ESSnet pilot Smart Meters

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statistics
estonia

Outline

- Smart Electricity Meters
- Plans to roll out smart meters
- ESSnet pilot Smart Meters
- Data Access
- Visualising first results

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ESSnet pilot Smart Meters

- The work package WP3 Smart meters in the ESSnet Big Data project is a pilot study on electricity smart meters data.

- The work package is currently carried out by partners from four national statistical institutes: Statistics Austria, Statistics Denmark, Statistics Estonia, and Statistics Sweden.

- The aim of the pilot study is to demonstrate the use of data from electricity meters, which can be read from a distance and measure electricity consumption at a high frequency, for production of official statistics.

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Aims of the WP

- Usefulness of the data source
- Linking smart meters data with administrative data
- Methodology to produce electricity consumption statistics – businesses
- Methodology to produce electricity consumption statistics – households
- Methodology to produce estimates of seasonally vacant living spaces
- Guidelines for producing statistics

13.10.2016

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Smart Electricity Meter

- A smart meter is usually an electronic device that records consumption of electric energy in intervals of an hour or less and communicates that information at least daily back to the utility for monitoring and billing.

- Smart meters enable two-way communication between the meter and the central system. Unlike home energy monitors, smart meters can gather data for remote reporting.

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Smart Meters Infrastructure

- Advanced metering infrastructure (AMI) is architecture for automated, two-way communication between a smart utility meter with an IP address and a DSO Distribution System Operator.

- The goal of an AMI is to provides utility companies with real-time data about power consumption and allow customers to make informed choices about energy usage based on the price at the time of use
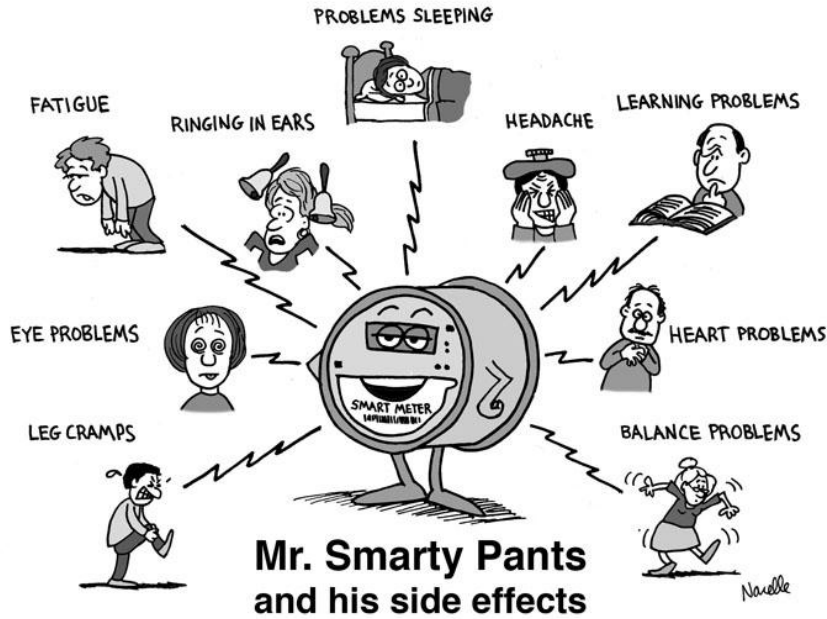

