Ideas on Options for accelerating solar Photovoltaic Installations in Lappeenranta

Christian Breyer

Professor for Solar Economy

Lappeenranta University of Technology

Aurinkofoorumi

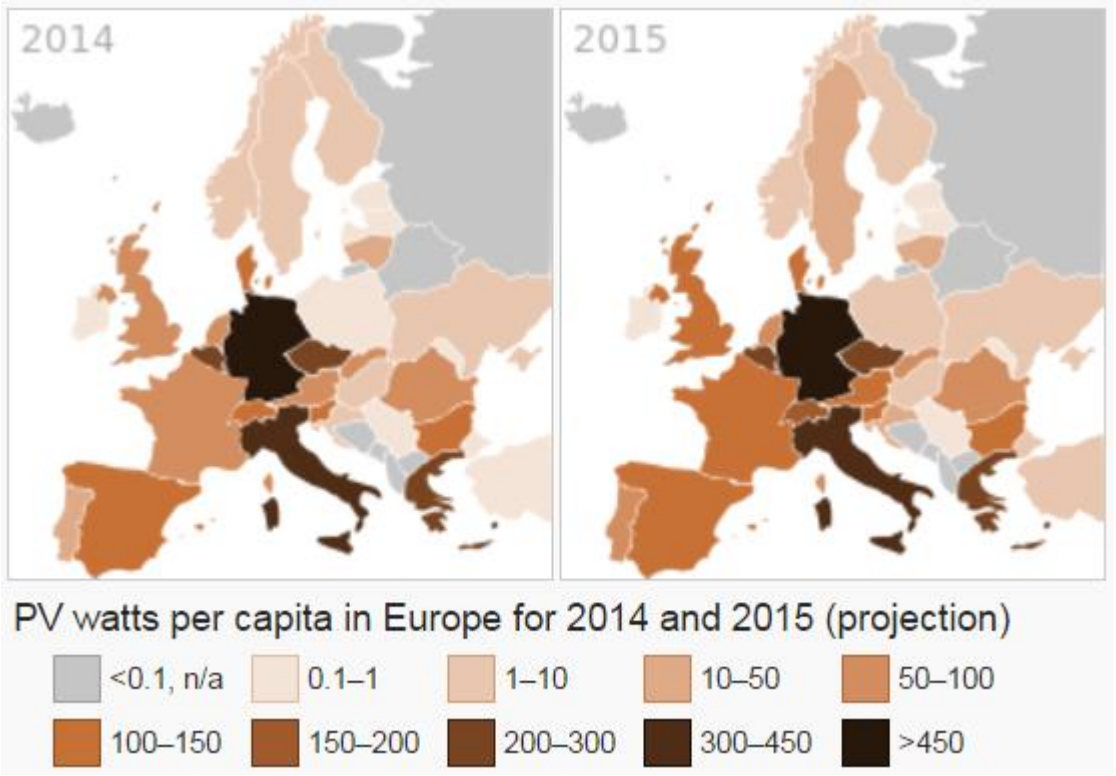
Lappeenranta, November 22, 2016

LAPPEENRANTA UNIVERSITY OF TECHNOLOGY STRATEGY 2020

TRAILBLAZER

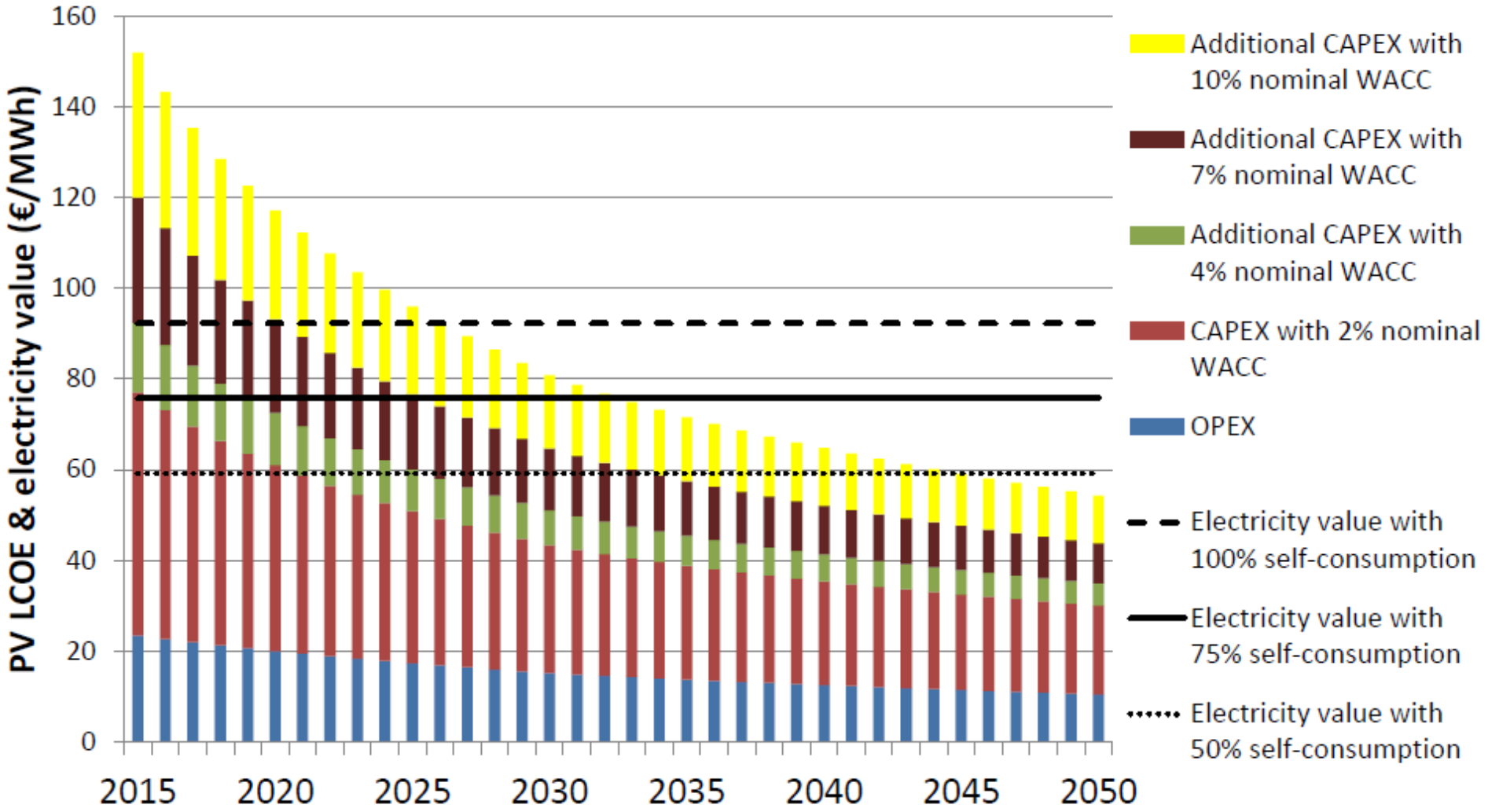
Show the way.
Never follow.

