

Greenreality Network and Lappeenranta Virtual Power Plant

Markku Mäki-Hokkonen 17.6.2020

Photo: Topi Lainio

Greenreality

NETWORK



Greenreality Network – a business-oriented network of energy and environmental actors

[Päättökäsi näytön nähtiin ensimmäisenä](#)

Greenreality

NETWORK

We dare. We do.



0:01 / 1:38

Näet tiedot vierittämällä alas



Greenreality Network services

- Accelerating the development of new businesses and products, projects and projects
 - Information and know-how
 - References and demonstrations (eg. Plasma oxidizer and P2H battery)
 - Investments and joint projects (eg. Power2Methanol pilot factory)
- Contacts and networking
 - Domestic and international contacts
 - Theme groups (energy efficient buildings, solar economy, sustainable traffic, communications)
- Marketing and communication
 - Visibility and strengthening image (Social media, news letter, media releases, brochure..)
 - Influencing demand
- Influencing and lobbying
 - Bringing energy and environmental business perspective to public planning and decision-making
 - Influencing on public procurement

Value for membership!

KPI's for 2021 -2023

Innovation and projects

Projects (with public funding), min 2 company members € volume

International projects with min 2 company members € volume

Network enabled investments

Networking

Events organised

New members

Registered Teams and Greenreality platform users

Marketing and communication

Visitor at Network web site

Media releases of members

Greenreality social media accounts

Lobbying

Statements and initiatives to public authorities

Energy and environmental business

Tavoite

Increases 30% compared to 2020

Increases 50% compared to 2020

level kept unchanged, ca. 10 events / a

increasing moderately (10 new members)