▶ Overview of AMI system

http://internetofthingsagenda.techtarget.com/definition/advanced-metering-infrastructure-AMI
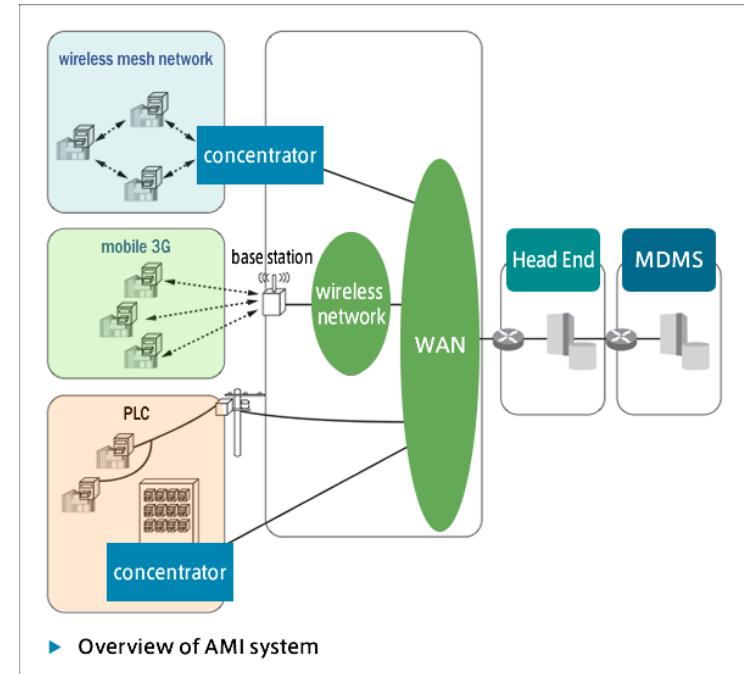
Why Smart Meters?

- More accurate bills — smart meters mean the end of estimated bills, and the end of overpaying (or underpaying) for your energy

- No one has to come to your home to read your meter; you do not have to submit meter readings yourself

- Better oversight and management of your energy use with a real-time data display in your home
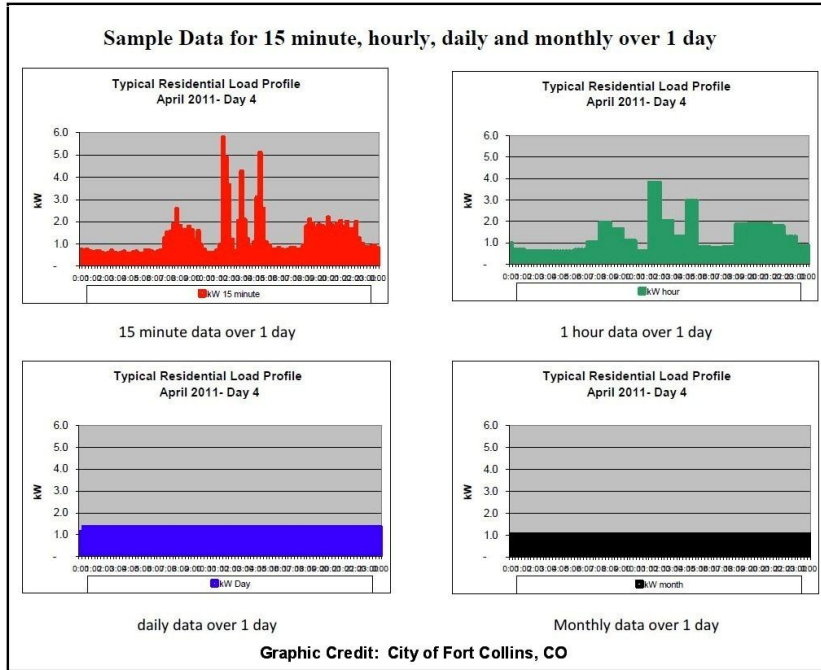
Opposition to Smart Meters