Installed PV per capita in Europe



Finland: 3.6 W/capita
Lappeenranta: 10.8 W/capita
Germany: 495 W/capita

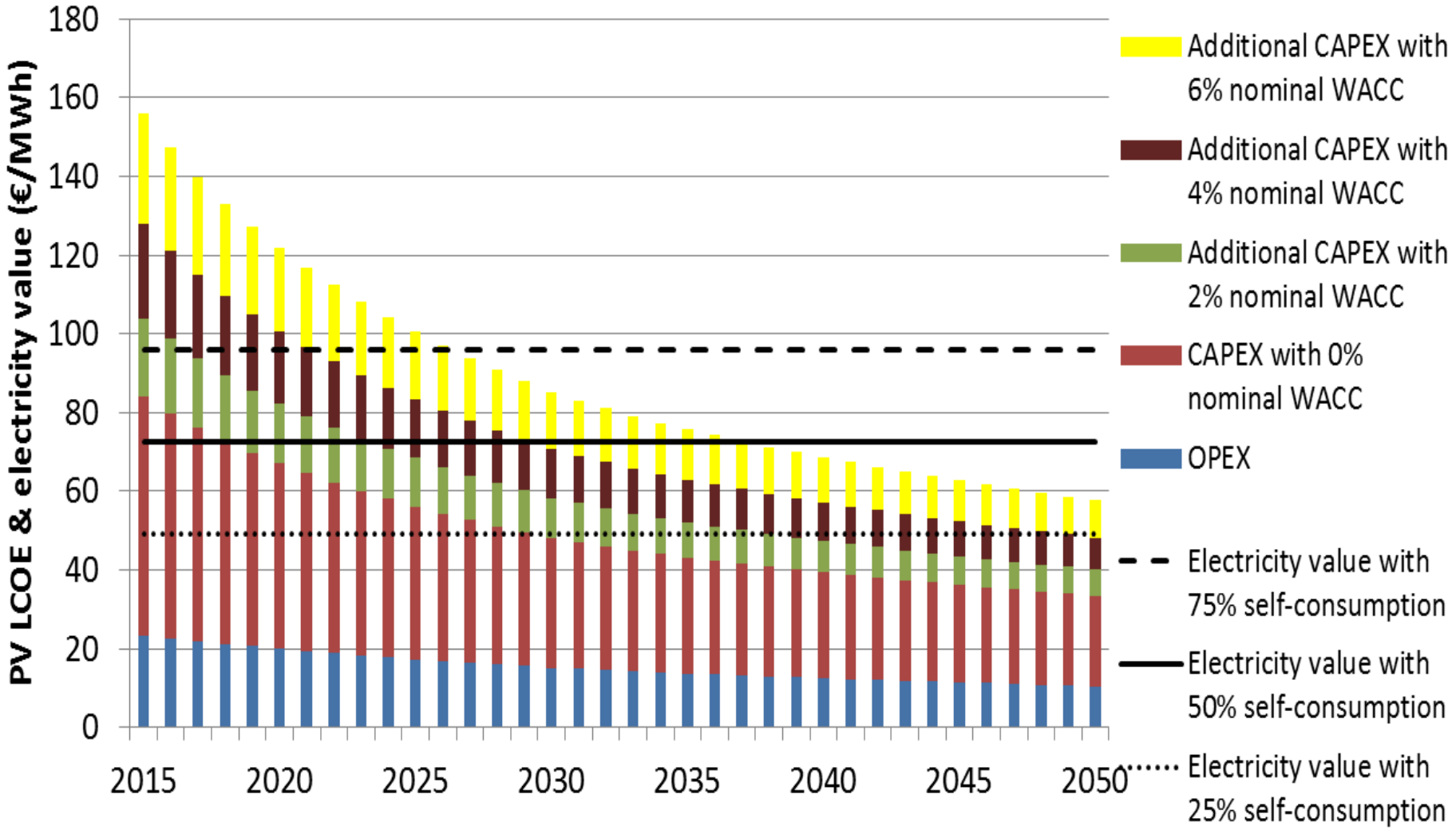
Commercial PV LCOE vs electricity value: Finland



Accelerating solar PV in Lappeenranta
Christian Breyer ► christian.breyer@lut.fi

source: Vartiainen E., Masson G., Breyer Ch., 2016. True competitiveness of solar PV – a European case study, 32nd EU PVSEC, Munich, June 20-24

Residential PV LCOE vs electricity value: Finland



source: Vartiainen E., Masson G., Breyer Ch., 2016. True competitiveness of solar PV – a European case study, 32nd EU PVSEC, Munich, June 20-24

Accelerating solar PV in Lappeenranta
Christian Breyer ► christian.breyer@lut.fi

PV Competitiveness in Finland

Commercial PV:

- profitable for moderate cost of capital and high self-consumption
- promotion of commercial PV project may be helpful
- PV systems on public buildings (e.g. new fire brigade close to the airport) would demonstrate how serious this is for the City of Lappeenranta – this would be also a form of leadership and it would be rather profitable – many municipalities in the world go this way

Residential PV:

- financially not profitable on the current basis
- profitability could be achieved within the next 15 years depending on the PV size
- main reason for low profitability: low self-consumption ratio and low electricity prices
- however: electricity generation costs are lower than residential electricity price
- solution: net-metering (widespread in the US, Brazil, but also successful in SE and DK)

Net Metering for Lappeenranta: idea, cost

- for residential customers (commercial customers can already invest)
- balancing period of one year, i.e. generation in one year and consumption in one year
- good scheme for growth (currently: 99 systems and 973 kWp in total since 2014)

- Cost of such a programme
  - PV LCOE in LPR of about 11 snt/kWh (capex 1400 €/kWp, opex 0.5% of capex, lifetime 25 a, WACC 4%, yield of about 850 kWh/kWp)
  - net metering share of generation of about 75% (rest is direct consumption)
  - variable electricity cost for end-users of about 12 snt/kWh (wholesale price 3 snt/kWh, grid price 3 snt/kWh, others 6 snt/kWh)
  - cost per MWp installed capacity of 57 k€/MWp/a
    - yield x net metering share x net metering cost = 850 kWh/kWp x 0.75 x 9 snt/kWh = 57 €/kWp/a
    - amortisation period of about 17 years indicate a net metering period of about 15 years
  - Rules:
    - accessible for all customers of Lappeenrannan Energia in the own 'area'
    - for not more than the own consumption (for maximum impact and larger systems)
    - virtual net metering in rivitalot and kerrostalot enabled (as fair as possible for all)

Net Metering for Lappeenranta: benefit

- Benefit of such a programme
  - very positive marketing for Lappeenranta in Finland
  - being on top of a new trend in Finland: go for 100% renewables
  - citizens want a sustainable energy system and solar energy is on top
  - investments done by the private sector, based on stable local policies
  - job creation can partly refinance the programme
    - created jobs may be about 12.5 jobs/MWp
    - local tax income of roughly 100 k€/MWp installations
    - calculation: total time per installation of about 6.7 h/kWp, working hours 1600 h/job/a, gross salary 40 k€/job/a, local tax income 20% of gross salary, work for activities in the area of Lappeenranta Energia of about 1/3 per created job

