

A hand is shown holding a small amount of water, with a single drop falling into a calm lake. The background features a majestic mountain range under a clear blue sky, with the sun shining brightly in the upper left corner, creating a lens flare effect. The water in the lake reflects the surrounding landscape and the falling drop. In the top left corner, there is a small graphic of several colored squares (green, yellow, orange) arranged in a grid-like pattern.

Intelligent Electric Networks and Emobility

May 2018

Join the
change

 fortum

“The world is changing, energy is changing. Our role is to make the energy transformation sustainable, with solutions optimal for different markets and regions. This will help us to stay competitive.”

CEO Pekka Lundmark





Climate change & resource
efficiency



Active customers



The global megatrends affecting our industry



Urbanization



Digitalization & new
technologies

We drive productivity and industry transformation



We create solutions for sustainable cities



**Our focus
going
forward**

We grow in solar and wind



We build new energy ventures



Fortum in brief

Our core

Hydro and nuclear
Combined heat and
power production
Circular economy
Energy-related
products and expert
services

We are the largest
electricity retailer in
the Nordics and one of
the leading heat
producers globally.
We have
2.5 million
customers.

96% of our
electricity
production is CO₂
free in Europe,
61% in all
operations

9,000
professionals
in the Nordics,
the Baltics,
Russia, Poland
and India

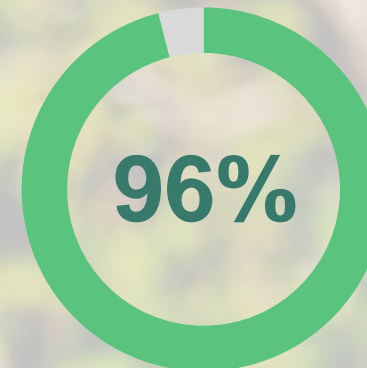
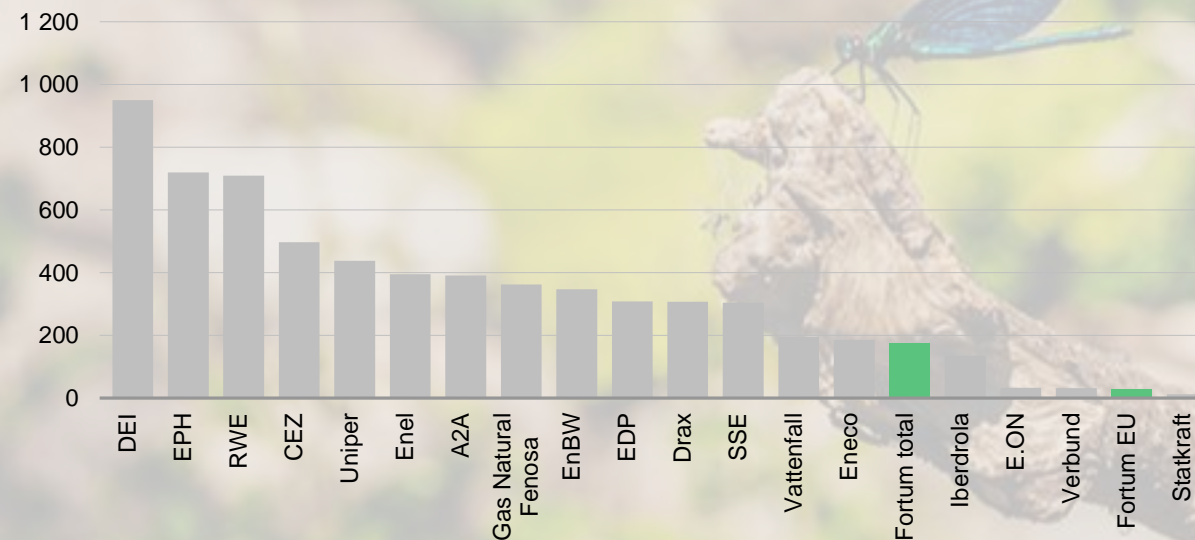
2/3 of our
power
production is
**hydro and
nuclear**

Our carbon exposure is among the lowest in Europe

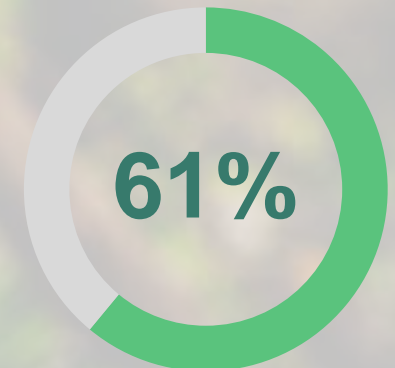
Fortum's specific emissions of the power generation in the EU in 2017 were 28 g/kWh and in total 174 g/kWh, same as in the previous year

Share of CO₂-free power in Fortum's generation in 2017

g CO₂/kWh electricity, 2016



Fortum in the EU

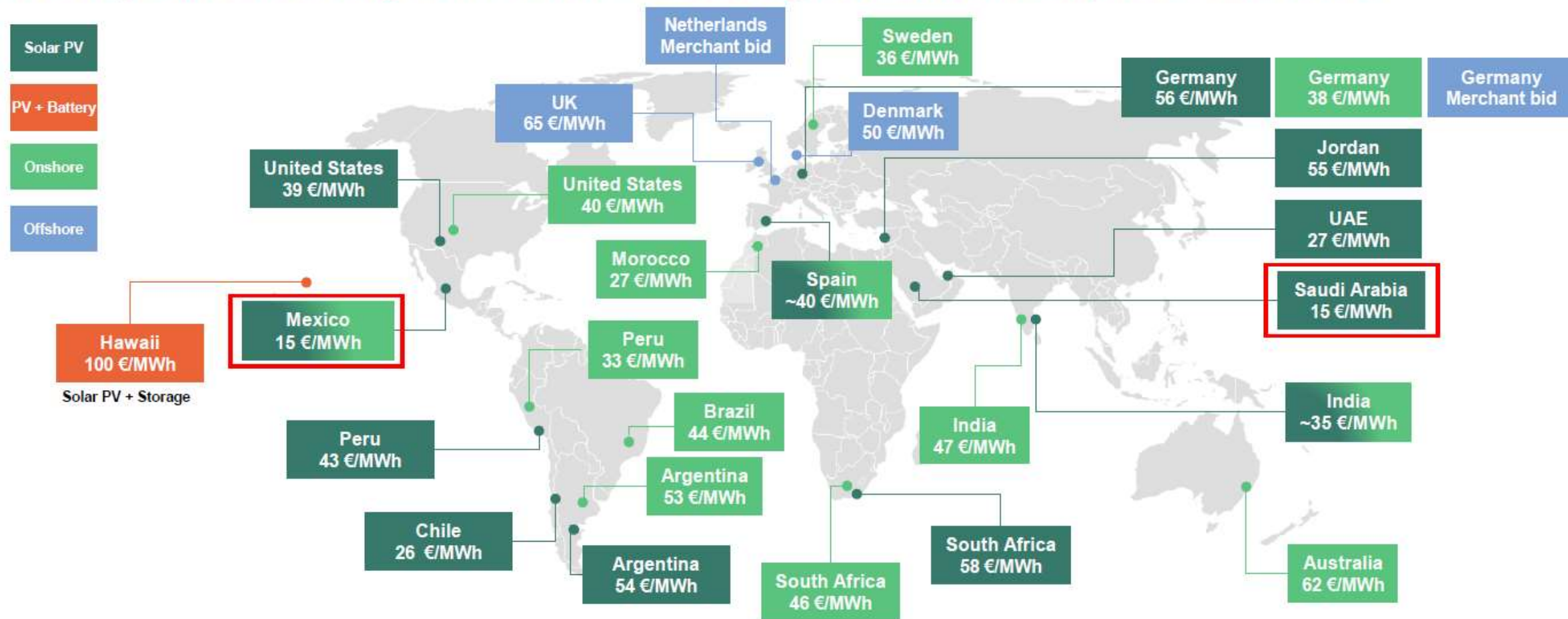


Fortum total

Note:
All figures, except "Fortum total", include only European power generation.
Source: PwC, December 2017, Climate Change and Electricity (including those companies with data for power generation available only), Fortum