Levels of aggregation

Sample Data for 15 minute, hourly, daily and monthly over 1 day

15 minute data over 1 day

1 hour data over 1 day

daily data over 1 day

Monthly data over 1 day

Graphic Credit: City of Fort Collins, CO
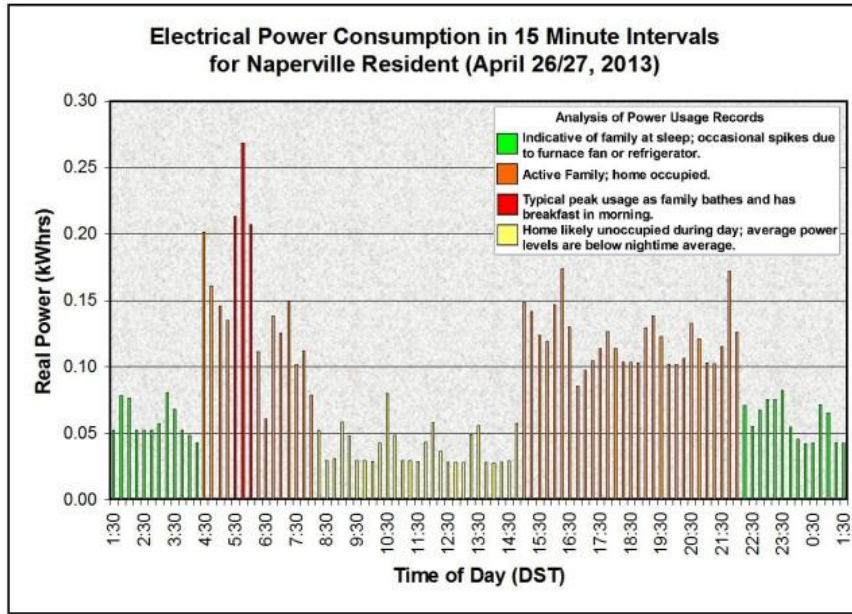
■ Detailed analysis of granular data collected and retained via smart meters over time can reveal significant personal details about the lives of electric customers

http://smartgridawareness.org/2015/04/08/providing-consumer-choice-on-smart-meters/

Electrical power consumption

Electrical Power Consumption in 15 Minute Intervals for Naperville Resident (April 26/27, 2013)

- Without special software or other analytical tools, it is easy to infer human behavior from the graph.
- To protect consumers' personal data when it comes to smart meters and smart grids, the European Commission recommends various data protection and privacy provisions.

http://smartgridawareness.org/2015/04/08/providing-consumer-choice-on-smart-meters/
https://ec.europa.eu/energy/en/topics/markets-and-consumers/smart-grids-and-meters

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Five megatrends in the electricity sector

- Evolution of power generation from centralized plants to distributed renewable energy sources

- The completion of the Internal Electricity Market for Europe and integrated wholesale markets.

- Higher costs due to evolution towards cleaner energy are creating a regulatory pressure for lower costs and higher operating efficiency

- R&D will be facilitated on a pan-European basis

- Evolution towards the smart grid

ENTSO-E (2012) Research & development roadmap 2013-2022

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Smart Metering deployment in the European Union