Support of decision making

energiavalinta.fi

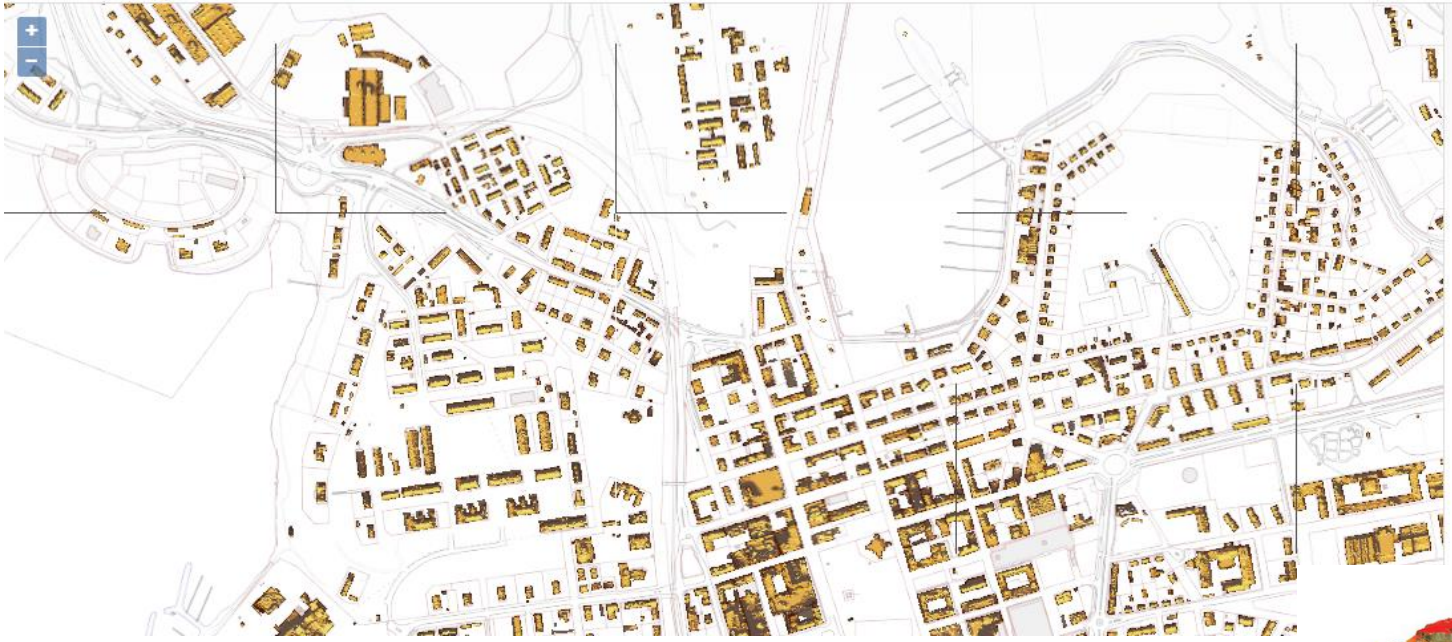
LAPPEENRANTA

Search with address

Select a building by clicking on the map

Change map type

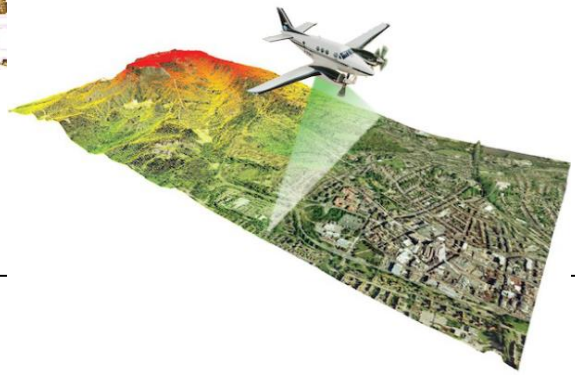
Street map | Aerial photography | Solar energy map | Geo Energy Map



Building found

Check if the address below is correct and choose it by clicking.

Building address:
Mestarinkatu 1, Lappeenranta



Study on South Karelia

Open your mind. LUT.
Lappeenranta University of Technology

TIIVISTELMÄ

Lappeenrannan teknillinen yliopisto
LUT School of Energy Systems
Energiatekniikan koulutusohjelma

Jori Lindgren

Uusiutuvan energian skenaariot Etelä-Karjalalle – julkisen sektorin, liikenteen sekä rakennusten energiatarpeet