Onshore wind and solar PV have become competitive among new power plants in most regions across the World

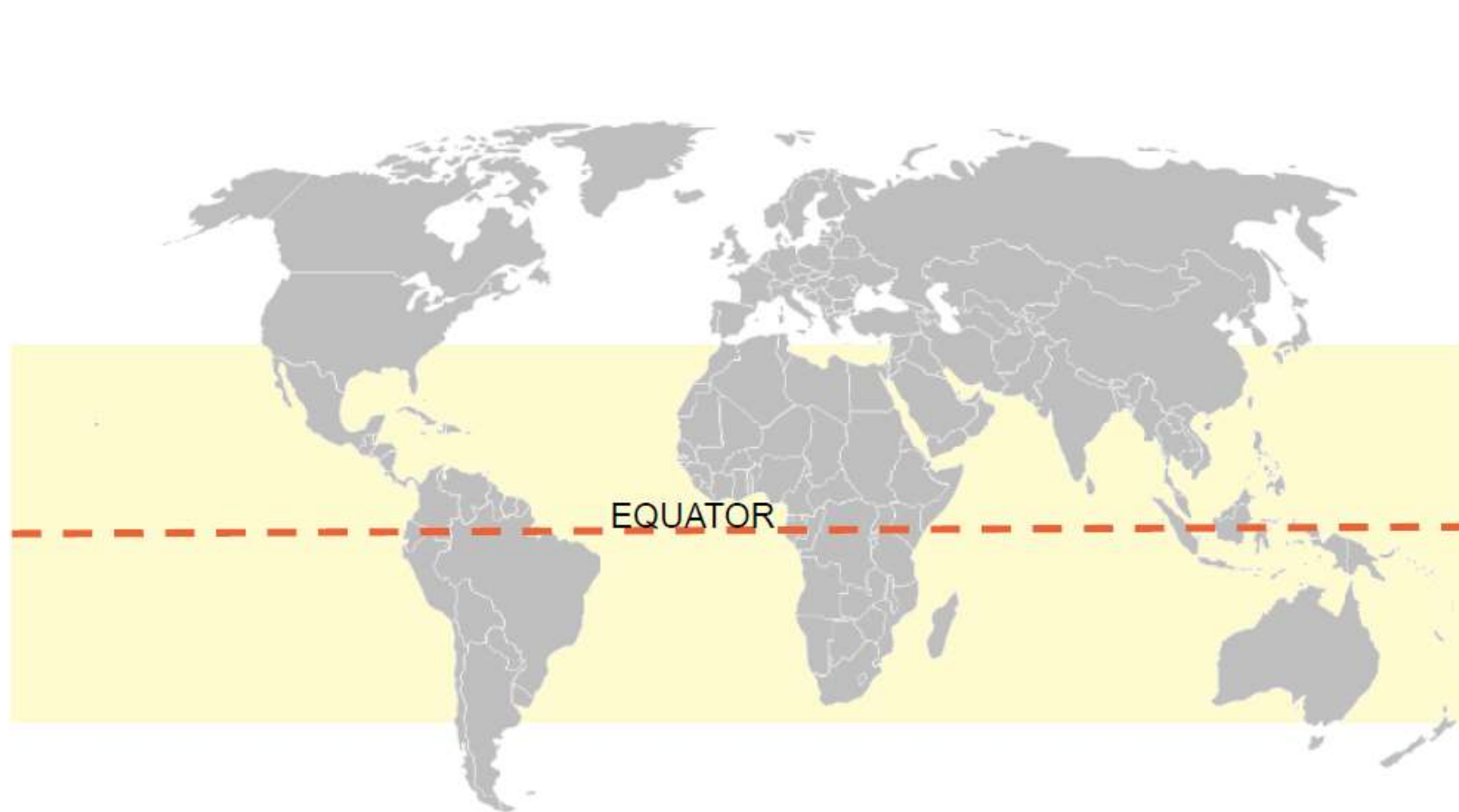
Recently announced long-term Power Purchase Agreement contract prices / tariff levels¹



¹ Sources: announcements by the investing companies and IEA report "Renewable Energy Medium-Term Market Report 2015" for US, Brazil, South Africa, Australia and Jordan. Values reported in nominal euros. United States values calculated excluding tax credits. Typical contract lengths are 15-25 years. The prices indicate levels with which investors have been willing to invest, however, they may not describe the actual comparable costs as the bid prices may be reduced by preferential land prices, site exploration cost, targeted low-cost loans etc. For Sweden the price level at which investors can hedge their renewable production for the next 4 years: average of 2017-2020 electricity (LUL) + elcertificate futures with 29.8.2016 closing prices. In Spain, wind and solar built on market prices with only downside protection mechanisms in case of significant drop in market price. Germany and Netherlands have had merchant bids in offshore were grid connection is provided by TSO.

Future energy system features:

- Security of Supply a limited resource
- Energy a non limited resource



- Clear Seasonality
- Wind most competitive
- Intermittent power

- Low seasonality
- PV most competitive
- Intermittent power

A wide-angle photograph of a vast solar farm at sunset. The sun is a bright, glowing orb in the upper left corner, casting a warm, orange light across the sky and the rows of solar panels. The panels are arranged in long, straight rows that recede into the distance, creating a strong sense of perspective. The ground between the rows is dark and flat. The overall atmosphere is serene and emphasizes the scale of the renewable energy installation.

In less than 2 hours the earth receives the amount of energy we consume annually

We grow in solar

We continue to develop our solar business to secure our longer-term competitiveness.

Our immediate focus is in **India**. The country offers one of the best solar resources and sound government support for the development of the solar sector.

Our solar plants in India

5 MW Amrit, Rajasthan

10 MW, Kapeli, Madhya Pradesh

70 MW, Bhadla, Rajasthan

100 MW, Pavagada, Karnataka

Fortum to supply the biggest solar electricity system in Nordic history to S-Group

40 commercial buildings where electricity consumption peaks during summer

In the best cases solar energy to satisfy **100% of the electricity needs** of one building in the summer

30% increase in solar power production capacity in Finland

We grow in wind

We focus on areas closer to our current markets, in the **Nordics** and in **Russia**, where the market conditions are more suitable for wind power.

