



Solution Architect for Global  
Bioeconomy & Cleantech Opportunities

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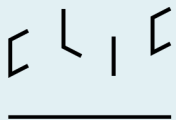
01.09.2017

Tommy Jacobson

Pia Saari

# **FLEXIBLE ENERGY SYSTEM DEMONSTRATION**

## **...new business models in a future energy markets**



# CLIC INNOVATION

**\*1.9.2015**

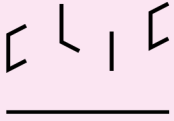


Solution Architect for  
Global Bioeconomy &  
Cleantech Opportunities

**CLEEN**

Cluster for Energy and Environment

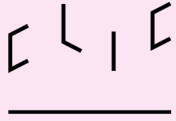




# What is CLIC Innovation

## It is...

- ...The Open Innovation and Public-Private Partnership R&D&I platform
- ...Focused on turning resource scarcity to global business opportunities
- ...Initiating and coordinating new competence and business ecosystems for Bio and Circular economy as well as Cleantech
- ...Creating new knowledge and competences for global business
- ...Designing and demonstrating comprehensive solutions for systemic challenges
- ...Coordinating target-oriented R&D&I-project portfolios
- ...A Ltd owned by 30 multinational companies representing 9 industrial sectors and 16 Finnish universities and research institutes



# SHAREHOLDERS OF CLIC – THE INNOVATORS

30 Multinational companies from 9 industrial sectors

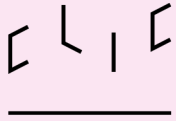
&

16 Nationally most significant universities and research institutes



- Scope and focus based on global business needs and opportunities facilitated by science
- Most efficient open innovation and public-private partnership based R&D&I practices





# TOOLS AND THEMES TO ADDRESS RESOURCE SCARCITY

## CLEAN SOLUTIONS

- Flexible energy systems to facilitate variable renewable generation
- Impact of environment to a human being and vice versa

## BIOECONOMY

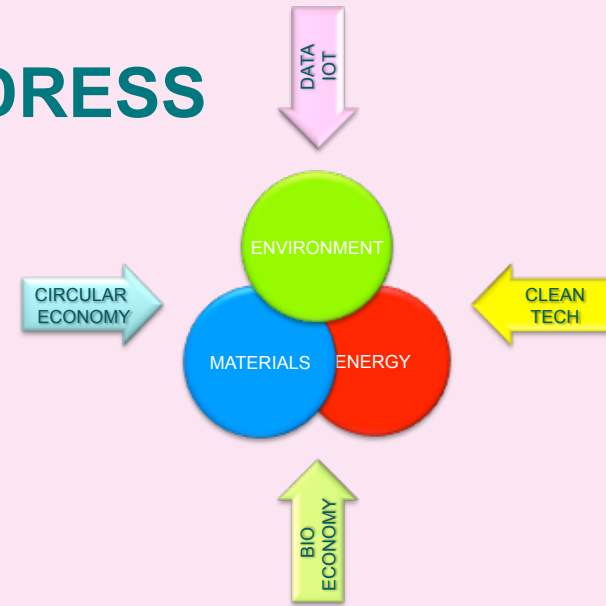
- Replacing non-renewable materials by renewable ones
- Increasing the value of forest based raw materials
- Novel business ecosystems and business models

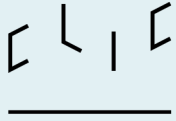
## CIRCULAR ECONOMY

- Increasing the life cycle of non-renewable materials
- Addressing resource scarcity by circulating value