Diplomityö

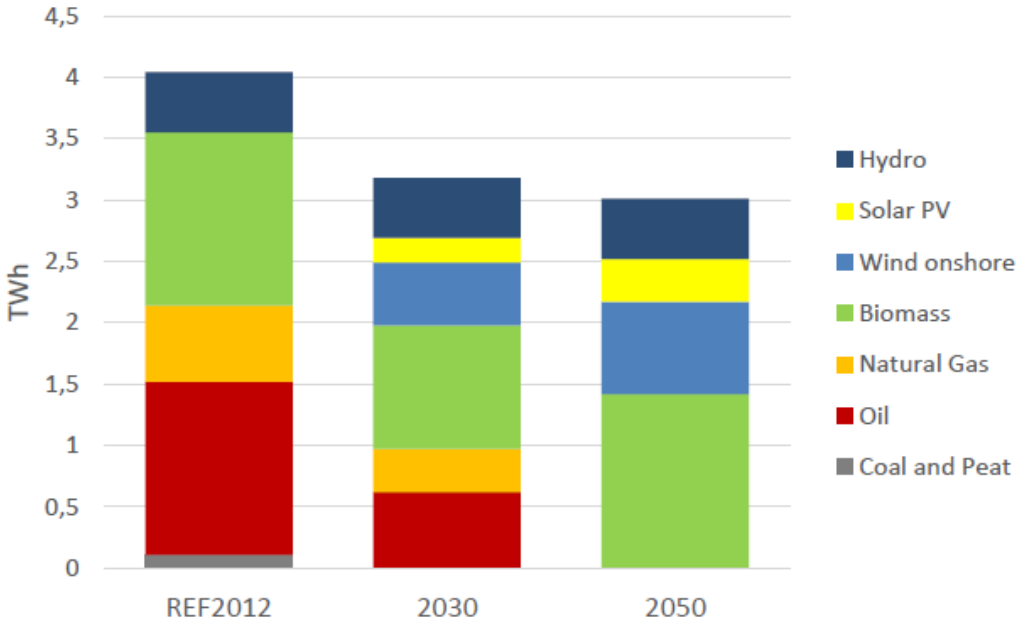
2016

113 sivua, 42 kuvaa, 8 taulukkoa, 10 liitettä

Työn tarkastajat: Professori Esa Vakkilainen
Professori Jero Ahola

Hakusanat: uusiutuva energia, energiajärjestelmä, mallinnus, Etelä-Karjala, energiasuunnittelu

