



GreenEnergy Finland Oy

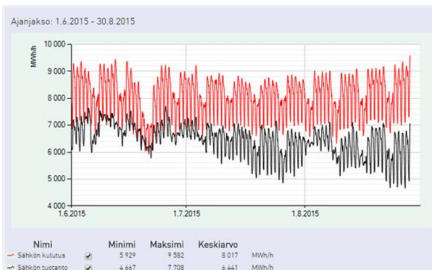
Sähköllä uuteen aikaan –seminaari 25.4.2017 Heureka
Älykäs aurinkosähkö - Smart Grid Ready Distributed PV
Miko Huomo
GEF



Agenda

1. Development of Electricity Consumption and Production
2. Potential of Solar PV (Photovoltaic)
3. Solar PV in Finland and in Europe
4. Scenario "Substantial Growth and High Utilization of Solar PV"
5. Distributed Energy Production – Demand for Smart Grid Solutions

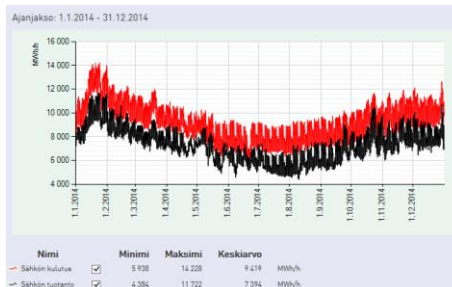
Electricity Production and Consumption FIN



Source: Fingrid

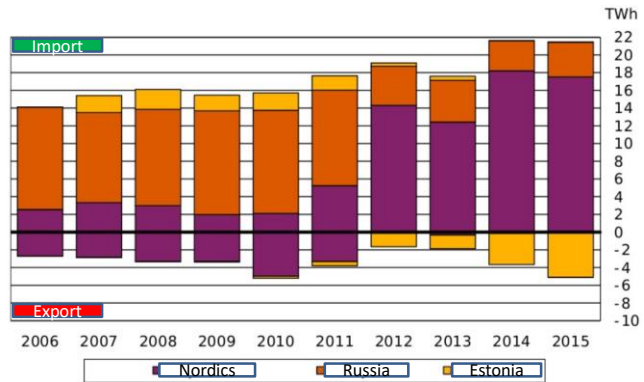
- Industry was the majority consumer with roughly 50% (The forest industry alone 30-32%)
- Demand response?
- Energy storages?
- Development of the capacity and production price?
- Other price components (tax, transfer)

- Significant share of imported electricity also during summer time
- Electricity self sufficiency in 2014 ca. 78%
- We can adopt more production!
- Consumption ca 17 MWh/PPPY as EU average is ca. 7 MWh/PPPY



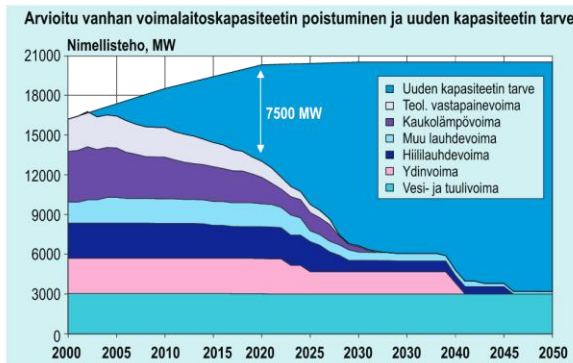
Electricity Net Import FIN

- Net import was 18 TWh 2015
- Share was 21,6 % of the total consumption (2013 18,7%)
- Majority from Sweden and produced by hydro power, good water balance
- Active import a healthy sign of operational and well organized nordic electricity market -> electricity will be purchased where it is the most cheapest



Source: Finnish Energy

Production Forecast FIN



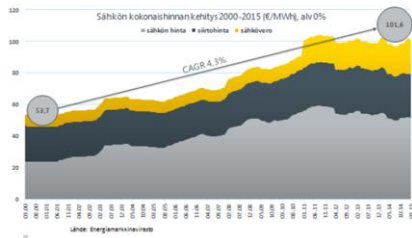
Kuva 1 Arvioitu vanhan voimalaitoskapasiteetin poistuminen ja uuden kapasiteetin tarve.