## BIG AND OPEN ENVIRONMENTAL DATA

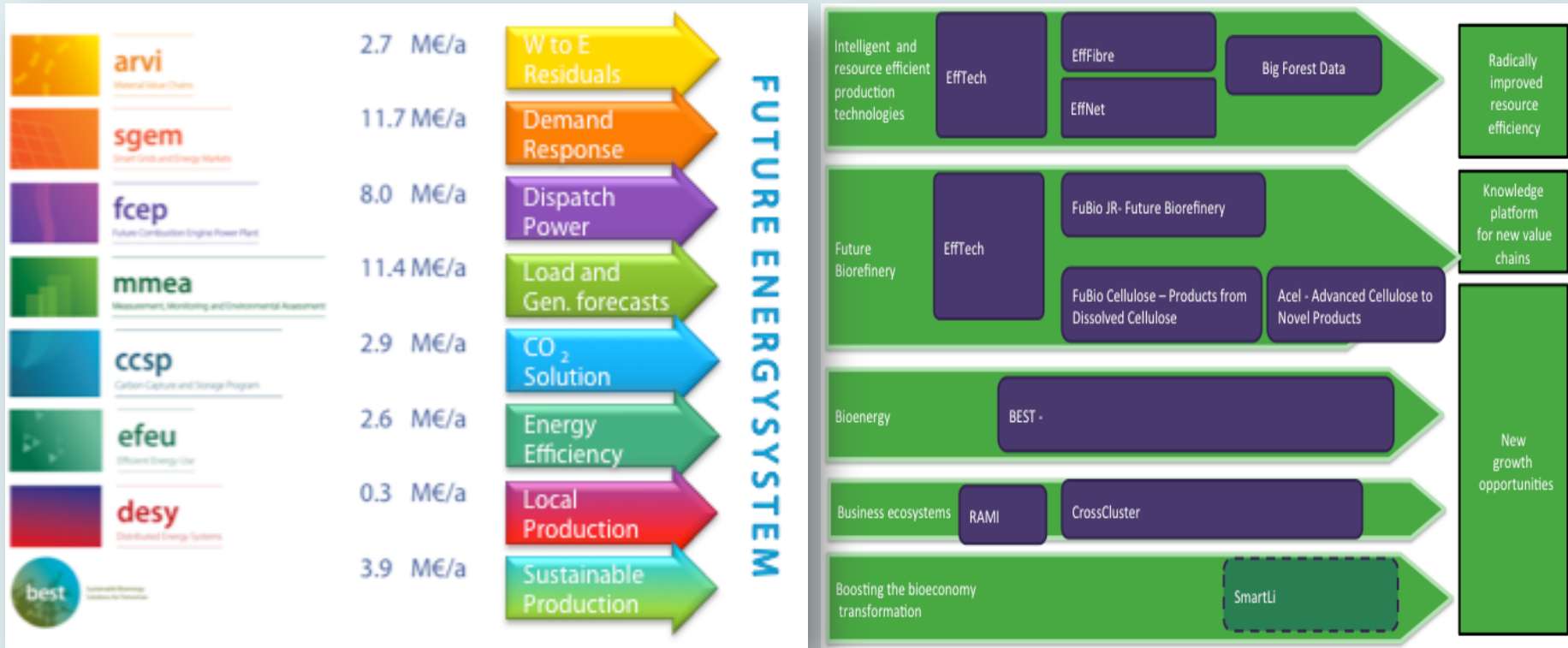
- Comprehensive big big picture of environment: Assessment and Control
- Accessibility, quality and interoperability





# TRACK RECORD

Total R&D&I volume > 200 M€  
Number of research programmes > 15  
Annual volume (2012-2014) 50 - 70 M€/a