Smart Electricity Metering Roll-Out

http://ses.jrc.ec.europa.eu/smart-metering-deployment-european-union
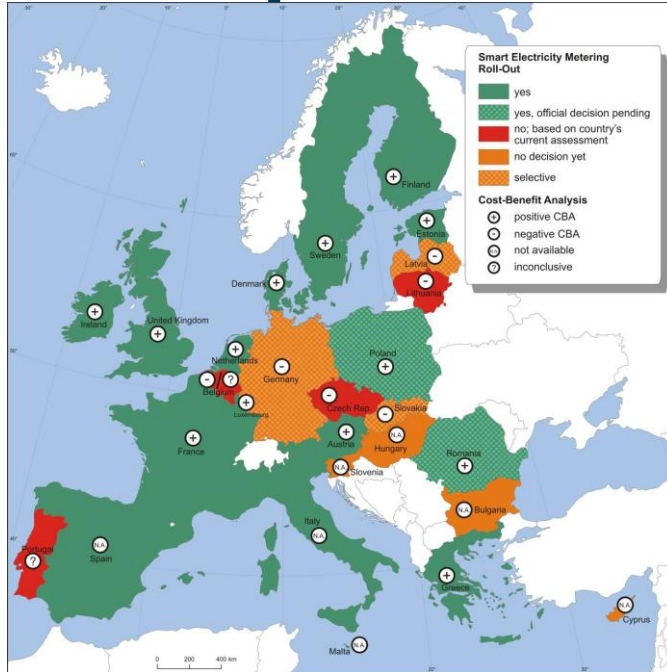
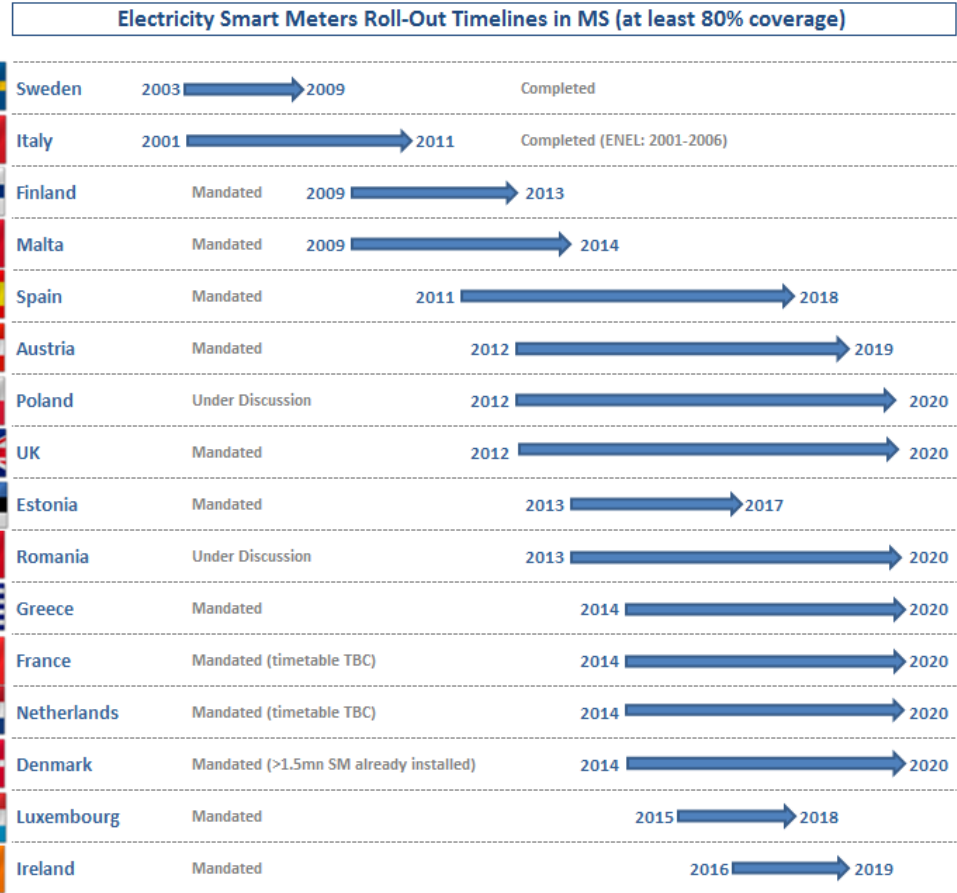- The Commission issued the document "Benchmarking smart metering deployment in the EU-27 with a focus on electricity", jointly drafted by DG ENER and JRC, as COM(2014)356.

- This report gauges progress in the deployment of intelligent metering in the EU Member States on the basis of economic assessments of long-term costs and benefits (CBAs) of electricity and gas smart metering

Plans to roll out smart meters

The European Commission has proposed a deployment plan for smart electricity meters in the EU Member States on the basis of economic assessments of long-term costs and benefits and achieve almost 72% deployment rate by 2020.

Due to the fact that there are ambitious roll out plans of smart meters in Europe the use of smart meter data as big data in statistics has gained remarkable attention.

Electricity Smart Meters Roll-Out Timelines in MS (at least 80% coverage)

Country	Status	Timeline
Sweden		2003 → 2009 — Completed
Italy		2001 → 2011 — Completed (ENEL: 2001-2006)
Finland	Mandated	2009 → 2013
Malta	Mandated	2009 → 2014
Spain	Mandated	2011 → 2018
Austria	Mandated	2012 → 2019
Poland	Under Discussion	2012 → 2020
UK	Mandated	2012 → 2020
Estonia	Mandated	2013 → 2017
Romania	Under Discussion	2013 → 2020
Greece	Mandated	2014 → 2020
France	Mandated (timetable TBC)	2014 → 2020
Netherlands	Mandated (timetable TBC)	2014 → 2020
Denmark	Mandated (>1.5mn SM already installed)	2014 → 2020
Luxembourg	Mandated	2015 → 2018
Ireland	Mandated	2016 → 2019

http://ses.jrc.ec.europa.eu/smart-metering-deployment-european-union

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Smart meter data in EU countries