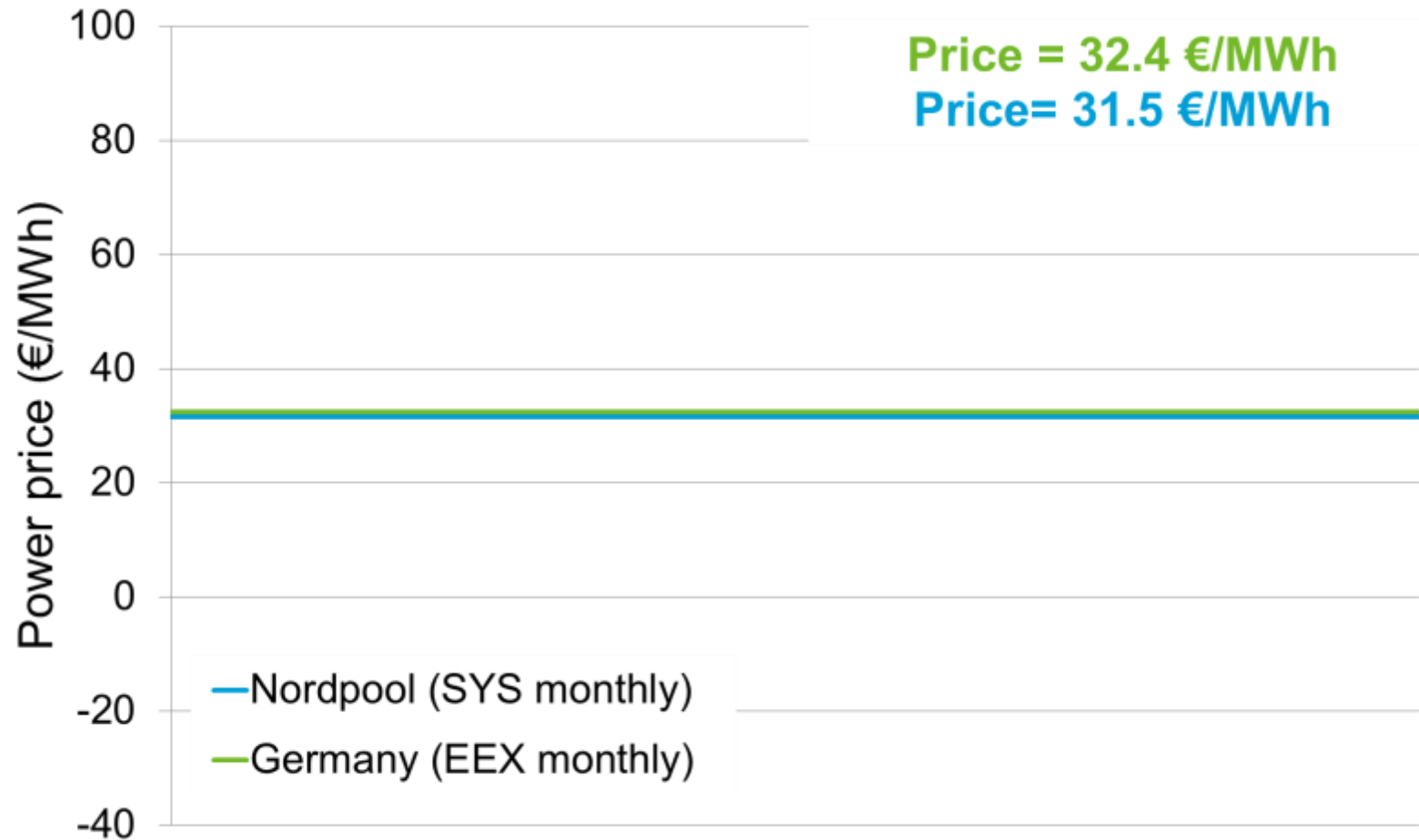
Our wind projects and farms:

- Nygårdsfjellet, Ånstadblåheia and Sørfjord, in Norway
- Blaiken and Solberg, in Sweden
- Ulyanovsk, in Russia

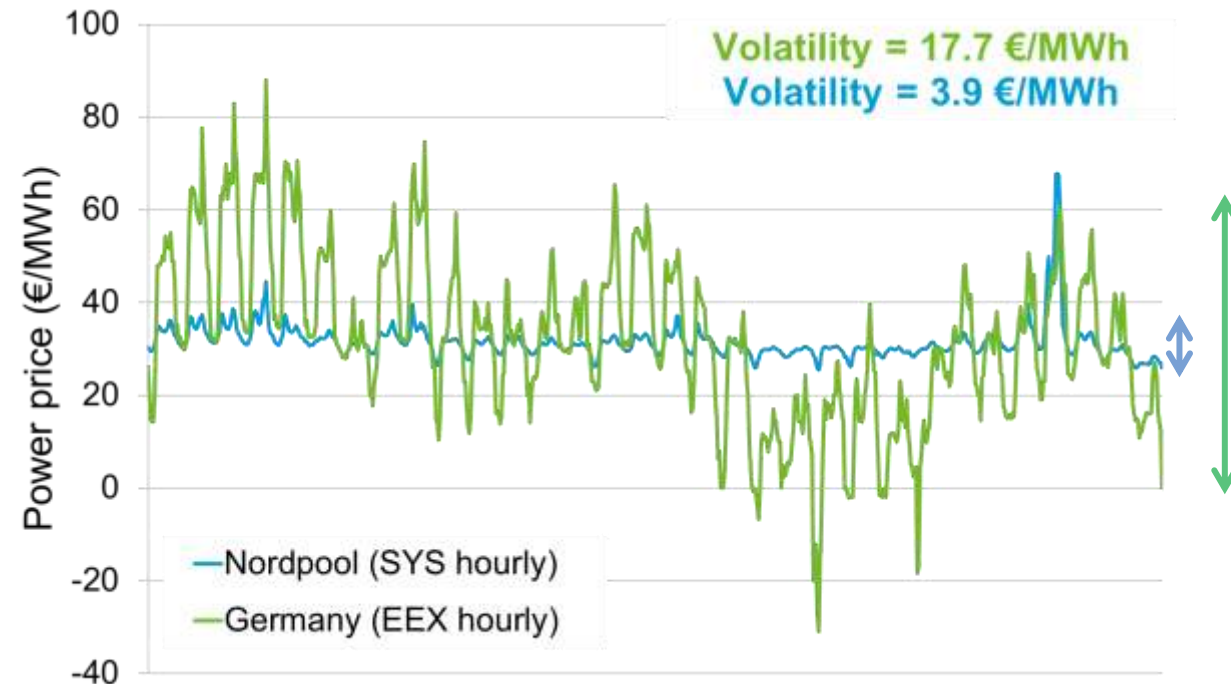
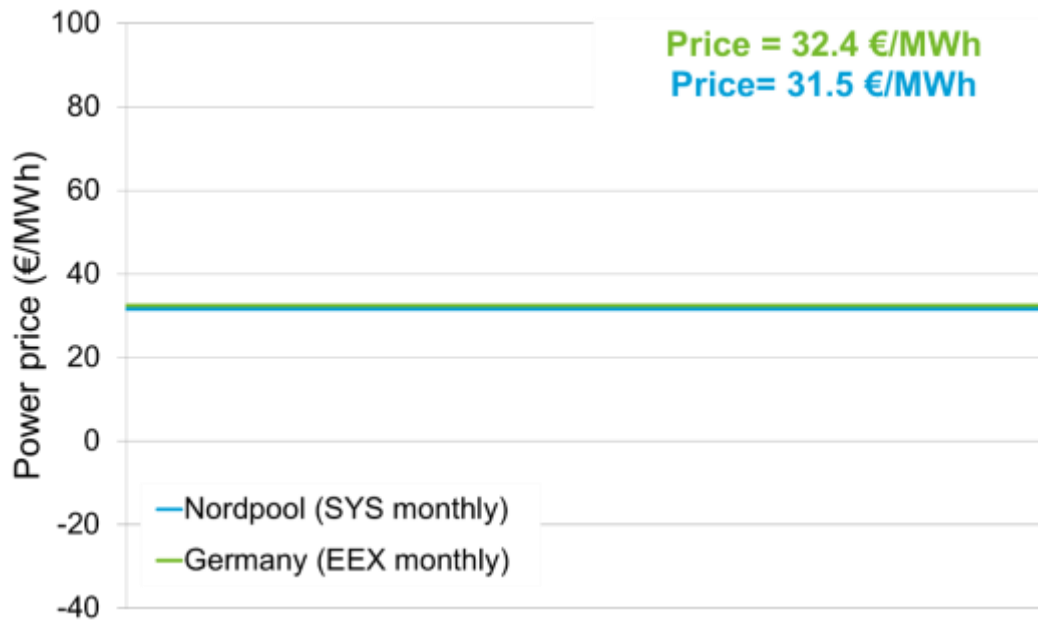
Solar & wind dominate the future of energy