200%

Increasing 50% compared to 2020

8/v

Increases 100% compared to 2020

4/a

Share of total economy in South Karelia increases from 12% to 13%

World's first city piloting virtual power plant service. Case Lappeenranta

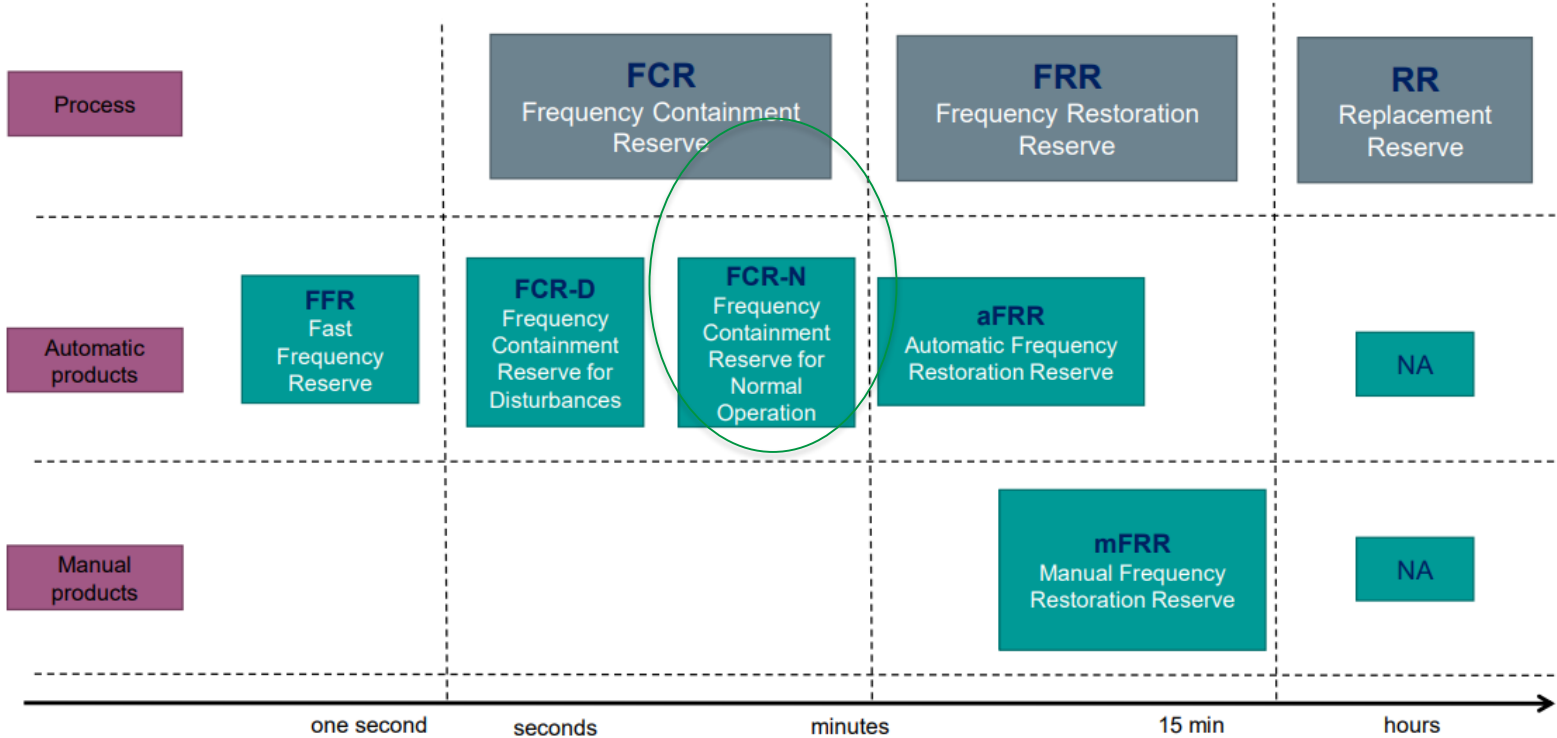
Greenreality
LAPPEENRANTA

Drivers for demand response

- Increasing and fluctuating renewable energy production requires flexible grid ie. storages and demand side response
- Buildings can act as active reserves in both power and heat markets
- With open power reserve markets new business models are created for demand response services.
- Aggregation means combining smaller electricity production, consumption and storage sites that are capable of balancing into larger packages that can be offered on different electricity marketplaces. The aggregation of different resources is already permitted in all electricity marketplaces in Finland.
- These aggregated loads can be called virtual power plants and aggregators as VPP service providers.
- Reserve markets are opening in Europe and it seems there shall be European wide markets in the future

Fingrid (TSO) maintains power balance with Nordic reserve markets

Reserves used in the Nordic countries



Suomessa kehitettiin uudenlainen voimalaitos – ”Omistaja ei huomaa muuta, kuin että tilille tulee rahaa”



Helsingin päärautatieasemast

Julkaistu: 13.5. 11:39



Älykkäät sähköverkot

MOBIILISÄHKÖVARASTOILLA ENERGIAHUOLTOVARMUUTTA SÄÄTÖVOIMAA UUSIUTUVALLE ENERGIALLE

BLOMQVIST KIM, HÄRKÖNEN JARNO JA MAKKONEN TARMO

Lappeenranta virtuaalivoimalan käyttäjäksi ensimmäisinä kaupunkeina maailmassa – Siemens mahdollistaa kiinteistöjen liittymisen sähkön säätömarkkinoihin

1 ulmahaällä kuuluu virtuaalivoimalaitospalveluun. Vuodenvaihteen jälkeen tiedetään paremmin, tullaanko palveluun vielä 50 lappeenrantaaliskierteistöä lisää.

Technology

Siemens pilots virtual power plant project in Finland

Its software intelligently balances electrical loads from buildings that have been connected in a microgrid, incorporating renewable energy and battery storage

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Keinokas hankinta: Virtuaalivoimalaitoksen hankinta Lappeenrannassa