NSI	Plans to explore Smart Meters data	Legal obstacles	Data hub available
Sweden	Yes	Yes	No
Norway	Yes	No	Under construction
Hungary	Yes	No	No
France	Yes	Yes	No
Lithuania	No	No	No
Cyprus	No	No	No
Bosnia and Herzegovina	No	No	No
Poland	Yes	Yes	No
Belgium	No	No	No
Germany	Yes	Yes	No
Portugal	No	No	No
Luxembourg	No	NA	No
The former Yugoslav Republic of Macedonia	No	NA	No
Denmark	Data received	No	Yes
Estonia	Data received	No	Yes
Austria	No	Yes	No

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Smart meter deployment policies in participating countries

Country	Deployment strategy	Metering points in the country	Implementation speed	Penetration rate by 2020	Data refresh rate	Communication technology
Austria	Mandatory roll-out	5.7 mn.	2012-2019	95%	15 minutes	From the smart meter to the data concentrator – 70% PLC and 30% GPRS, From the data concentrator to the Data Management System – 100% Fibre Optics
Denmark	Mandatory roll-out	3.28 mn.	2014-2020	100%	15 minutes	PLC, GPRS/GSM, WiFi and RF
Estonia	Mandatory roll-out	709000	2013-2017	100%	1 hour	PLC – 90%, GPRS – 10%
Sweden	Voluntary	5.2 mn.	2003-2009	100%	1 hour	Mix of GPRS, PLC and/or Radio (46%), PLC only (37%), Radio only (17%), GPRS (1%)

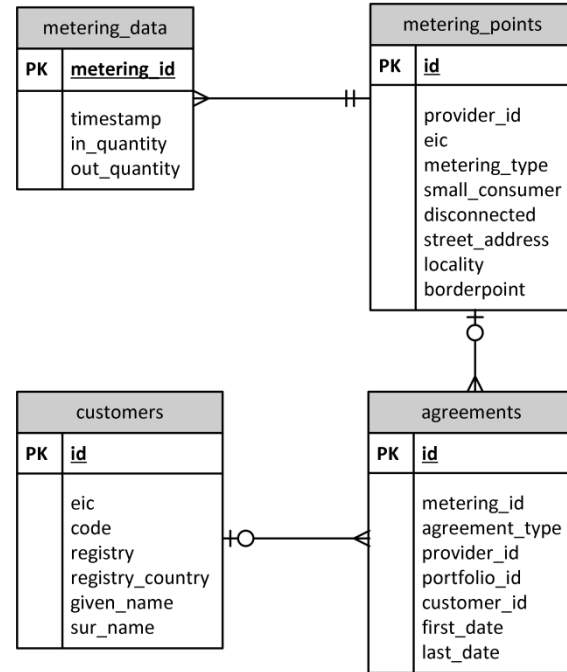Toomas Kirt

Data access (1)

- Access to data
- Estonia
    - Access to 2013-2014 hourly data (2015 data soon)
    - 722 000 metering points
    - Amount 1.5 TB, recordings per a year ca 6,2 billion
    - Access process: from 2013 until March 2015
- Denmark
    - Access to 2013-2014 15-min interval smart meters data
    - Agreement in process to get data more frequently

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Data access (2)

- No access to data
- Sweden
    - SCB has contacted Svenskenergi for accessing the smart meter test data. Svenskenergi is electricity branch association with around 380 companies.
- Austria
    - No attempt to access smart meters data so far. Mainly technical barriers.

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Smart meters data: structure

- Estonian data structure:
- *Metering data* – main table with hourly consumptions
- *Metering points* – location
- *Agreements* – contract info
- *Customers* – contract holder information

metering_data

PK	**metering_id**
	timestamp in_quantity out_quantity

metering_points

PK	**id**
	provider_id eic metering_type small_consumer disconnected street_address locality borderpoint

customers

PK	**id**
	eic code registry registry_country given_name sur_name

agreements

PK	**id**
	metering_id agreement_type provider_id portfolio_id customer_id first_date last_date