- Bloomberg New Energy Outlook 2017:
- Solar electricity has got 72% cheaper since 2009, with another 67% reduction forecast by 2040
- By 2040 Solar and Wind are the two largest categories and fossil fuels make-up less than a third

Average power prices in Nordics and Germany were very close in December 2014



... but hourly prices were very different: Price pattern is becoming more important than average price



Emobility is about

Environment

Emotions

Economy

Fortum Charge & Drive, Norway



Environment

- Climate change and urbanization as megatrends
- In Nordics almost 90% of power production is CO2-free
- Solar and Wind energy growing globally

Emotions

- Silent, Smooth, Safe, Speed
- Range anxiety
- It is about getting people to try electric vehicle: one-way street

Economy

Today

- Efficiency 3 X internal combustion engine (ICE)
- Driving 100km with 15kWh and 2€ (Finland, home charging)
- Service: EV 20 moving parts, no gears, no oil. ICE 2000 moving parts.
- Ownership with **4% utilization rate** and **10 000€ annual cost**

What about tomorrow?

- Or sharing autonomous car with **40% utilization rate** and **1 000€ p.a.**

Future of mobility

- **C**onnected
- **A**utonomous
- **S**hared
- **E**lectric



Emobility with Renewables, Demand Response, Batteries, & V2G



Our services will change our customers' lives

Solar
panels

Electricity
retail

Smart
heating

EV
charging

Smart
living
solutions

Virtual
power
plants

Insurances

We are building smart and helpful services that give our customers peace of mind.



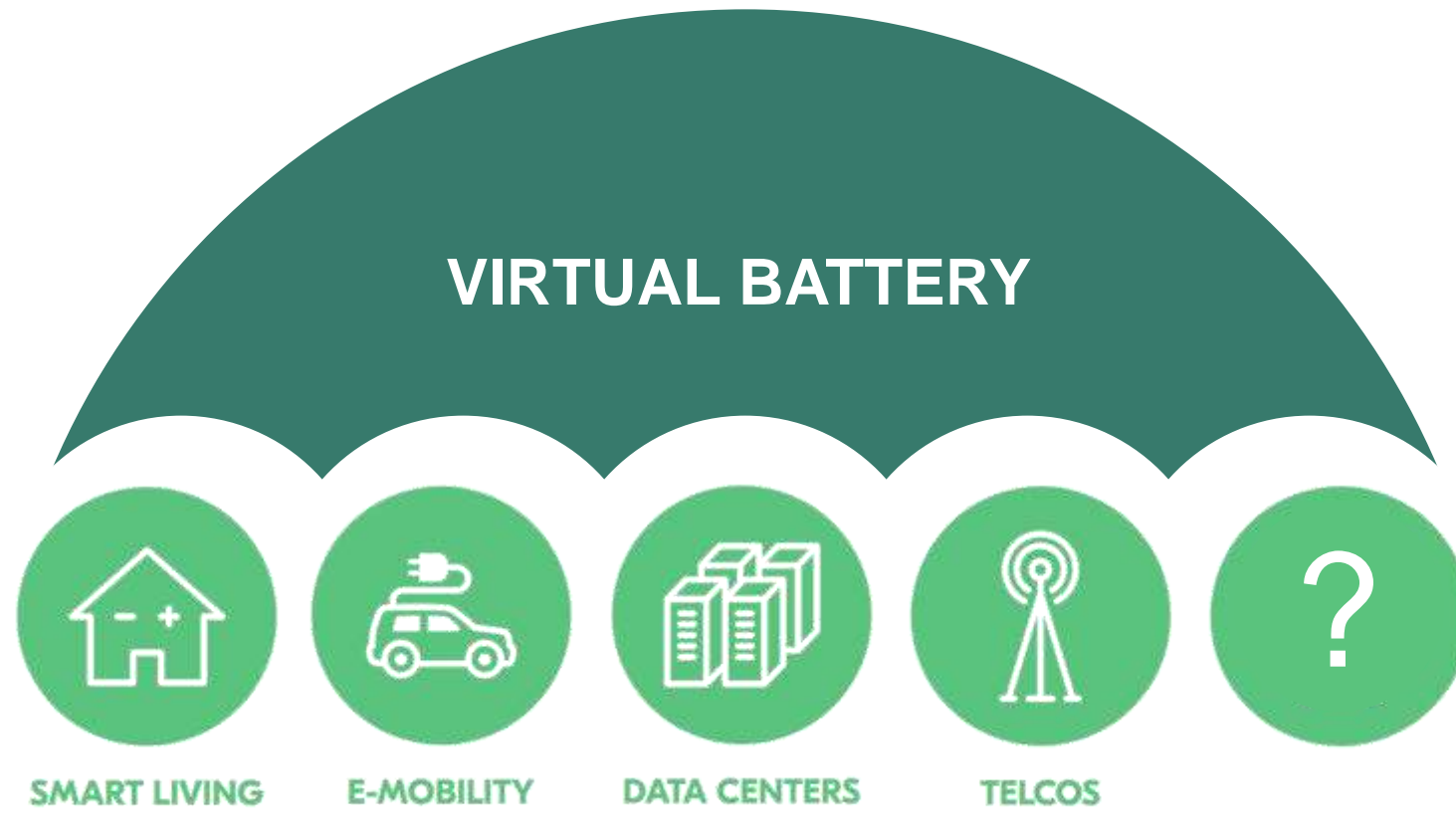
Digitalization and renewable energy are best friends

Billions of appliances are connected to internet and electricity grid

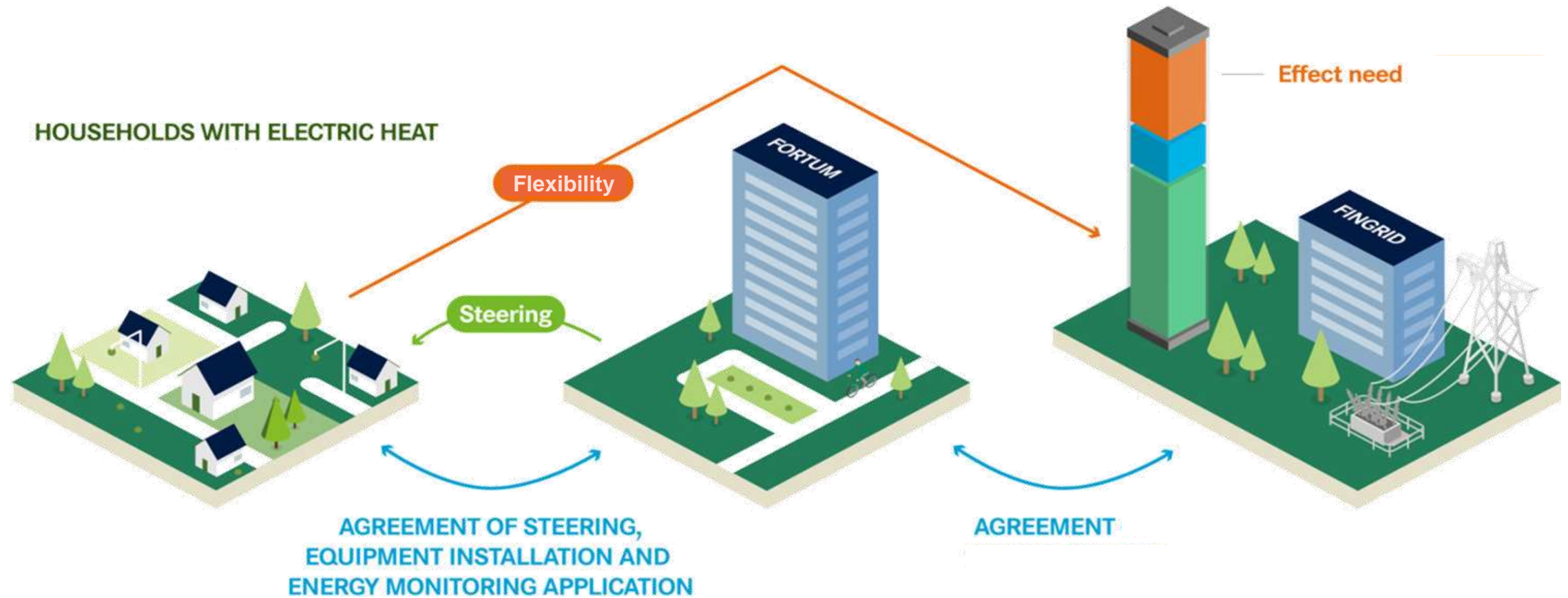
Technology is in place, only framework for flexibility needed