Source: http://www.vtt.fi/files/projects/energy_book_series/ev_2030_tivistelma.pdf

- Decommissioning of 7500 MW already in 2020
- After 2020 even more production retires
- Curve remains in the lowering trend
- Production Capacity Exists but the Cost is the Factor!

Consumption and Price Development FIN

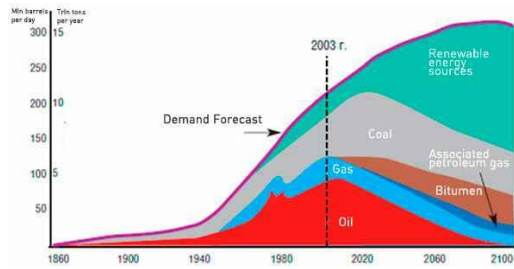
Electricity Price Development



Source: Fingrid

- Demand response and flexibility?
- Pricing?
- Subsidies in Future?

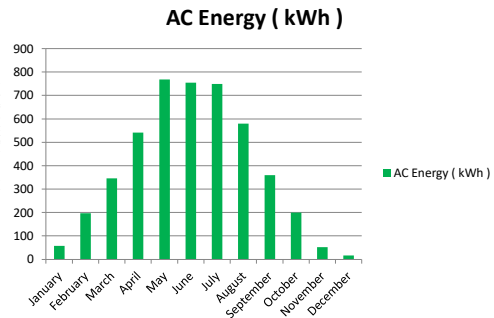
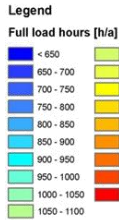
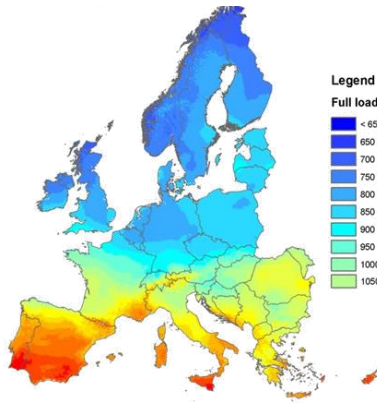
- What is the Trend in Electricity Price?
 - Taxes?
 - Transfer?
 - Production?



Lähde: russiancouncil.ru

PV Potential

Solar PV Irradiation in FIN/ EU



Source <http://www.green-x.at/>, ref 6.10.2014

Source PV Sol Advanced



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PV Installation is Sweden

Figure 1: Yearly installed PV capacity in Sweden.

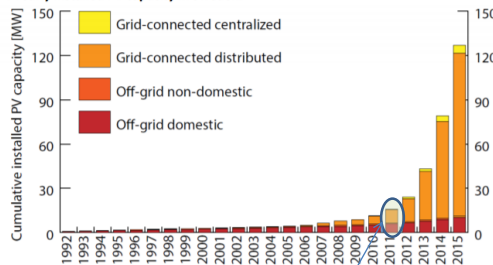


Figure 2: Cumulative installed PV capacity in Sweden.

Source ©IEA: National Survey Report of PV Power Applications in Sweden 2015

Situation in FIN 2016

- Subsidy policy for corporate users started at 2005 and was active with 30% until 2008
- 2009 -2012 subsidies were expanded to all ongrid-systems, levels 20% for Privates and 30 % for Corporates
- 2013-2016 Subsidy level was 35 % for Private and Corporate End Clients

For a reference in Finland PV capacity in 2015 was ca.10 MW



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PV Potential in Finland

1. By 2030 the expected consumption is 102 TWh (88 TWh/ 2010)¹
2. Distributed PV Production by 2030 could be as follows:
3. 1 150 000 residential houses (2014)², average plant size 3 kWp
 - Saturated with 50 % houses integrated with PV -> 1700 MW
4. 214 000 corporate and public buildings (2014)², average plant size 50 kWp
 - Saturated with 50 % buildings integrated with PV > 5000 MW
5. Total Production ca. 6700 MWp x 900 kWh / kWp = 6030 GWh
6. Share of total Consumption =>6 TWh / 102 TWh = 5,9 %
 - In Germany (2014) PV production 35,2 TWh / 502,9 TWh = 7 %

Sources:

1. JYU: Kasvua ja työllisyyttä uudella energiapolitiikalla:

<https://jyx.jyu.fi/dspace/bitstream/handle/123456789/43024/Kasvua%20ja%20ty%C3%B6llisyytt%C3%A4%20uudella%20energiapolitiikalla.pdf?sequence=1>

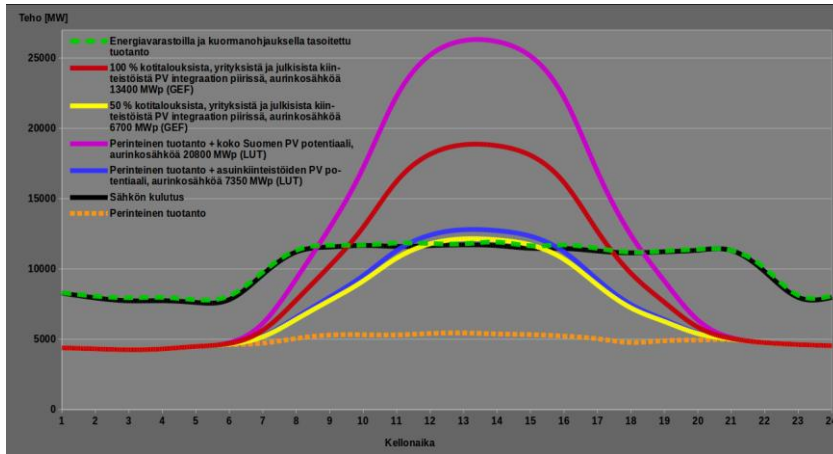
2. Stat.fi /rakennuskanta 2014

http://www.stat.fi/til/rakke/2014/rakke_2014_2015-05-28_kat_002_fi.html

PV Potential in Finland



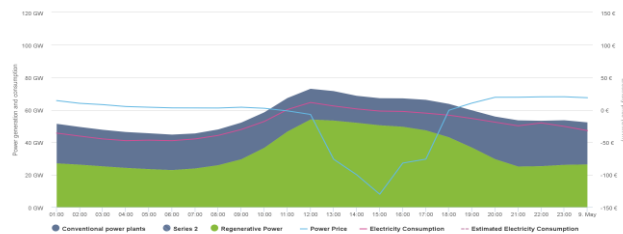
Event Forecast Finland 2030



Source LUT "Nationwide Photovoltaic Hosting Capacity", GEF

Snapshot from Germany at 8.5.2016

- Renewable production resulted with 54 GW and is ca. 85 % of the existing consumption
- Conventional Production e.g. Nuclear Power Plants could not regulate with required response time -> electricity consumers were paid to consume more
- Electricity Price went from 3 EUR in few hours to - 130 EUR /MWh until returned to positive tariff later in the evening
- Not enough insights for the usage and production resulted this unwanted event that could have regulated with intelligent distributed production ecosystem

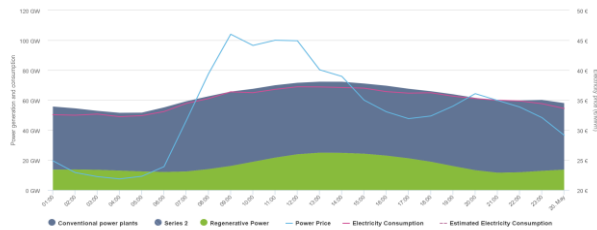


Pic 1. Event at 8.5.2016

Source <https://www.agora-energiende.de/en/topics/-agothem-/Produkt/produkt/76/Agorameter/>

