioenergy 5-20%
- Availability depending on society

Geothermal 10-20%
- Economically feasible only as heat

Specific e-storage

Networks and grids
- Gas / NG, H2, CO2?
- District Heating
- Electricity

Market models
- Energy communities
- Flexibility markets
- Peer to peer trading

Production of synthetic fuels

CO2

System storage capacity

System storage capacity in:
- BEV's
- Fuel tanks

Direct electrical loads
- Residential
- Commercial & Industrial

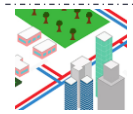
Heating and cooling
- Residential
- Commercial & Industrial

Transportation sector
- Road
- Rail
- Maritime
- Aviation

Smart Energy Åland project highlights

	PROJECT NAME	SUBSYSTEM	ROLE IN MARKET	PROJECT DETAILS	ENERGY SYSTEM STUDY & DESIGN PHASE	PROJECT DEVELOPMENT PHASE
	**HYDROGEN FERRY** *Customer:* *Government of Åland*	TRANSPORTATION	• Hydrogen as a flexibility resource for peak wind power production • Significant CO2 reduction	• Creation of hydrogen ecosystem with locally produces hydrogen from integrated wind park	**2020** • LOI with customer to conduct feasibility studies of ferry network and hydrogen production • Flexens as lead project coordinator	**2021-** • Flexens as lead Project developer • Potential EPC opportunities to be evaluated (e.g. Hydrogen plant, wind farm, etc.)
	**ENERGY PORTAL** *Customer:* *Government of Åland*	ENERGY TRANSITION & CITIZEN ENGAGEMENT	• Improve data quality to facilitate energy transition • Increase citizen engagement	• Ongoing 6 month demo of tool • Approx. 20 data point, including aggregate heating, electricity & transportation data	**2020-2021** • LOI to pilot data monitoring tool of real-time data of society scale energy and heat consumption	• Enables visualisation of energy transition targets and impact of future investments
	**PUMPED HYDRO STORAGE** *Customer:* *Pumped Hydro Sweden*	FLEXIBILITY RESOURCE	• Supporting expansion of VRES resources • Earnings mainly from reserve markets	• Underground energy storage pilot connected to existing wind farm to provide flexibility • Facility built in old mine		**2020-2023** • Flexens is part of the EU LIFE programme • Equity investment under evaluation
	**SMART ISLAND ENERGY COMMUNITY** *Customer:* *Kökar municipality*	FLEXIBILITY RESOURCE & MARKET MODELS	• Showcase energy system on society level • Introduce new market models • Technology implementations	• Pioneer island in the Clean Energy for EU Islands programme	**2019-2020** • Flexens has delivered, and invoiced, energy system design and creation of energy transition agenda	**2021-** • Potential for Flexens to implement assets In accordance with design study
	**SMART BUILDING DEMO** *Customer:* *Carlsro Hotel*	ENERGY EFFICIENCY & FLEXIBILITY RESOURCE	• Increase energy efficiency and readiness to participate in demand response • Increase citizen engagement	• Demo of energy management system		**2021** • Demo installation to be completed during 2021
	**LÅNGNABBA WIND PARK** *Customer:* *Vind AX*	VRES ROLLOUT	• Supporting VRES growth • Create need for storage solutions and flexibility resources	• 42 MW energy asset • Pending co-investment • Flexens to propose flexibility demonstration at site		**2020-2021** • Possibility to demonstrate flexibility resources at site is a precondition for Flexens to co-invest
	**ELECTRIC BUS DEMO** **COMPLETED** *Customer:* *Government of Åland*	TRANSPORTATION	• Facilitate electrification of transport sector • Increase citizen engagement	• Pilot of electric bus in City of Mariehamn	**2020** • **Completed in August 2020** • Created sales lead for EV bus network, tendering process 2020-2021	
	**SMART BUILDING** **COMPLETED** *Customer:* *Vikingaåsen Public School*	ENERGY EFFICIENCY & FLEXIBILITY RESOURCE	• Increase energy efficiency and readiness to participate in demand response • Increase citizen engagement	• Pilot of cloud-based smart heating system based on machine learning • Pilot ends in December 2020	**2019** • **Completed in November 2019**	