# BACKGROUND AND OPPORTUNITY



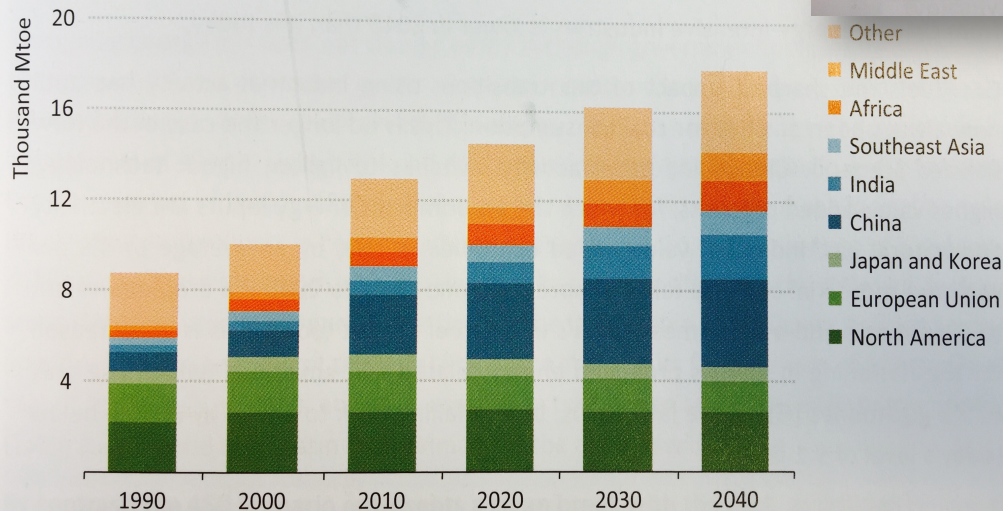


# TRENDS

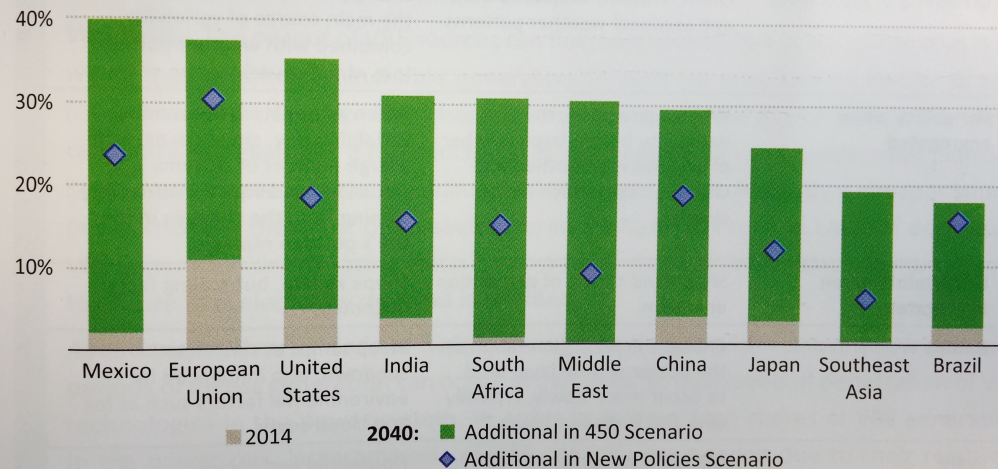
IEA World Energy Outlook 2016

Share of solar and wind > **25%**

Energy demand will rise **30%**



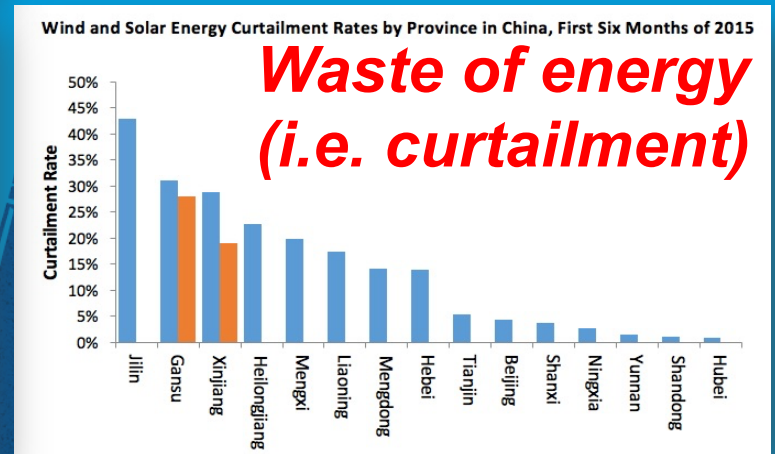
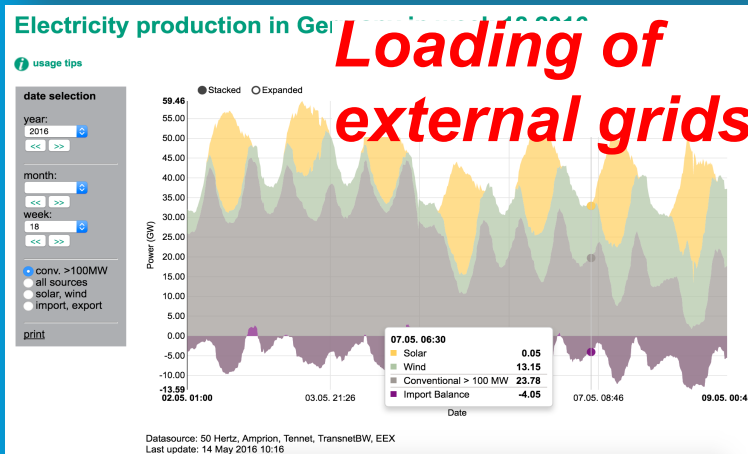
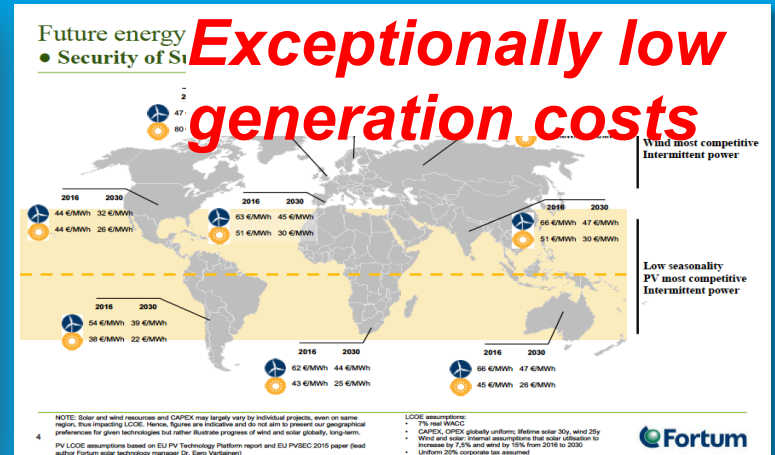
*The geography of global energy demand continues to shift*



*More than one-quarter of global electricity is generated by wind and solar PV by 2040 in the 450 Scenario*



# DISRUPTIVE MARKET





# CHALLENGE

- Conventional measures could integrate  
**< 25% solar and wind**
- No shortage of cheap energy, but  
**on-time availability**







# TARGETS

100% RES<sub>e</sub> FLEXIBLE ENERGY SYSTEM

- a) Performance/availability/power based  
**market and regulation**
- b) **Integration** of subsystems, technologies  
and businesses on smart grid platform
- c) Empowerment of **citizens**
- d) **Demonstration of 100% RES<sub>e</sub>** in a  
small society scale based on Finnish strengths