Snapshot from Germany at 19.5.2016

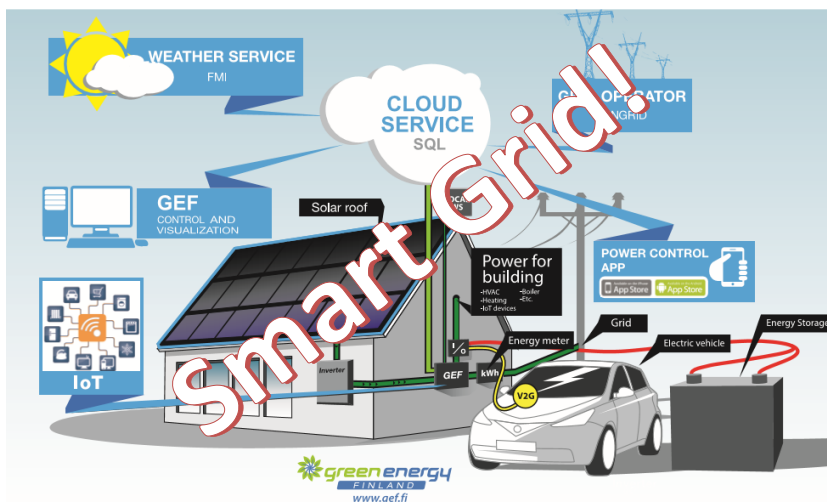
- Just few weeks later the share of the renewable production peaked only at 25 GW, that resulted 35 % of the consumption
- The price of electricity went up to 45 EUR /MWh
- With the help of regulation by the active load control and Energy Storages this impact could have been significantly reduced -> Intelligent Energy Balance Management is required!

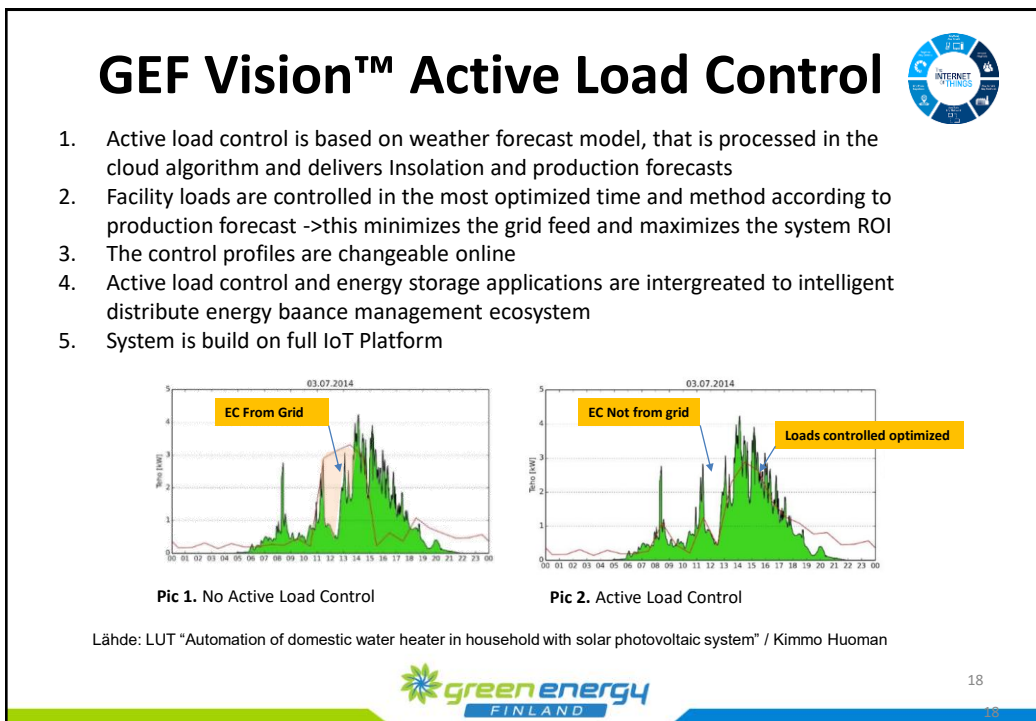
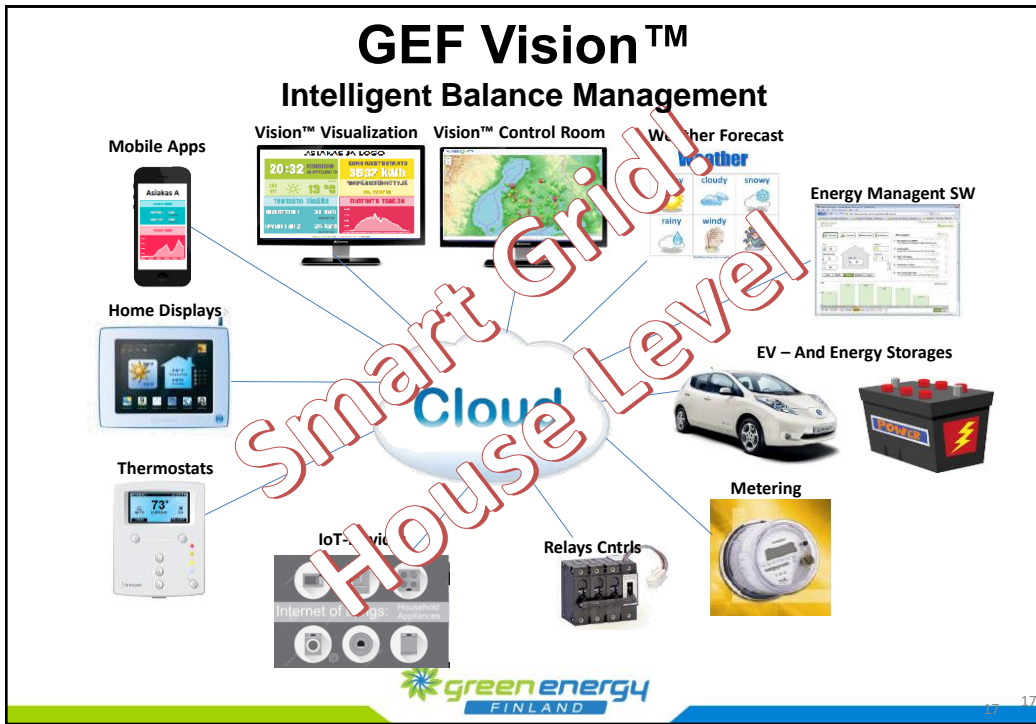