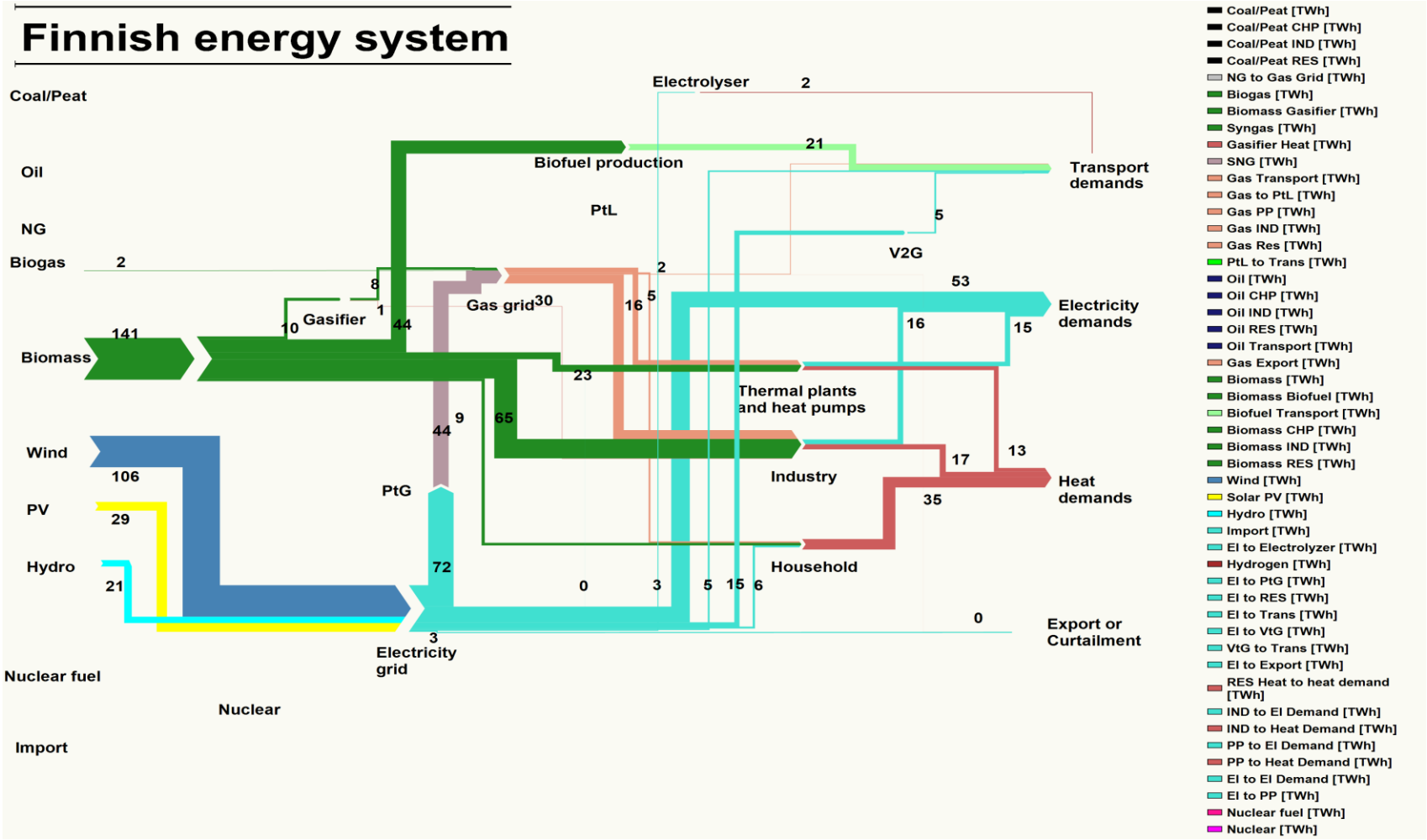
Tässä diplomityössä tarkastellaan täysin uusiutuvaa energiajärjestelmää Etelä-Karjalan maakunnan alueella, mikä onkin jo tällä hetkellä Suomen uusiutuvin maakunta. Diplomityössä tarkastellaan julkisen sektorin, liikenteen ja rakennusten energian kulutusta mutta teollisuuden energiankäyttö jätetään tarkastelun ulkopuolelle. Työssä tutustutaan tämän hetken Etelä-Karjalan energiajärjestelmään ja sen perusteella tehdään referenssi-skenaario. Tulevaisuuden skenaariot tehdään vuosille 2030 ja 2050. Tulevaisuuden skenaarioissa muutos keskittyy järjestelmän sähköistymiseen ja uusiutuvien tuotantomuotojen integroimiseen järjestelmään. Sähköistyminen kasvattaa sähkönkulutusta, joka pyritään kattamaan uusiutuvilla tuotantomuodoilla, lähinnä tuuli- ja aurinkovoimalla. Liikennesektori rajataan kumipyöräliikenteeseen ja sen muutos tulee olemaan haastavin ja aikaa vievin. Muutokseen pyritään liikennepolttoaineiden tuotannolla maakunnassa sekä sähköautoilulla. Uusiutuva energiajärjestelmä tarvitsee tuotannon ja kysynnän joustoa sekä älyä järjestelmältä. Työssä tarkastellaan myös järjestelmän kustannuksia sekä työllisyysvaikutuksia.



Primary energy consumption in the different scenarios.