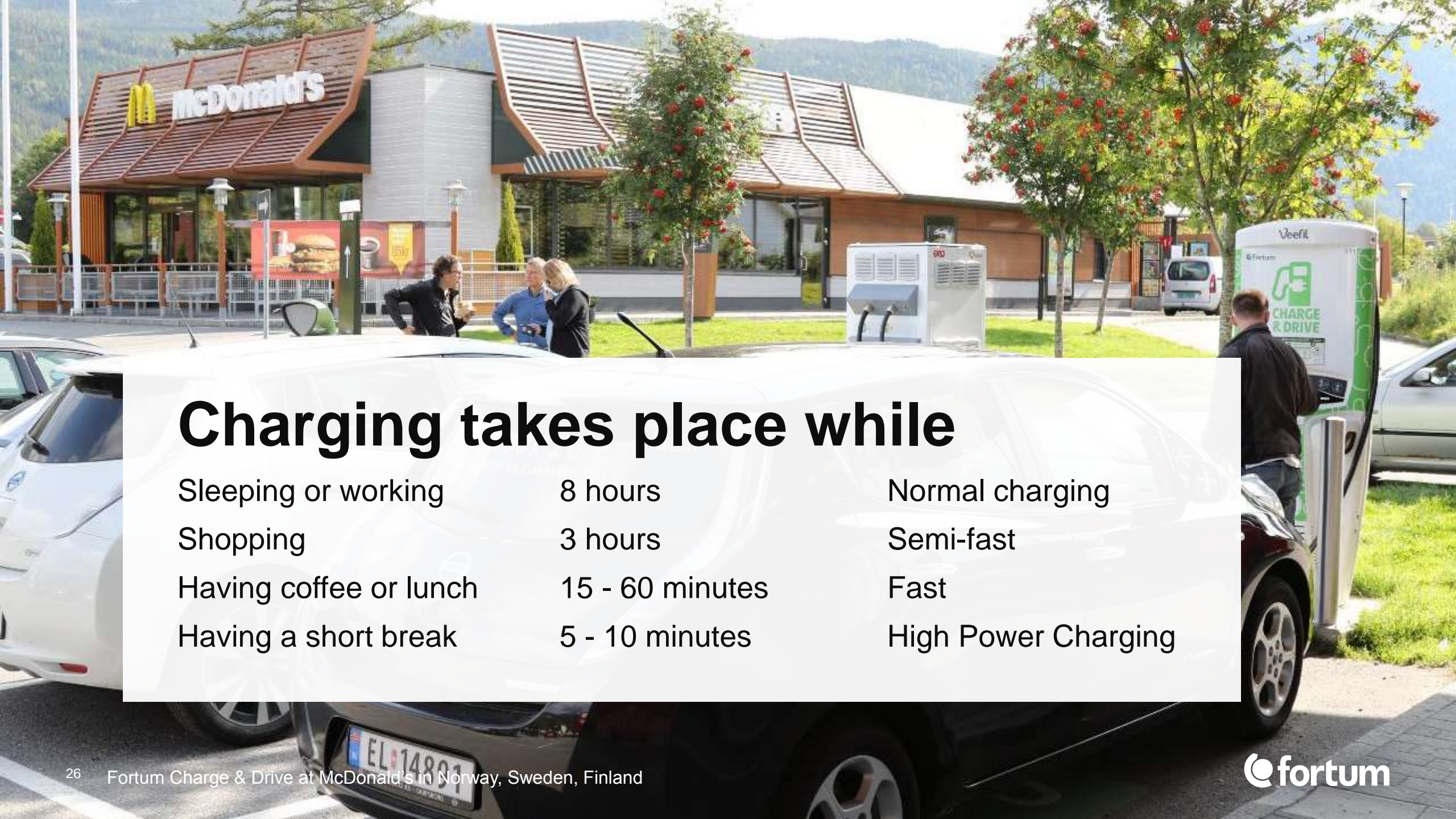


Spring by Fortum is building a virtual battery for distributed demand-side resources



In our groundbreaking case, household loads are sold to balance the system in the Frequency Containment Reserve (N)





Charging takes place while

Sleeping or working	8 hours	Normal charging
Shopping	3 hours	Semi-fast
Having coffee or lunch	15 - 60 minutes	Fast
Having a short break	5 - 10 minutes	High Power Charging

Case: Vulkan, Oslo

- **100 flexible semi-fast charging stations** (22 kW) & 2 fast-charging stations with support for both the CHAdeMO and CCS standard (50 kW, & 150 kW at a later time)
- A **battery solution** to balance the phase distortions and reduce peaks in the power grid. This means EVs get more power at every single charge point
- Use of a display or an app to **select charging speed**
- Possibility to **reserve charging spots** via an app
- Power balancing with **battery storage**
- **V2G ready**



Smart Charging at Fortum Espoo HQ

- 92 semi-fast chargers with smart load management
- 2 rapid charging stations
- 1 vehicle-to-grid charger
- Planning the pilot for inductive charging
- Only electric vehicles and plug-in hybrids to be selected for company cars.
- Office charging makes EVs possible for people who live in the city center without home parking/charging possibilities.

High Power Charging Corridor Oslo-Stockholm-Turku-Helsinki

- Connecting Nordic capitals with four stations
- Enabling the next step in eMobility, also in longer distances
- 150 kW = 125 km range in 10 minutes
- 350 kW = 300 km range in 10 minutes
- Opening of the first chargers on April 5 near Oslo
- 2 stations to be opened in Sweden and 1 in Finland during 2018





Digital Services for Emobility





Fortum Charge & Drive is the leading EV charging service provider in the Nordic countries



CLOUD SERVICE

Business software for operating any smart charging network



TURN-KEY SOLUTION IN NORDIC HOME MARKETS

Comprehensive charging solutions for B2B & B2C

Fast facts

- **Serving 75 000 registered users**
- **Over 2100** chargers of which **700** fast chargers and **2 HPC**
- **Market leader in Finland and Norway**, the frontrunner in the global EV market
- **Finland: over doubled the network in a year** to almost 250 chargers (500 charging outlets)
- Cloud service for operating charging networks, **16 countries**
- **Started operations in India 2017**

Charge & Drive Serves Multiple Industries (a few examples):

Property & Estate Management



VASAKRONAN



Utilities (White Label)



