PERSPECTIVES ON ELECTRIC TRANSPORT AND GRØNN KONTAKT

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Statkraft

Agenda

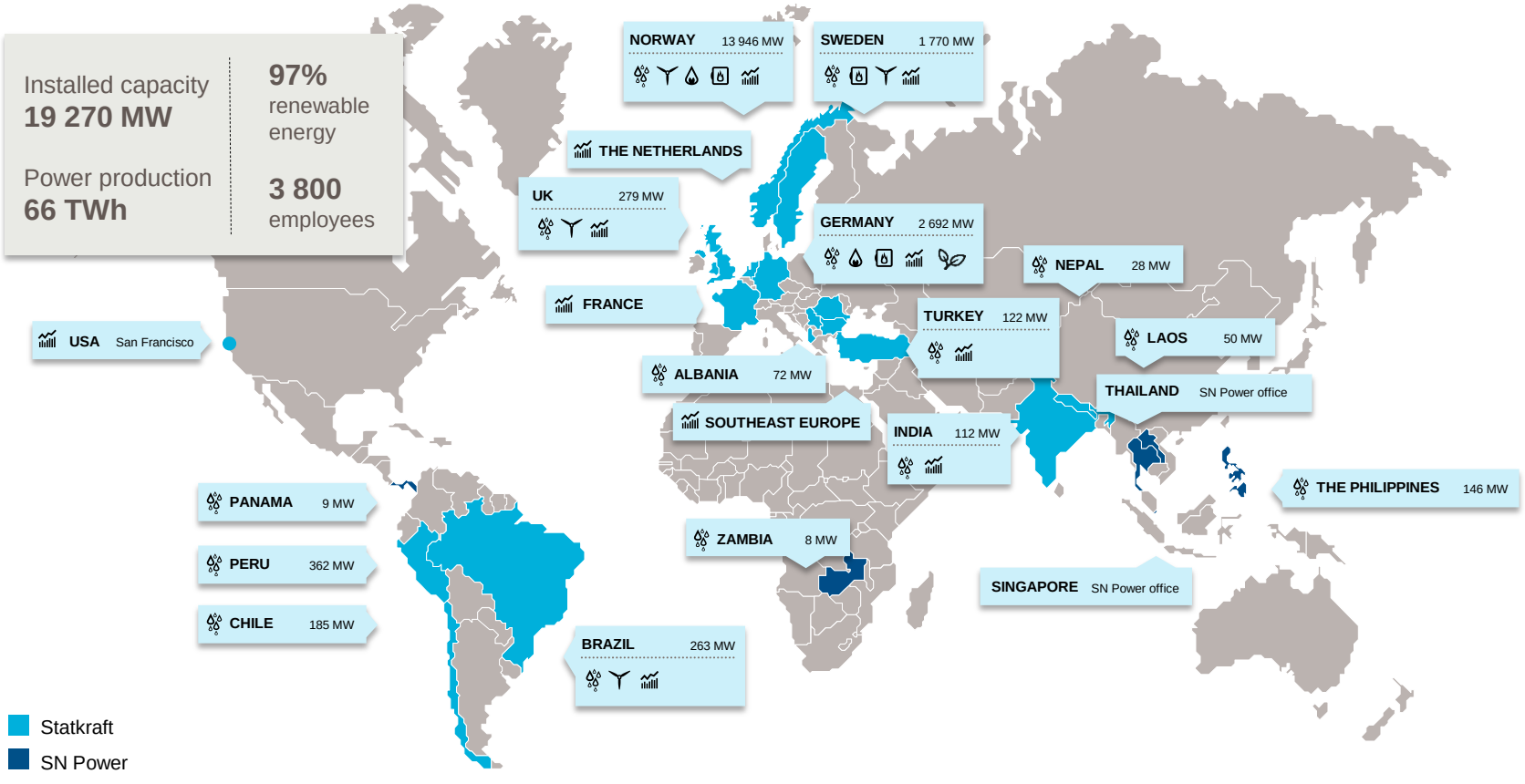
- **Statkraft and the future energy system**
- Drivers of transport transformation
- EV technology perspectives
- EV charging company: Grønn Kontakt

PROVIDING PURE ENERGY

Statkraft's ambition is to strengthen the position as a leading, international provider of pure energy

competent | **responsible** | **innovative**

Statkraft's global presence



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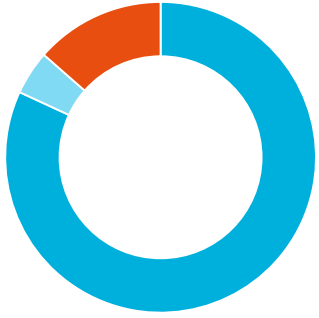
Key figures 2016

- Power generation:
  66 TWh
- Installed capacity:
  19 270 MW
- EBITDA*:
  NOK 13.8 bn
- Total assets:
  NOK 167 bn