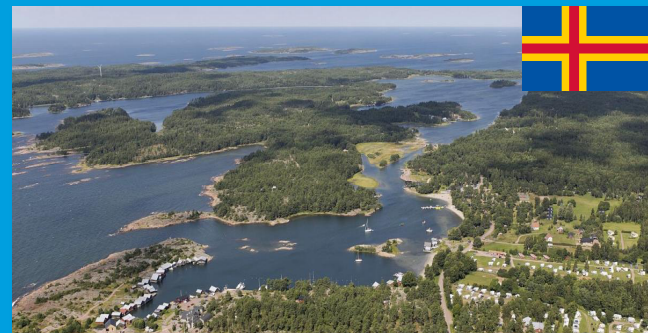


# UNIQUE LOCATION

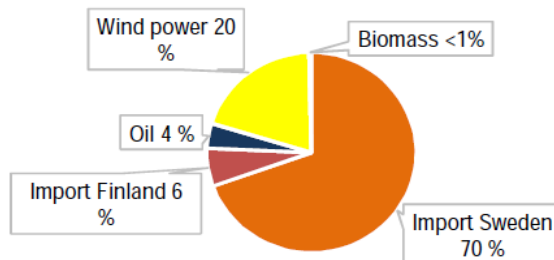
## Åland islands –

Comprehensive but small enough

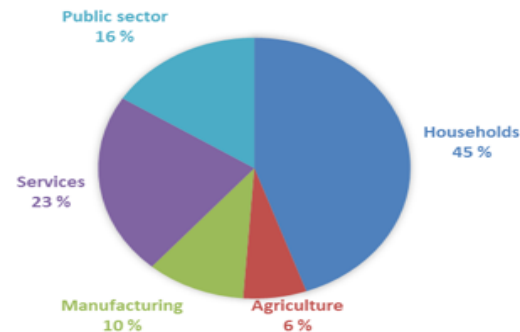
- Excellent wind and solar conditions
- 80% of electricity imported
- Self-governed
- ***Full society of 30 000 citizens***
- ***Readiness up to 125 % RES<sub>e</sub>***
- 0.5% of Finnish GDP, electricity consumption, population etc.



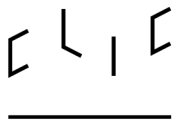
Electricity supply 2014 [GWh] – Total 288 GWh



ELECTRICITY USE IN ÅLAND IN 2015







## Very large research programs in the area of clean energy

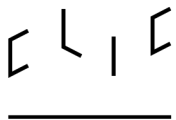
CLIC SHOK* programs / innovation ecosystems	Total volume, M€	Duration
SGEM (Smart Grids and Energy Markets)	52	2010-2015
FLEX <sup>e</sup> (Future Flexible Energy Systems)	(50)**	2015-2016
FCEP (Future Combustion Engine Power Plants)	37,5	2010-2014
EFEU (Efficient Energy Use)	11	2012-2016
CCSP (Carbon Capture and Storage Program)	15	2011-2016

\*The Strategic Centres for Science, Technology and Innovation (SHOKs)

\*\* For 4 years

### Some other recent and remarkable research projects

- EL-TRAN
- BCDC Energy
- Smart Energy Transition
- NeoCarbon



# Finnish Smart Grid demo projects

## Finnish Smart Grid project catalogue

- Contents

- Grid technology cases

- Sundom Smart Grid pilot
    - Tampere smart grid case
    - Pusula substation project
    - Masala substation project
    - Pinsiö substation project
    - e-Gotham district heating microgrid
    - Suomenniemi LVDC pilot
    - Kylmäkoski LVDC pilot

- Component technology cases

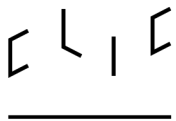
- Fortum electricity storage pilot
    - Suvilahti battery energy storage facility
    - Suvilahti and Kivikko solar power plants
    - Åland Smart Energy platform