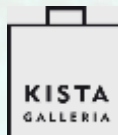
Charge Point Operators (White Label)



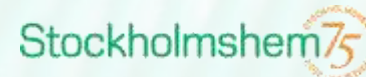
Retail & Restaurants (grey label)



TÄBYC



Municipalities



Fuel Stations



Car Manufacturers



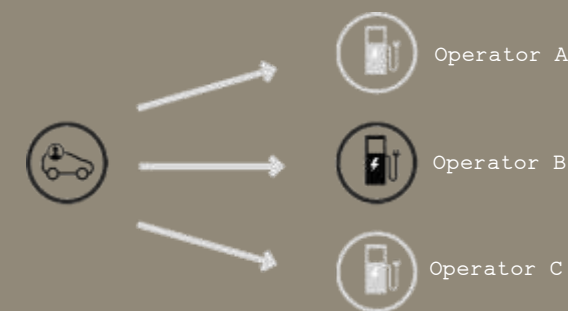


EUROPE'S LARGEST CHARGING POINT NETWORK

1. EV Drivers need multiple contracts to access multiple charging station networks:

2. This creates a problem for the driver and the charging network:

3. Plugsurfing platform solution enables users to find and pay for charging at partner networks:



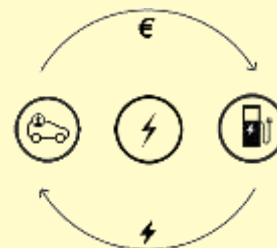
Island solutions for the EV driver



Multiple interfaces to access & pay for charging

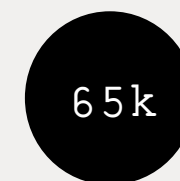
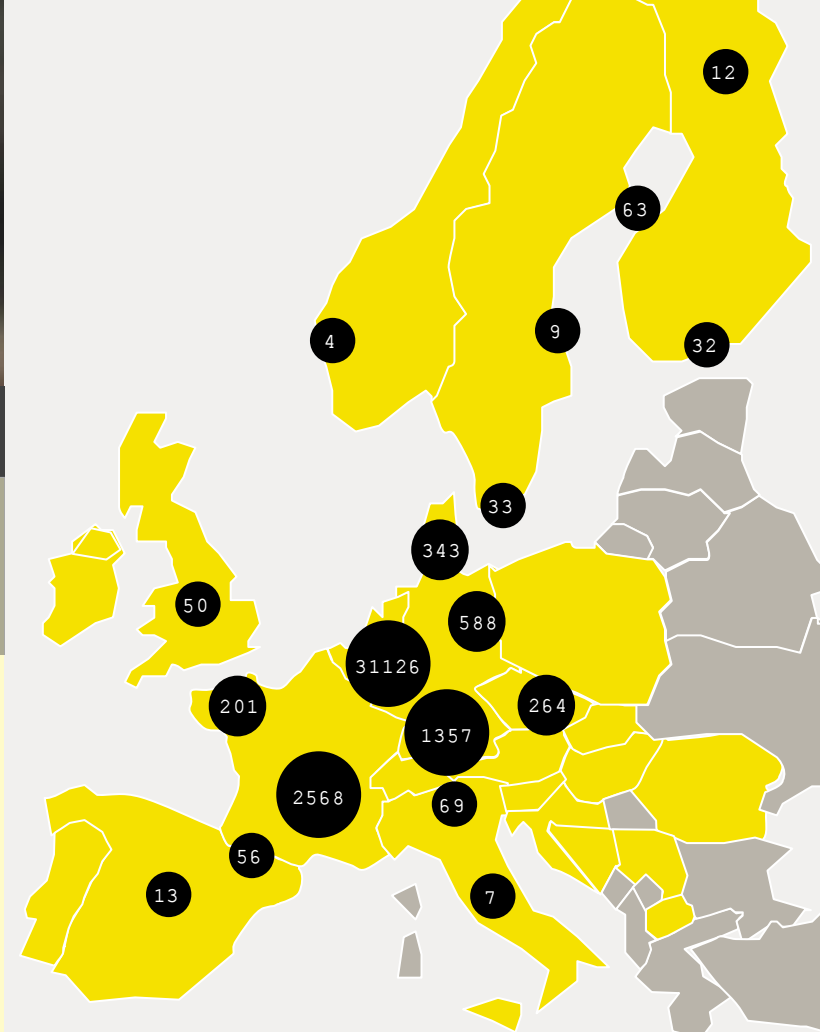


High customer acquisition costs for the charging point operators

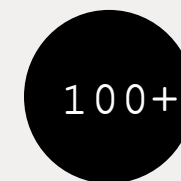


PLUGSURFING HANDLES:

USERS | CONTRACTS | BILLING



CHARGING POINTS



NETWORKS



SERVICE POINTS

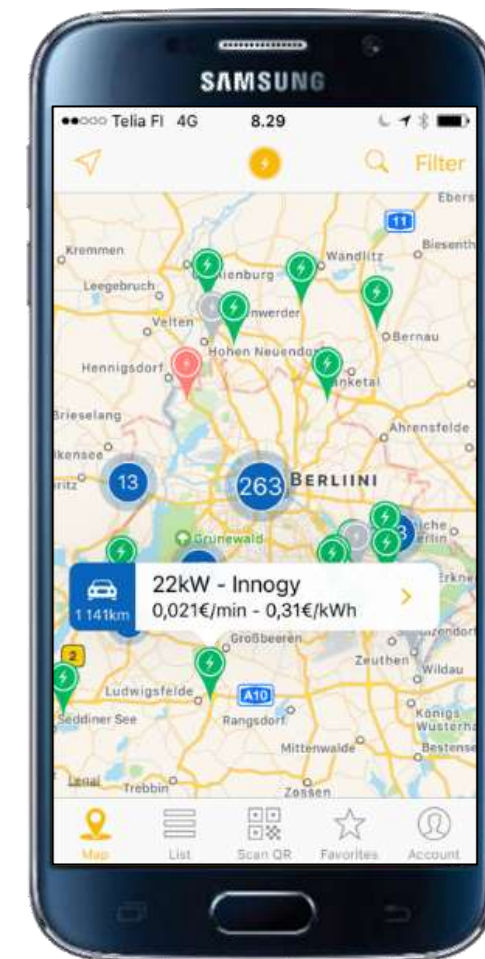
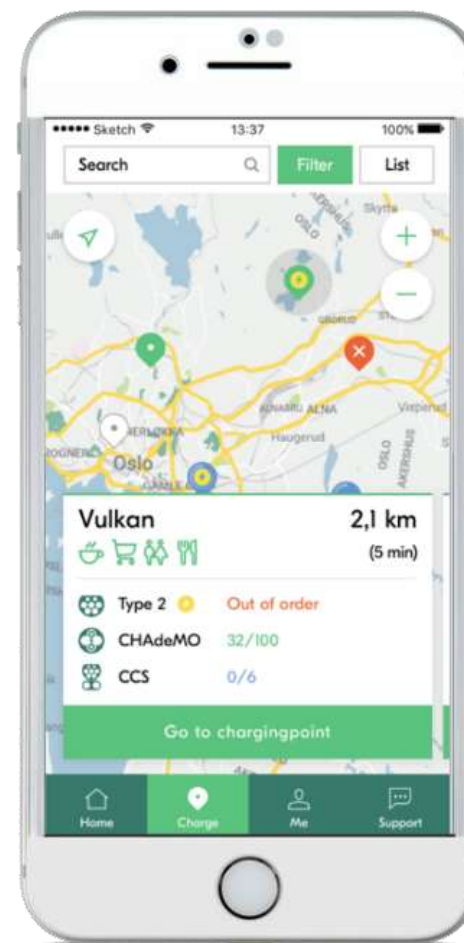
 **Fortum
charge
& drive**