Smart meters data: data

metering_data

metering_id	timestamp	in_quantity	out_quantity
7048	2013-01-01 09:00:00.000000	0	285
7048	2013-01-01 10:00:00.000000	0	386
7048	2013-01-01 11:00:00.000000	0	327
7048	2013-01-01 12:00:00.000000	0	318
7048	2013-01-01 13:00:00.000000	0	342

metering_points

id	provider_id	eic	metering_type	small_consumer	disconnected	street_address	locality	borderpoint
1263	14	38ZFE-04405625-V	REMOTE_READING	0	0	Sireli 2	Randvere küla, Viimsi vald, Harju maakond	0
1853	14	38ZFE-04403668-Z	DUAL_TARIFF_MANUAL	0	0	Raba 13	Randvere küla, Viimsi vald, Harju maakond	0
3802	14	38ZFE-04441399-U	REMOTE_READING	1	0	Lubja tee 21	Pringi küla, Viimsi vald, Harju maakond	0
2211	14	38ZFE-04402909-0	REMOTE_READING	0	0	Liiva tee 9	Miiduranna küla, Viimsi vald, Harju maakond	0
742	14	38ZFE-04414323-F	SINGLE_TARIFF_MANUAL	0	0	Daalia tee 4	Haabneeme, Viimsi vald, Harju maakond	0

agreements

id	metering_id	agreement_type	provider_id	portfolio_id	customer_id	first_date	last_date
7802	5456	GRID	14	56	336	2013-01-01	
7803	1795	GRID	14	56	479	2013-01-01	
7804	2113	GRID	14	56	4137	2013-01-01	2014-03-31
7805	2673	GRID	14	56	380	2013-01-01	
7806	2914	GRID	14	56	1795	2013-01-01	

customers

id	eic	code	registry	registry_country	given_name	sur_name
3245	38XAVP-L90090ED	isikukood	rahvastiku	EE	Siim	Susi
3446	38XAVP-M90090E5	isikukood	rahvastiku	EE	Mai	Mets
3747	38XAVP-N90090EY	isikukood	rahvastiku	EE	Kalle	Bossu
3348	38XAVP-O90090EQ	12345678	äriregister	EE	Bis OÜ	
3479	38XAVP-P90090EI	isikukood	rahvastiku	EE	Dalia	Verge
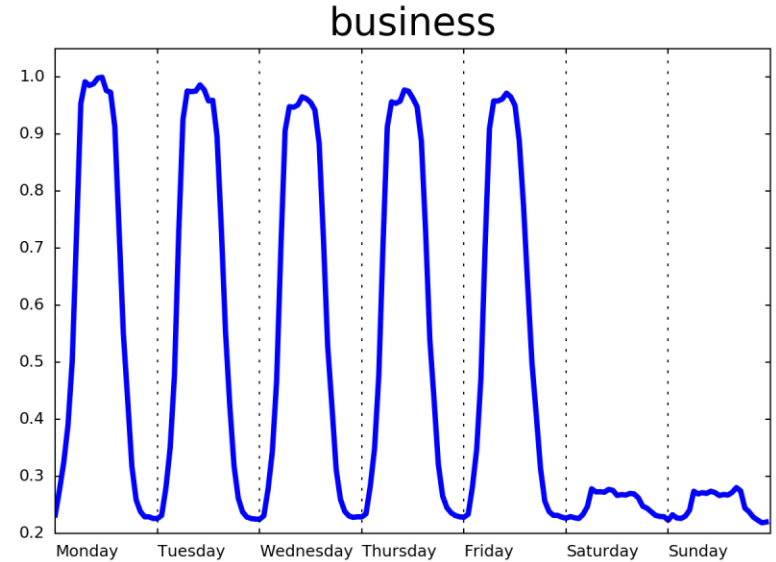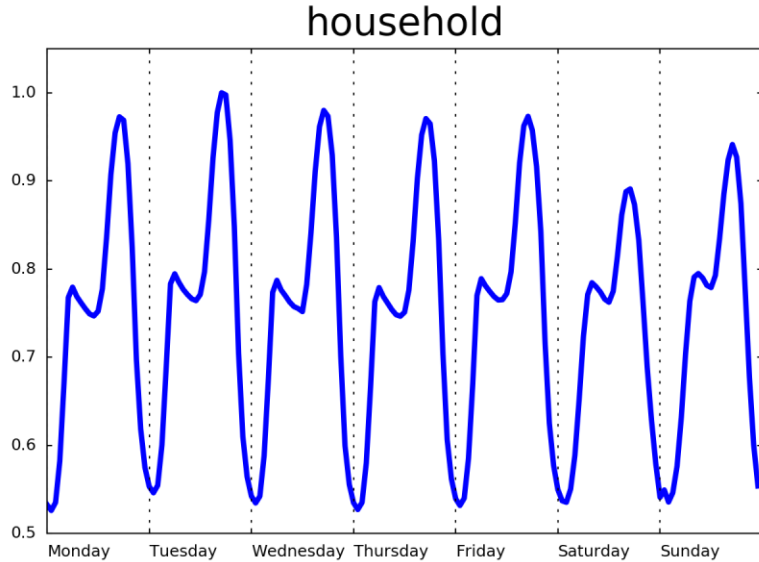
Data