- Smart areas and buildings

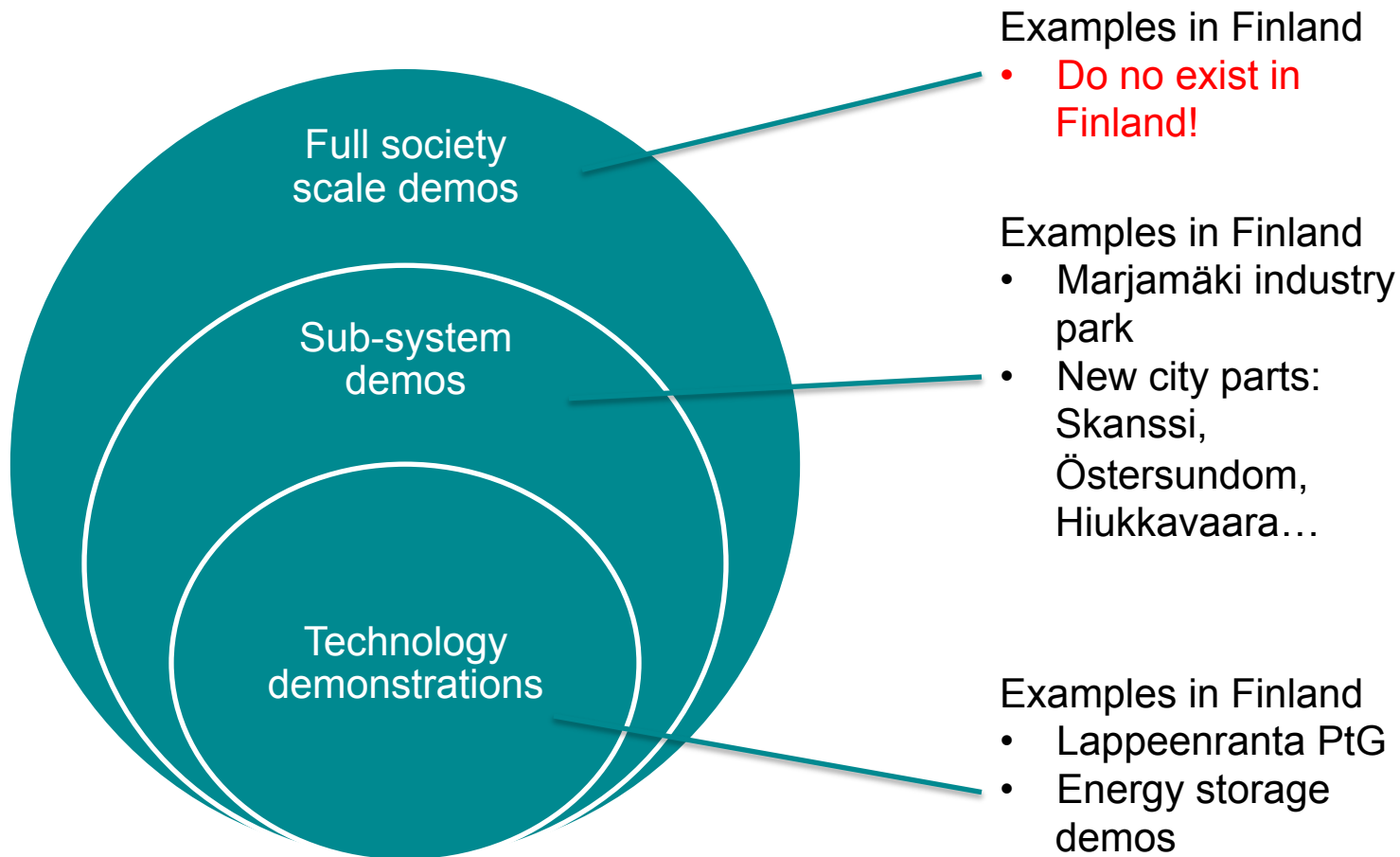
- Smart Kalasatama
    - Finnoo – the new green maritime city
    - Viikki environmental office building
    - Turku Skanssi
    - EEPOS demonstration site
    - RESCA Oulu / Hiukkavaara
    - Wasa Station event centre
    - Östersundom
    - Jyväskylä Kangas
    - Ilmastokatu

- Data-oriented cases

- Fingrid Datahub
    - VIRPA – Virtual service platform



# Three types of smart energy demonstrations





# BACKGROUND INITIATIVES & STUDIES

VALLETTA 18 May 2017

## POLITICAL DECLARATION on CLEAN ENERGY FOR EU ISLANDS

Inhabited EU islands are often well placed to employ innovative solutions and attract energy investments that integrate local renewable production, storage facilities and demand response in order to achieve interoperable, economic, environmentally friendly and sustainable energy systems, to implement the key priorities of the Clean Energy for all Europeans package;

Recognising that with their strong sea and sun resources, EU islands can be the architects of their own energy future, already global frontrunners with their energy into energy systems and for alternative fuels for transport both on land and at sea;

Underlining that EU islands are vulnerable to climate change, their small climatic potential, size and population require tailor-made solutions;

Acknowledging that most EU islands have a security of supply due to their geographical location, reliance on imported fossil fuels and high electricity prices for end-users;

Noting that many EU islands still rely on fossil fuels, which have significant negative impacts on the environment, driven by the frequent use of ad-hoc, non-transparent and reflective high electricity prices for end-users;

Taking into account that tourism is a key economic driver for many EU islands, which has a seasonal energy demand which puts pressure on the local energy system;

Acknowledging that alternative fuel energy efficiency measures implemented on islands are highly relevant, with the EU's electricity demand, resilient economic growth and the development of the EU islands;

Recognising that many islands and archipelagos require special attention during infrastructure development;

Highlighting, in the context of the 2015 Paris Agreement, the importance of climate change and the important role of islands in resilience plays to mitigate this risk;

Having regard, among other initiatives, to the EU Islands Strategy (2015-2014/ISPS) and the EU Islands Strategy, strengthening sustainable development on islands;

## Nordic Energy Co-operation: Strong today – stronger tomorrow

BY JORMA OLLILA



Nordic Council  
of Ministers

## SCENARIOS FOR A SUSTAINABLE ENERGY SYSTEM IN THE ÅLAND ISLANDS IN 2030



NEO  
CARBON  
ENERGY

Results  
Michael Child, Al  
Christian Breyer  
First Results for Åland  
Platform Stakeholders  
September 5, 2016

2017

Concept formulation for the demonstration  
of the flexible energy system and  
relevance of the demonstration to energy  
and investments in Finland