Smart Energy Åland project pipeline highlights

	PROJECT NAME	SUBSYSTEM	ROLE IN MARKET	PROJECT DETAILS	ENERGY SYSTEM STUDY & DESIGN PHASE	PROJECT DEVELOPMENT PHASE
	**ENERGY COMMUNITY** *Customer:*	NEW MARKET MODEL	• Demo of the Energy Community concept • Off-grid flexibility resources • Increase citizen engagement	• Engage households to invest to DRES and join energy community for P2P – trading and to provide flexibility	**2020** • Energy transition masterplan completed • CapEx need for 100% self-sufficiency identified	**2021-** • Implementing the RES and smart EMS • Virtual demo of the P2P trading and the demand response
	**BIOCHAR PLANT** *Customer:* *DSO*	CARBON SINKS AS FLEXUBILTY RESORCES	• Biochar plant pilot factory as source of heat with storage and carbon sink features	• Evaluating biochar plant that produces 5000 MWh energy, 1000 ton, and captures 3000 ton CO2, by disposing 3500 ton biomass	**2020-2021** • Planned feasibility study in cooperation with partners • Funding scheme under evaluation • Flexens as lead project coordinator	**2021-2022** • Key step is to set up operating management team • Possibility for Flexens to co-invest • Flexens as project developer
	**FLEXe MARKET** *Customer:* *Government of Åland*	FLEXIBILITY MARKETPLACE	• Flexibility products are traded multilaterally with many network operators and market parties.	• Technical POC of flexibility platform as a local marketplace for the transactions, and the market design and business models	**2020-2021** • Use case created in co-operation with partners • Feasibility study	2021 - 2022 • Technical POC demo • Flexens business models (e.g. VPP as a service, Flex market place as a service)
	**WASTE WATER HEAT RECOVERY** *Customer:* *Waste water facility*	ENERGY EFFICIENCY	• Heat recovery pilot at waste water treatment facility • Produced energy feeds district heating network • Ends existing use of oil and flaring	• Total investment of EUR 2m • 2 MW energy asset • Estimated payback: 3-5 years	**2021** • Solution created in cooperation with partners Feasibility and investment study completed • Flexens as project coordinator	**2021-2022** • Pending negotiations and evaluation of potential SPV structure
	**THERMAL HEAT STORAGE** *Customer:* *TBA*	FLEXIBILITY RESOURCES	• Flexible renewable energy consumption • Pilot of energy container for seasonal heat storage of solar power	• TBA	**2020** • Solution created in cooperation with partners • Feasibility and investment study completed • Pending decision from customer	**2020** • Flexens as lead project developer • Possibility to co-invest in SPV
	**DISTRICT HEATING DECARBONISATION** *Customer:* *City of Mariehamn*	FLEXIBILITY RESOURCES & ENERGY EFFICIENCY	• Remove fossil fuels in district heating network • Implement flexibility resources, e.g. sector coupling and storage	• Multi-technology project • New solutions for heating, cooling, electricity, storage, sector coupling • LOI under negotiation	**2021** • Flexens as lead project developer in energy system design phase	**2021-** • TBD
	**ELECTRIC BUS LINE** *Customer:* *Government of Åland*	TRANSPORTATION	• Facilitate electrification of transport sector • Significant CO2 impact • Increase citizen engagement	• 5 buses to be replaced • Total investment of EUR 2m	**2021** • Design of solution to meet customer expectations • SPV structure with co-investment opportunity to be evaluated	**2021-** • Flexens as potential asset owner • Customer responsible for operating the vehicles
	**GEOTHERMAL HEAT WELL** *Customer:* *Public Real Estate body*	FLEXIBILITY RESOURCES	• Heating and cooling with seasonal storage features • Pilot of emerging technology	• 1.3 GWh of produced heat • EUR 1.5m in total investment • Other potential locations under evaluation	**2021** • Solution created in cooperation with partners • Planned feasibility study • Ongoing discussion with customer	**2021-** • Flexens as potential co-owner of SPV

SMART ENERGY ÅLAND

Thank you

Berndt Schalin
CEO

berndt.schalin@flexens.com
+358 40 8429469

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