Flows of energy – Basic 100% RE scenario

Open your mind. LUT.
Lappeenranta University of Technology



NEO CARBON ENERGY

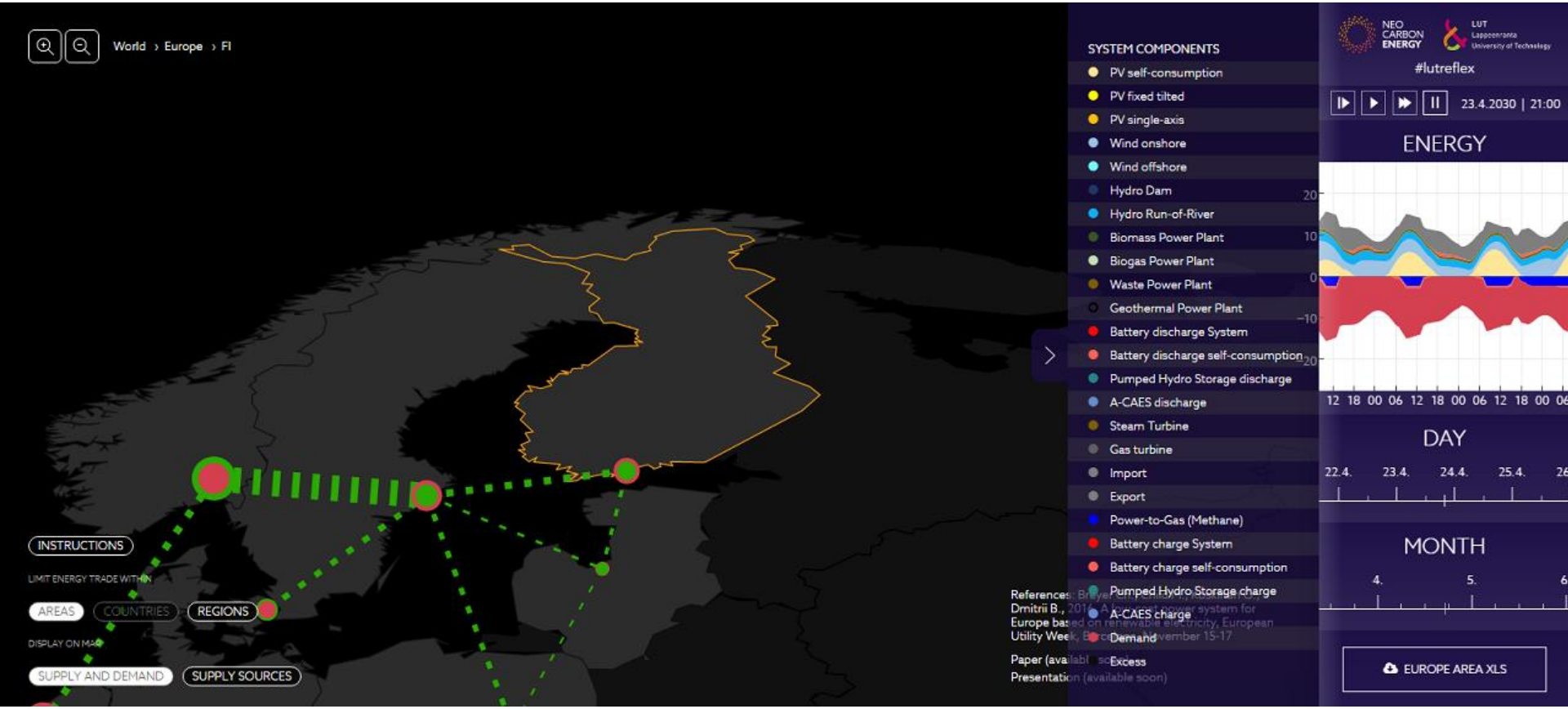
Accelerating solar PV in Lappeenranta
Christian Breyer ► christian.breyer@lut.fi

source: Child M. and Breyer Ch., 2015. Vision and Initial Feasibility Analysis of a Recarbonised Finnish Energy System, 17th Int. Conf. of the Finland Futures Research Centre, Turku, June 11-12

Results Visualisation

Open your mind. LUT.
Lappeenranta University of Technology

Global Internet of Energy: http://neocarbonenergy.fi/internetofenergy/#



NEO CARBON ENERGY

Accelerating solar PV in Lappeenranta
Christian Breyer ► christian.breyer@lut.fi

Summary

- Lappeenranta had a very good start into PV in Finland
- this advantage should be utilised for new jobs and demonstrating leadership
- commercial PV installations may require administrative support (not financial)
- residential PV installations lack a positive financial business case
- local net metering scheme could overcome a lack of good national policies
- the earlier pro active local support, the more local jobs may be created
- citizens want politicians to enable very high shares of renewables

Christian Breyer ► christian.breyer@lut.fi

Kiitos.

Open your mind. LUT.

Lappeenranta University of Technology