Tommy Jacobson  
Pia Saari  
Teija Laitinen

CLIC Innovation Oy

## Different Optimisation Perspectives in the Åland Energy Market due to the Increase of Renewable Energies

Master Thesis | Julia Marie Leichthammer, B.Sc. | 1635597 | Business Engineering with the technical field of studies Electrical Engineering and Information Technology | Specifications in Finance & Project Management as well as Electrical Power Engineering | Submission date: 1. November 2016

TU Darmstadt | Department of Law and Economics | Institute of Corporate Finance | Prof. Dr. Dirk Schiereck

TU Darmstadt | Department of Electrical Engineering and Information Technology | Institute of Electrical Power Supply with Integration of Renewable Energies | Prof. Dr.-Ing. Jutta Hanson | Tim Plöber, M.Sc.

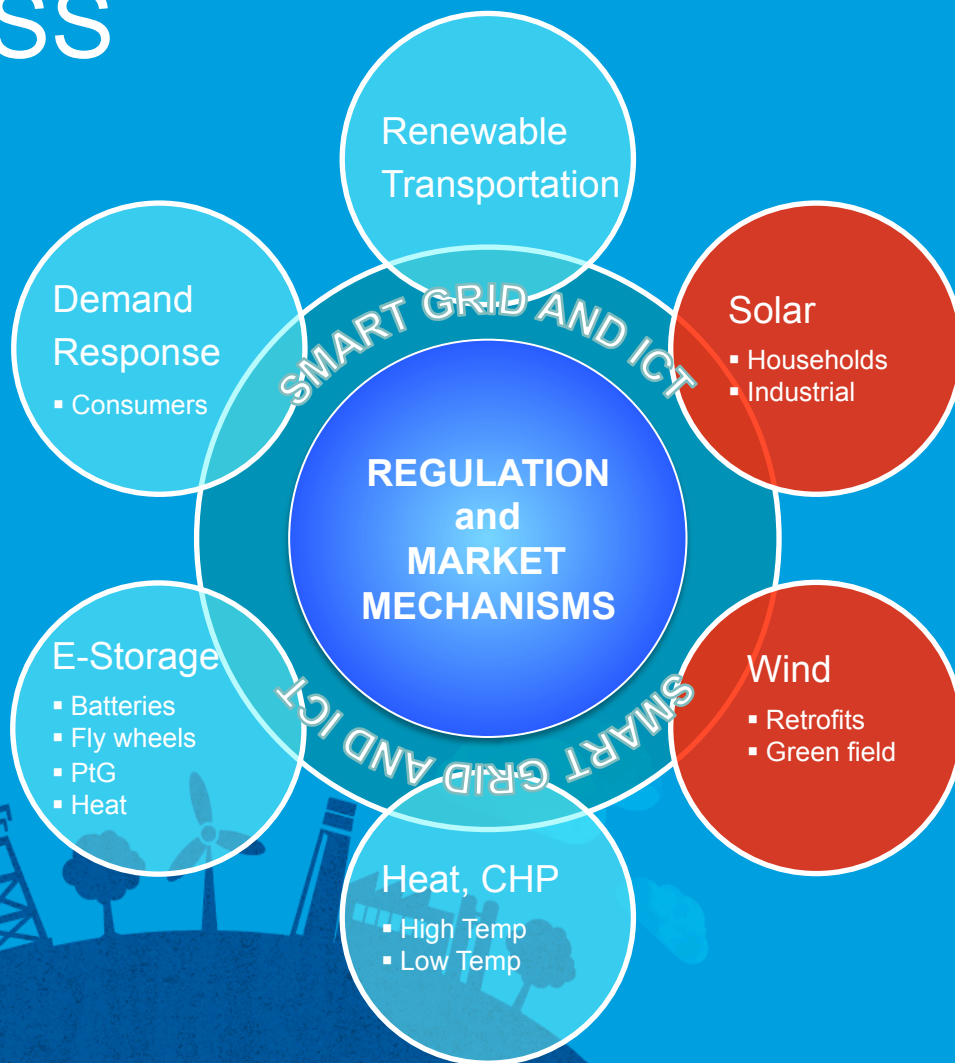
ABB Oy | Strömbergintie 1B, 00381 Helsinki, Finland | Discrete Automation and Motion Division | Business Unit Motors and Generators | Teijo Kärnä