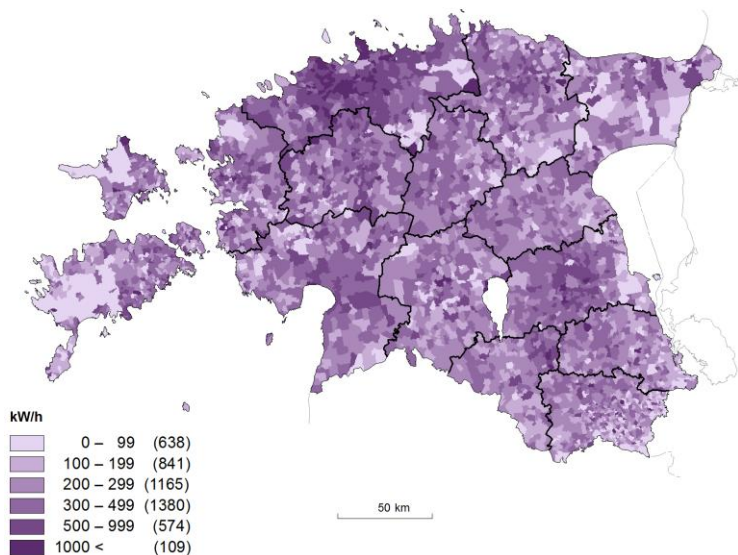Weekly real data (7x24) from household (left) and business (right) aggregated and scaled, 2013-2014.

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Input data quality

Indicator	Assessment
Coverage of smart meters	54% of businesses, 48% of households (Estonia, 2014)
Undercoverage	Data hub does not have information about the amount of electricity produced (and consumed) by private producers.
Percent of units that are adjusted	The metering data is not changed in Statistics Estonia and no adjustments are made in readings.
Percent imputed	No imputation is applied and data is handled in read only mode.
Periodicity	In Estonia, data is provided yearly at the moment - higher frequency is possible in the future.
Delay	In Estonia, the network operators have 3 months time for correcting the data, corrected data can be provided after that period.
Common units	In Estonia there is no other source for hourly data, aggregated consumption information available for businesses through survey.

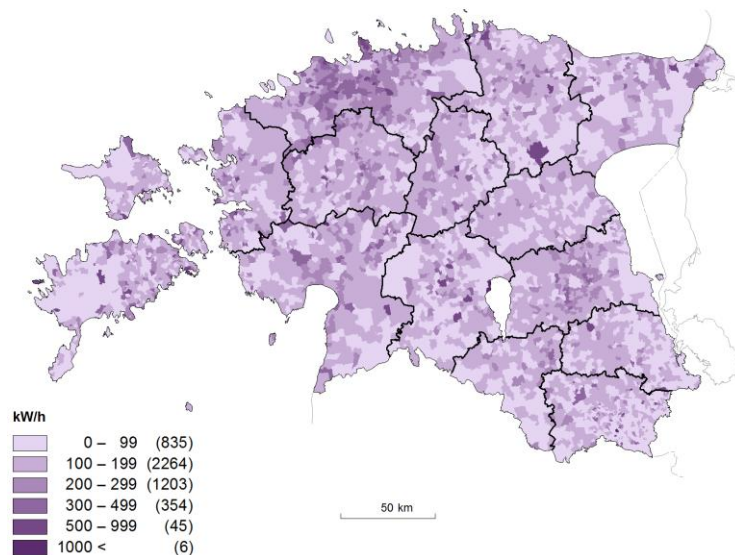# Visualisations of electricity consumption by Estionian private persons in 2014