- Paastomestari Visa Tuovinen ryhtyy yrittämään yksin, koska haluaa tehdä asiat täsmälleen omalla tavallaan – Streittari, vegaani ja punaviheranukiksi ei ole tavanomaisiin yrittäjiä
- Uutisanalyysi: SaiPan Tero Lehterällä on käsillä pian piinaviikot
- Henkilöauto ajautui ulos Ruokolahden rampilta Kuostostielillä Imatralla perjantain ja lauantain välisenä yönä
- Talouden teijä: Marjut Lohen vatsassa muljahiti, kun Pyöröpuikko tuli myyntiin – Kolmivuorotyö sairaalassa ja kolme lasta siivittäjät

ty

Background

- City of Lappeenranta has been building BACnet based building automation system since 2010 (ca. 120 buildings, 24000 I/O points)
- Intelligent building automation management and leveraging demand elasticity part of city strategy 2017
- Greenreality Network seminar April 2018 – Elasticity in Buildings and Intelligent Building Management
- Greenreality Network Theme Event - Possibilities in demand elasticity in buildings on November 2018
- In the spring of 2018, Siemens contacted after their ministry-funded project was launched. There were also discussions with GEF and Väre (E2M). After various discussions and studies, we ended up tendering a virtual power plant service.

We wanted to have a service

- The virtual power plant service includes the integration of buildings into the virtual power plant and Fingrid (TSO) balancing energy markets, as well as the related operational and maintenance costs, such as license fees, reporting tools, data security solutions and other needed services.

Time table of the tendering process

- Request for quotation in January 2019
- Offers in February 2019
- Procurement decision in March 2019
- Contract at the end of April (4 months delivery time)
- Operational since March 2020

Included city buildings

17 buildings for immediate implementation, approx. 0.1 MW reserve power

- 7 school buildings
- 2 kindergardens
- 3 sports halls
- 1 library
- 4 other public service buildings

OPTION

Buildings to be implemented later:

45 sites.

Requirements for providers

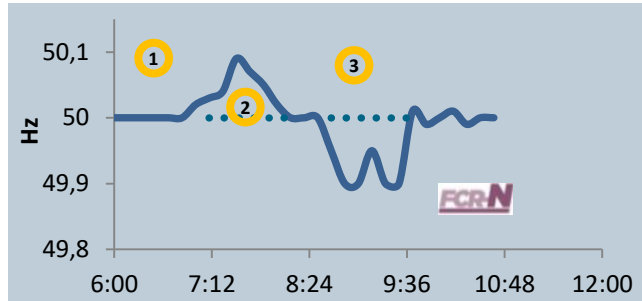
- The pay-back period must be less than 5 years
- **Demonstration that building loads are controlled in a way that is compatible with the current automation system and is based on available sensor measurements (CO2, temperature and humidity)**
- Prevent unnecessary alarms caused by external control in the property management system used by Lappeenranta (Siemens Desigo)
- Monthly reporting of the service, including at least the loads offered and ordered, the market revenues from them, and indoor air quality measurement data
- **Securing that building indoor conditions adhere to Climate Classification 2018 S2 Class**
- **The pressure ratios of the buildings must not change when the ventilation units are adjusted**
- Delivery in 4 months from order
- When connecting to a building automation system, the building automation guide (BACnet) of city of Lappeenranta must be followed

Economy – VPP pilot, 100kW power reserve

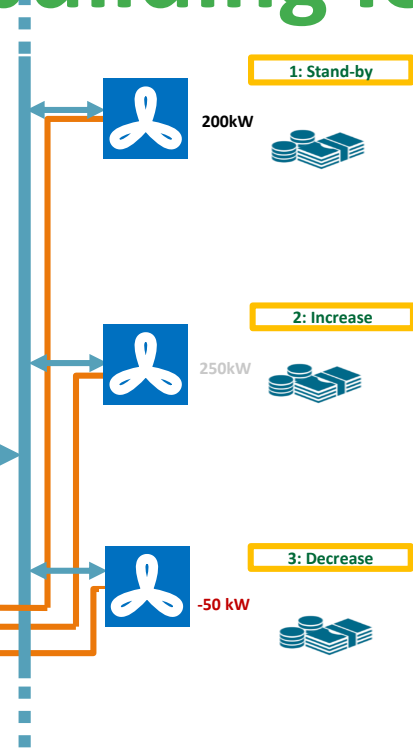
• Investment	40 000€
• Investment grant	- 20 000 €
• Net investment	20 000 €
• Service fee, annual	?
• Estimated profits/a	10-15 000 €
• Estimated pay back time	3 years

The use of frequency containment reserve in normal operation (FCR-N) in Finland has been 70-80 MW per year and the annual price ca. 13 € / MWh. The hourly price for has been ca. 28 € / MWh on average and amount 30-40 MW on average.