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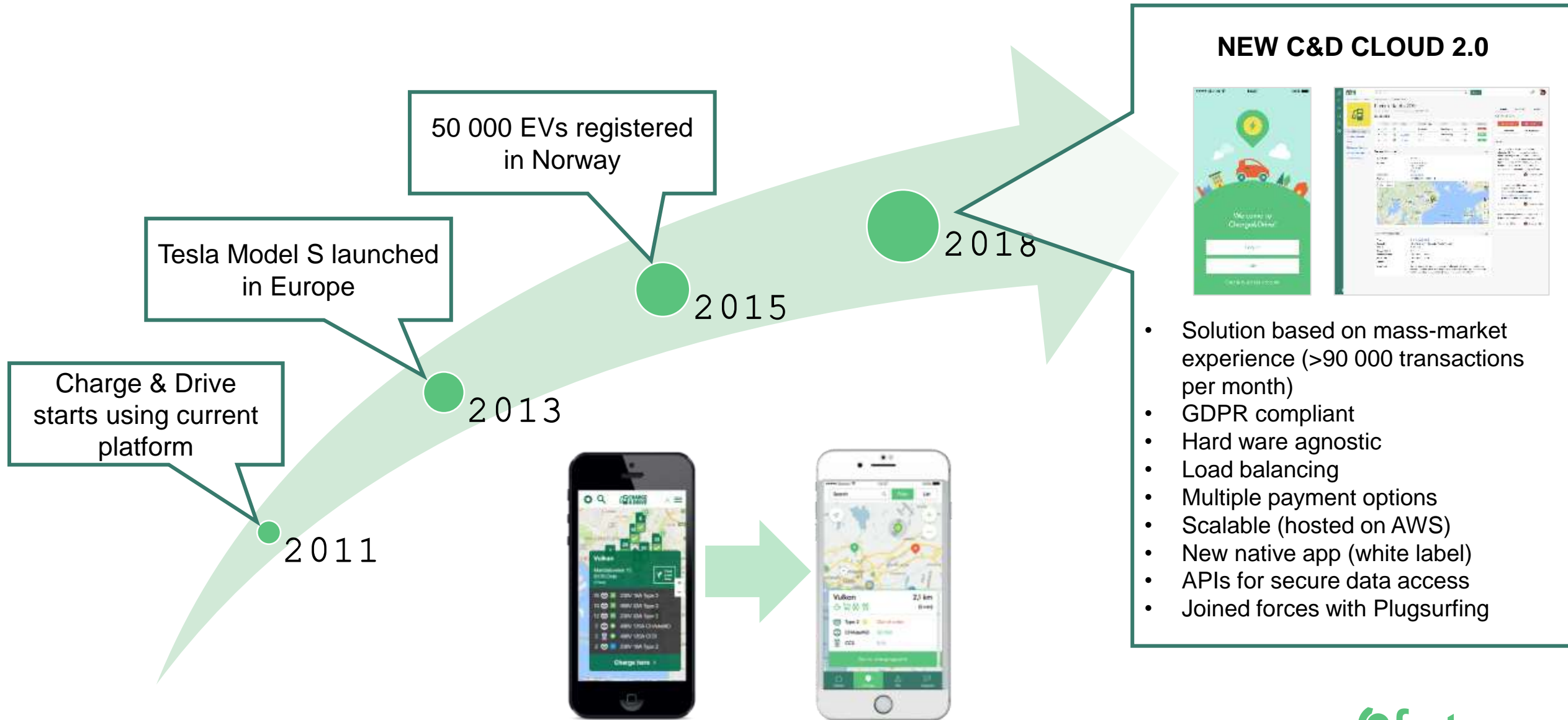
 **PlugSurfing**

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67000 CHARGERS
33 COUNTRIES

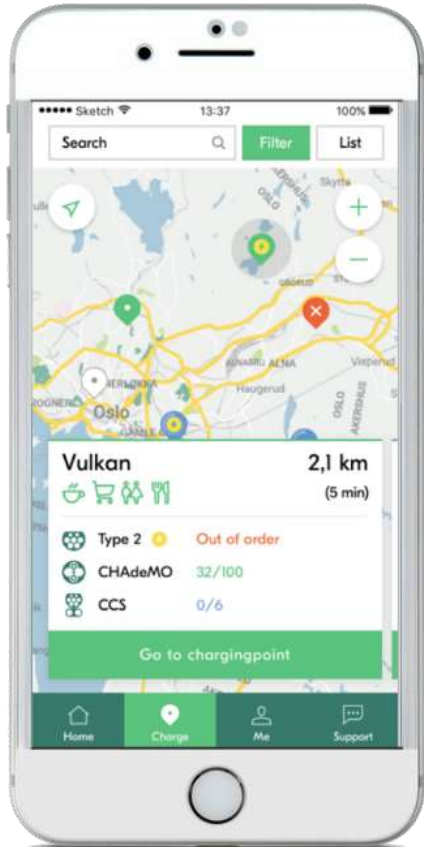


Charge & Drive platform has been used by Fortum since 2011



Charge & Drive Cloud 2.0 has two main parts:

1. Interface for the EV driver (native app)



- **Helps the EV driver to (a.o.)**
 - Locate charger and start/stop charging
 - Manage payments
 - Contact customer support
 - See charging history
- **Launched in Q1 2018**
- **Offered as white label in Q2 2018**



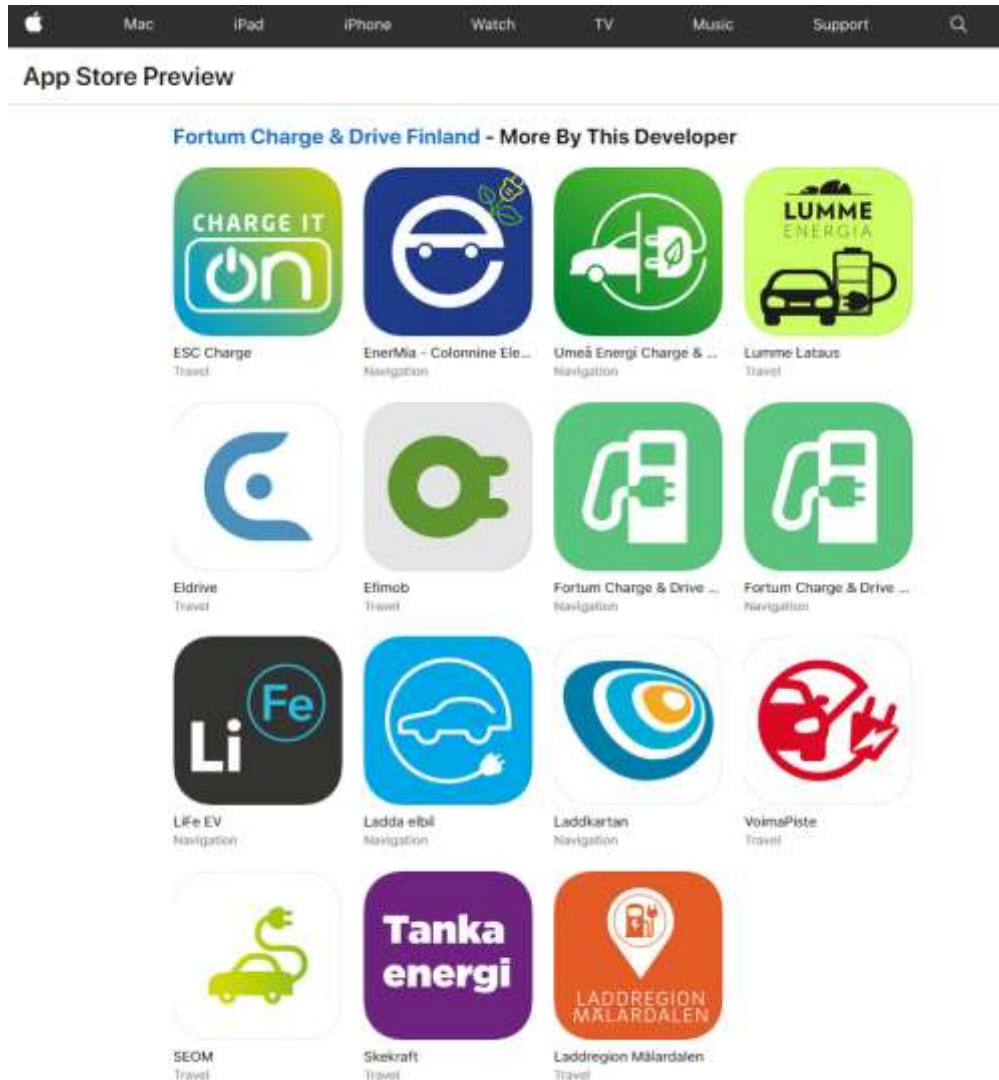
2. Back-end platform for business operations