TECHNISCHE  
UNIVERSITÄT  
DARMSTADT



# READINESS CONCEPT

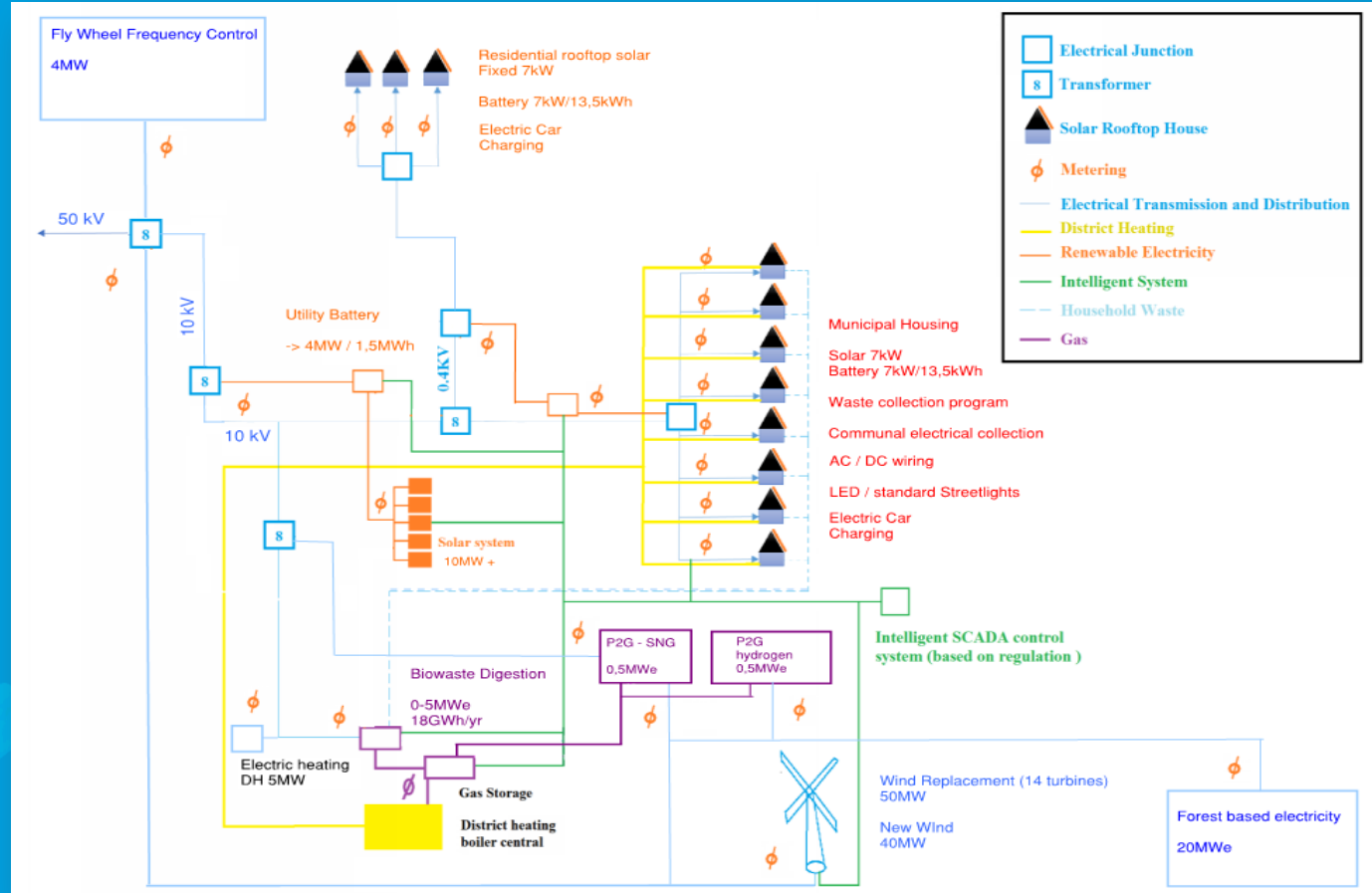




# READINESS

## TECHNICAL CONCEPT - DRAFT

- 40 + 50 MW<sub>e</sub> wind power
- 10 MW<sub>e</sub> utility scale solar power plant
- 4000 x 7 kW<sub>e</sub> roof top + 7 kWh battery
- ~4000 EVs
- 4 MWe Flywheel Frequency control
- 1.5 MWh utility battery
- 20 MW<sub>e</sub> bio-CHP
- 0.5 MW<sub>e</sub> Power to H<sub>2</sub>
- 0.5 MW<sub>e</sub> Power to CH<sub>4</sub> with CCU





# FLEX<sup>e</sup>-DEMO

## CLIC'S TEKES FUNDED

## ECOSYSTEM BUILD-UP

*500 k€ for 1.6.2017 – 31.12.2018*





# 1. GOALS

## *DEMONSTRATION*

- Test and demonstrate new business models on future energy market and regulative environment promoting flexibility
- Integrate subsystems, actors and technologies by a smart grid platform to enable flexibility
- Activate and empower citizens to prosumers







# 1. GOALS

## *ECOSYSTEM BUILD-UP*

- Identify and commit ecosystem to specify and design the demonstration
- Identify and specify relevant subsystems for detailed design
- Define future energy market and smart grid enabling investments and operations necessary for flexibility