January

Average monthly electricity consumption of private persons, January 2014
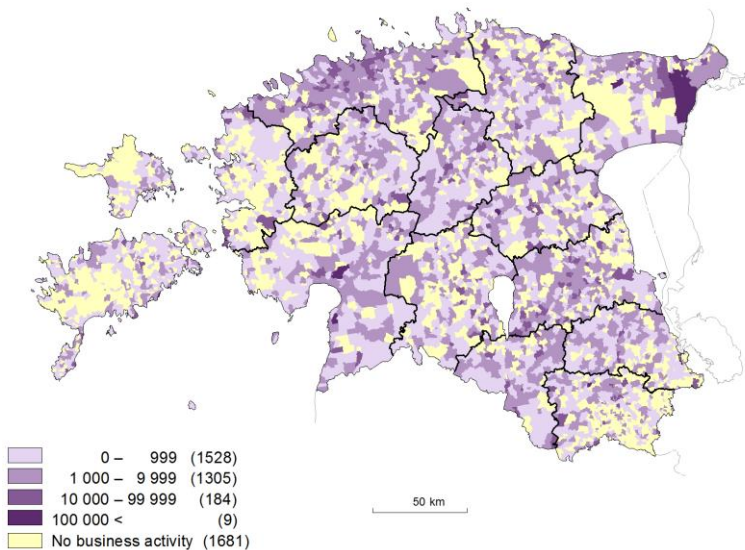

kW/h

0 – 99	(638)	
100 – 199	(841)	
200 – 299	(1165)	
300 – 499	(1380)	
500 – 999	(574)	
1000 <	(109)	

50 km

July

Average monthly electricity consumption of private persons, July 2014

kW/h

0 – 99	(835)	
100 – 199	(2264)	
200 – 299	(1203)	
300 – 499	(354)	
500 – 999	(45)	
1000 <	(6)	

50 km

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Visualisations of electricity consumption by Estionian legal persons in 2014

January

Average monthly electricity consumption of enterprises, January 2014

	0 – 999 (1528)
	1 000 – 9 999 (1305)
	10 000 – 99 999 (184)
	100 000 < (9)
	No business activity (1681)

50 km

July

Average monthly electricity consumption of enterprises, July 2014

	0 – 999 (2026)
	1 000 – 9 999 (908)
	10 000 – 99 999 (100)
	100 000 < (4)
	No business activity (1669)

50 km

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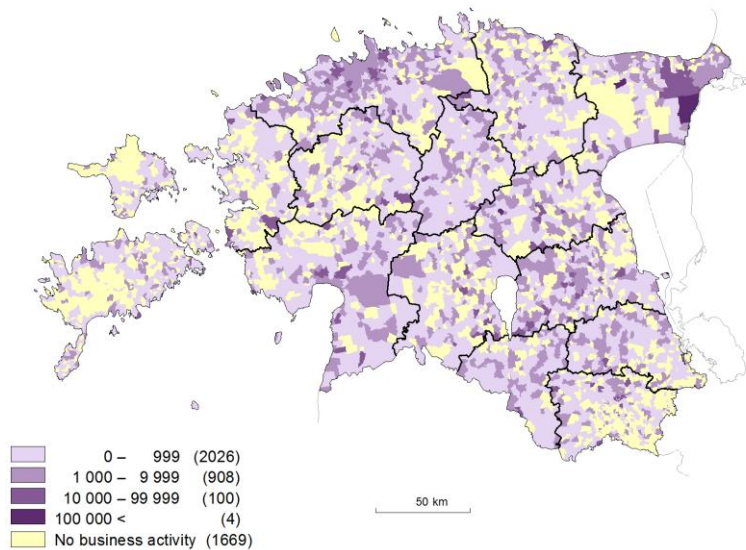
Work in progress

- Linking smart meters data with administrative data
    - Business register
    - Register of buildings
    - Statistical register of households
- Dealing with representativity issues
    - Metering point not equal to experimental unit
    - Metering point does not correspond to household or business
- Calculating statistics

Thank You!

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