Control of flexible building loads



FINGRID



Control signal log for exhaust and supply fans, example

TK3

Yritys: Lappeenrannan kaupunki

Alkupvm: 10.6.2020 0:00

Loppupvm: 17.6.2020 0:00

Resoluutio: 60 minuuttia



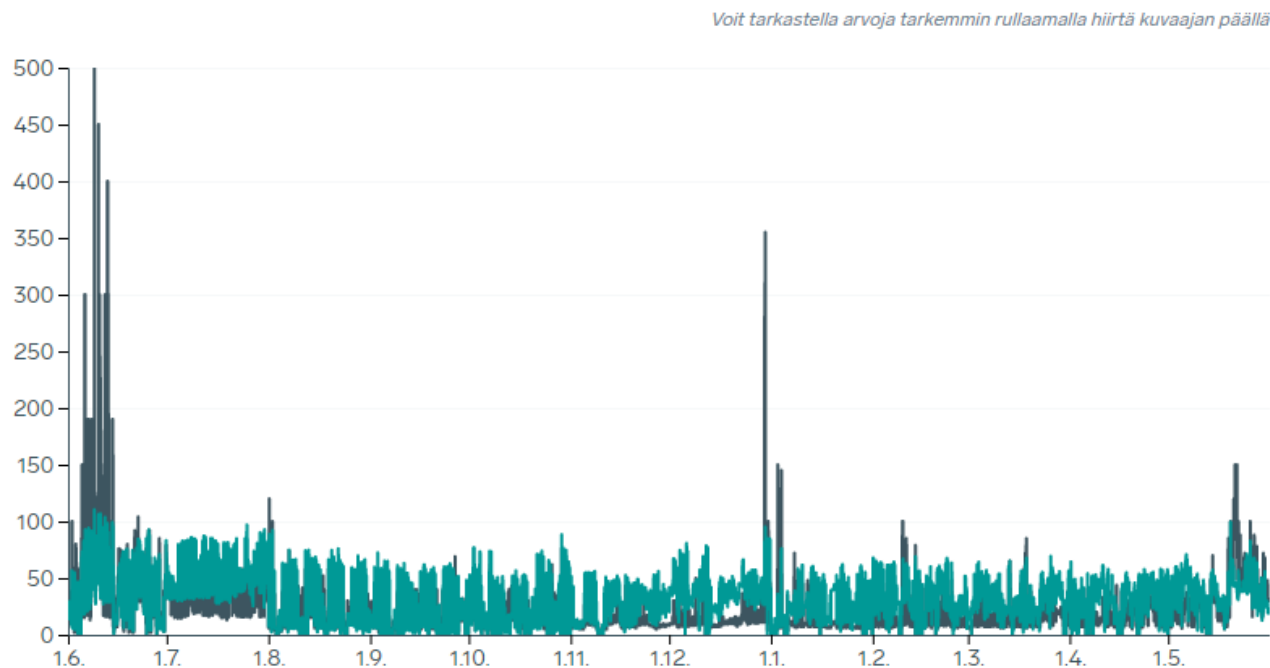
Conclusions

- Ability of a building (stock) to respond to the needs of the energy grids is important part of smartness of the buildings
- Reserve markets are evolving as are aggregator and other services
- VPP service requires an advanced and integrated building automation system. Sufficient loads (power, time), censoring and controllability of devices are prerequisites for profitable deployment
- VPP provides building owner new profits for reserving power loads for the needs of the grid balancing. Impact to CO2 emissions positive but difficult to evaluate
- So far building users have not recognised any changes
- Possible next steps include managing our peak power and utilizing electric storage
- VPP service is being implemented at the moment also to LUT campus buildings



Thank you!
Markku Mäki-Hokkonen

Price of frequency controlled normal reserve in hourly market 1.6.2019-31.6.2020



Average 22,39 €/MW,h
Max 500 €/MW,h