- **Connect and configure chargers**
- **Monitor network performance**
- **Manager customers (CRM)**
- **Price plan administration**
- **Technical error detection**
- **Enable business analytics**
- **Launched in Q1 2018**
- **...and more**



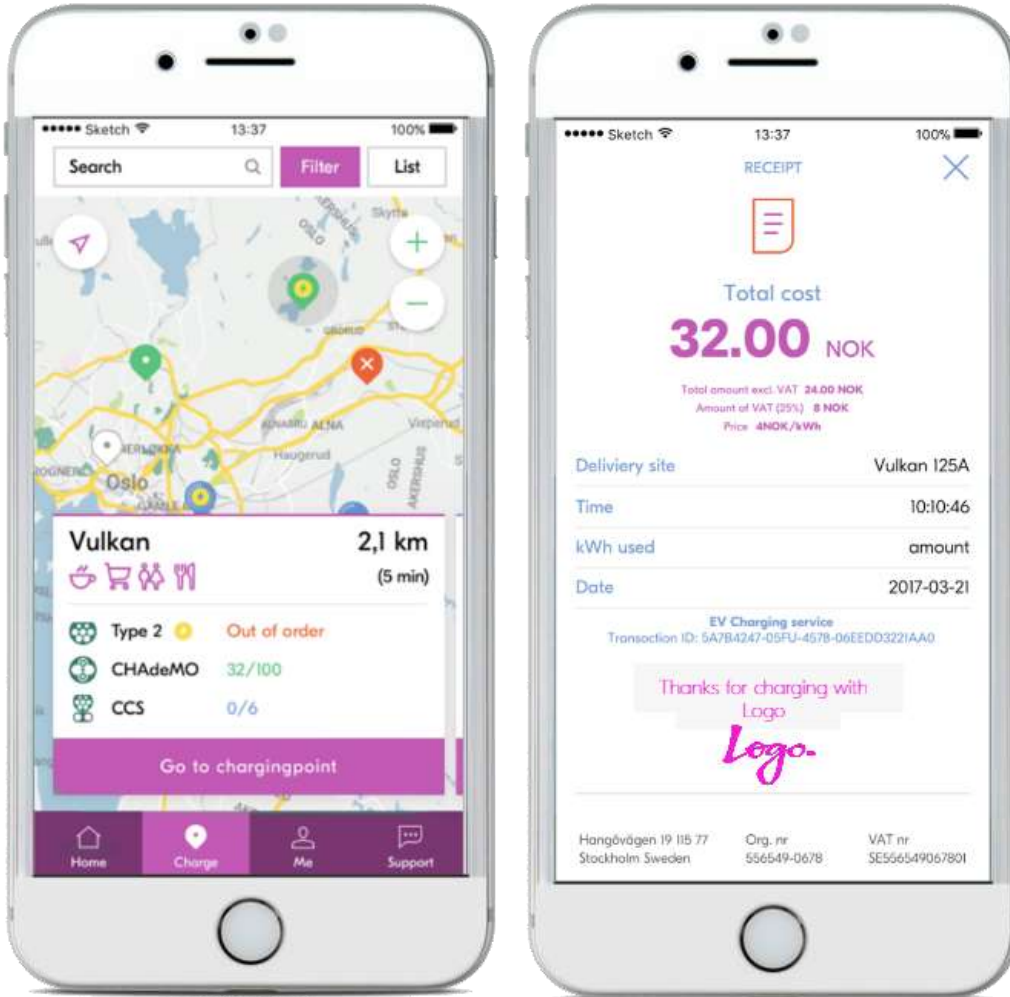
White label native app



- Already over 15 white label apps published, more coming this spring.
- Branded versions on iTunes and Google Play app stores
- White-label mobile apps from Fortum Charge & Drive ensures continuous improvements and stable processes.



White label native app



- A white-label version of the native app available in Q2 2018.
- iOS & Android versions
- Branded versions on iTunes and Google Play app stores
- White-label mobile apps from Fortum Charge & Drive ensures continuous improvements and stable processes.



Too much to remember? Remember this:

Fortum Charge & Drive, Norway

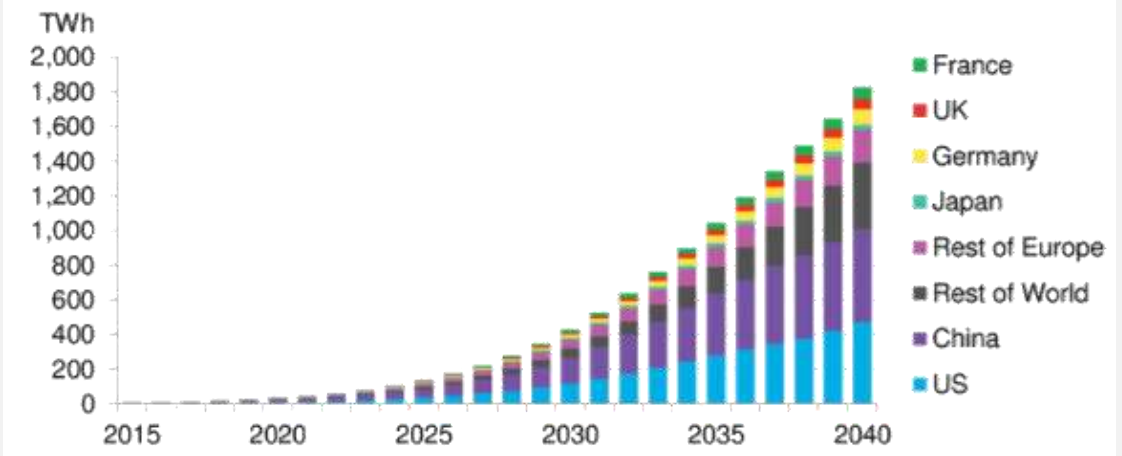
 fortum



There will be **530 million** EVs on the road by 2040, representing 33% of the global car fleet.

Source: BNEF EV Outlook 2017

EVs will require 1,800TWh of electricity in 2040



Source: BNEF EV Outlook 2017

EVs will play a vital role in smart homes, grid balancing & VPPs



**Fortum
charge
& drive**

Fortum Charge & Drive's ambition is to bring about the electrification of transport together with our customers and partners.

Join the change



@rami_syvari

Rami.Syvari@fortum.com

+358 40 709 5566