Kuva 1. Tulane 19.5.16

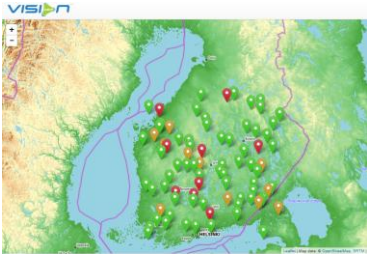
Lade: <https://www.agora-energiewende.de/en/topics/-agothem-/Produkt/produkt/76/Agoramerter/>

GEF Vision™ Intelligent Balance Management





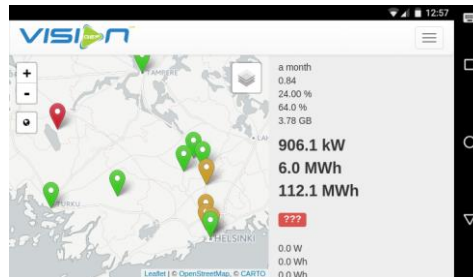
GEF Vision™ Control Room



1. All power plants are in the remote control
2. Real time troubleshooting and diagnostics
3. Facility load profiles can be changed online

4. Active load control, forecasting services and the energy storage applications integrate in to the energy balance management ecosystem

5. Enables virtual power plants to be controlled under grid holder or EHC for demand response etc



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GEF Vision™ Personalized Visualization



- All power plants are equipped with HMI
- Customized templates available
- Mathematical algorithms can be used for tailor made visualizations (more informative messaging)
- Enhance the introduction of the power plant to the viewer more effectively (system info, production etc.)

- Mobile Applications for Android and Ios
- Wide language options (including exotic options as arabic)
- All the control room data can be transparent to the mobile app, such as the O&M data as cleaning interval optimization etc.



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Questions?



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PÄÄSIMME FINAALIIN!

Äänestä GEF koko Euroopan voittajaksi osoitteessa www.gef.fi/eba.
Olemme ainoa Suomen edustaja European Business Awards (EBA)
kilpailun yleisöäänestysfinaalissa



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Thank You!



The ABB logo, consisting of the letters 'ABB' in a bold, red, sans-serif font.

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The JA SOLAR logo, with 'JA' in blue and 'SOLAR' in a lighter blue, sans-serif font.

www.aurinkovoimala.net/suomensuurin

The GreenEnergy Finland logo, featuring a green starburst icon to the left of the text 'greenenergy' in a green, lowercase, sans-serif font, with 'FINLAND' in a smaller, blue, uppercase, sans-serif font below it.