## 2. CONTENT

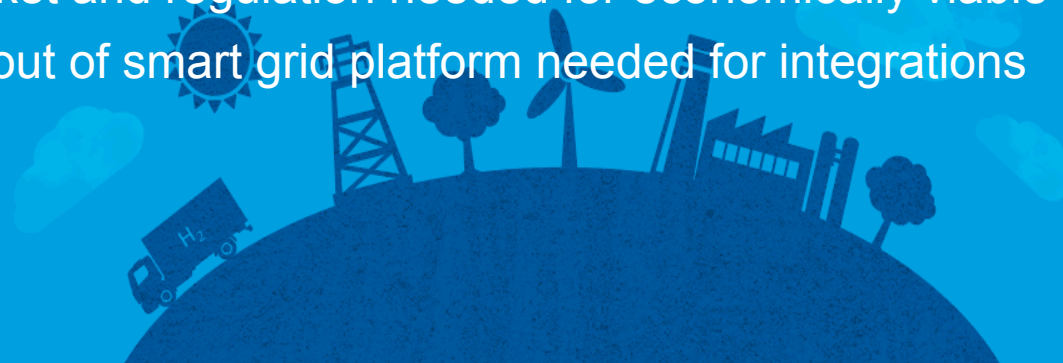
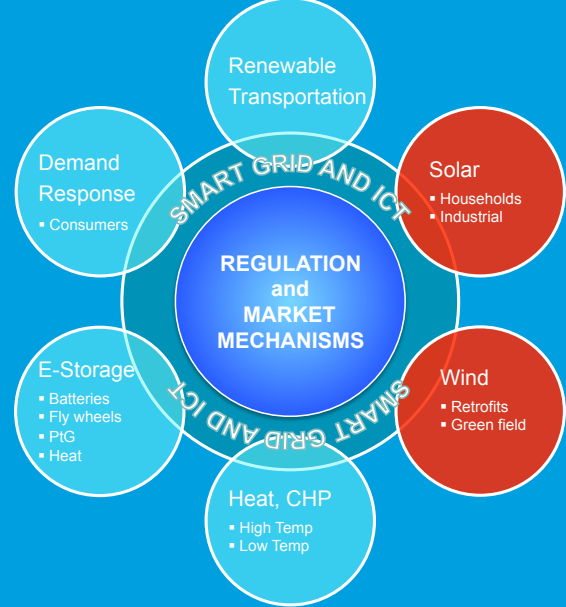
### *ECOSYSTEM BUILD-UP*

#### Phase I

- Identify and commit relevant actors
- Identify subsystems

#### Phase II

- Define parameters of subsystems
- Design market and regulation needed for economically viable investments
- Design lay-out of smart grid platform needed for integrations





# 3. TIMELINE

## ECOSYSTEM BUILD-UP

Phase I

Q4/17

Phase II

Q1/19

Week #32: Commitment of core partners

Week #40: Kick-Off seminar

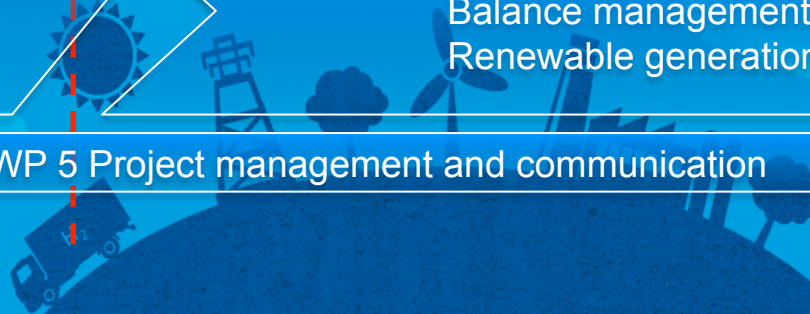
WP 1 Ecosystem building,  
Subsystem definition,  
Execution planning

WP 2 Smart Grid and ICT

WP 3 Market design and Business models

WP 4 Energy efficiency,  
Balance management,  
Renewable generation

WP 5 Project management and communication





# 4. RESOURCING

## ECOSYSTEM BUILD-UP

### FUNDING

TEKES	250
Core Companies	120
2 <sup>nd</sup> phase companies	40
Åland companies	30
<u>Åland government</u>	<u>60</u>
TOTAL	500 k€

### Expected contribution from Åland Government

- **Commitment:** Mutual agreement w/ Åland and Finnish governments
- **Support:** Finance and communication

### RESOURCES

ABB	3.0
CLIC	14.5
ÅTEC	9.0
TUT	0.5
LUT	3.0
Consultant N.N.	5.0
Finpro	2.5
Res.Org. N.N.	3.0
Law firm	1.0
Solved	5.0
<u>TOTAL</u>	<u>46.5 mm</u>



# 5. BENEFITS

## *DEMONSTRATION*

- Scalable home market reference
- Testbed for new business models viable on the future energy market
- Reinforce global customer and partner relationships





# 5. BENEFITS

## *ECOSYSTEM BUILD-UP*

- Global image and marketing goodwill
- Definition of demonstration to meet your needs
- Definition of partners and partnerships





# INTERESTED IN TO JOIN?

**Definition and ecosystem build-up in progress** - if you are interested to join, **contact us:**

Dr. Tommy Jacobson  
*[tommy.jacobson@clicinnovation.fi](mailto:tommy.jacobson@clicinnovation.fi)*

Dr. Pia Saari  
*[pia.saari@clicinnovation.fi](mailto:pia.saari@clicinnovation.fi)*