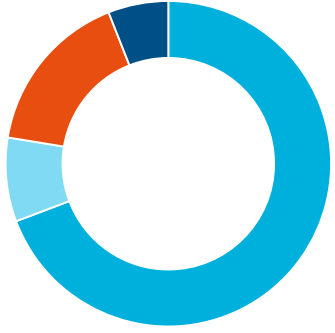
Technology**

- Hydropower 82%
- Wind power 5%
- Gas power 14%



Geography**

- Norway 69%
- Nordic region excl. Norway 8%
- Europe excl. Nordic region 16%
- The rest of the world 6%

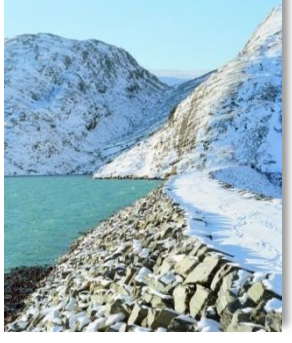


** Earnings before interest, taxes, depreciations and amortization*

*** Generation capacity*

Statkraft's strategic directions

EUROPEAN FLEXIBLE GENERATION



MARKET OPERATIONS

WIND POWER

INTERNATIONAL POWER

DISTRICT HEATING

NEW BUSINESS DEVELOPMENT NORWAY

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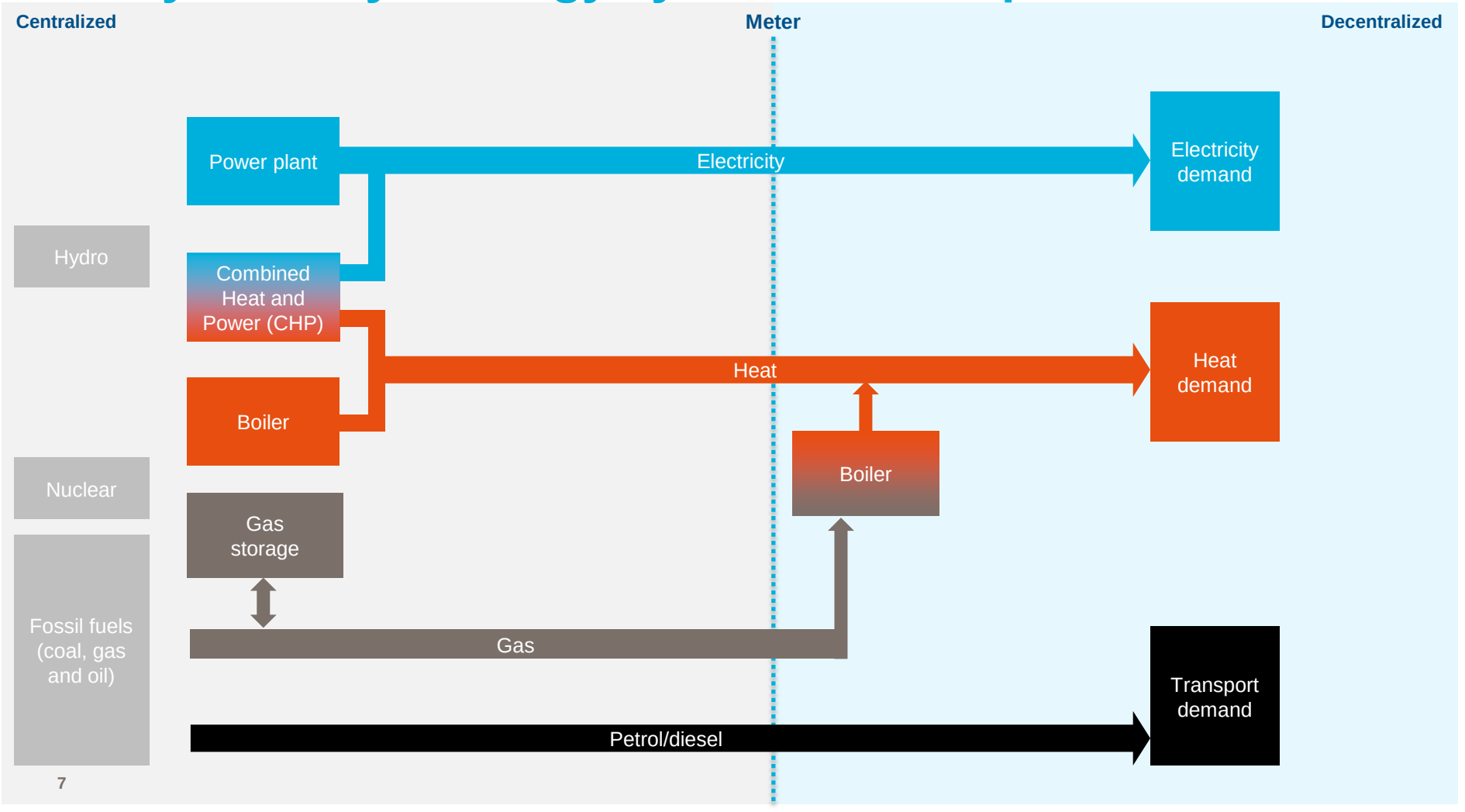
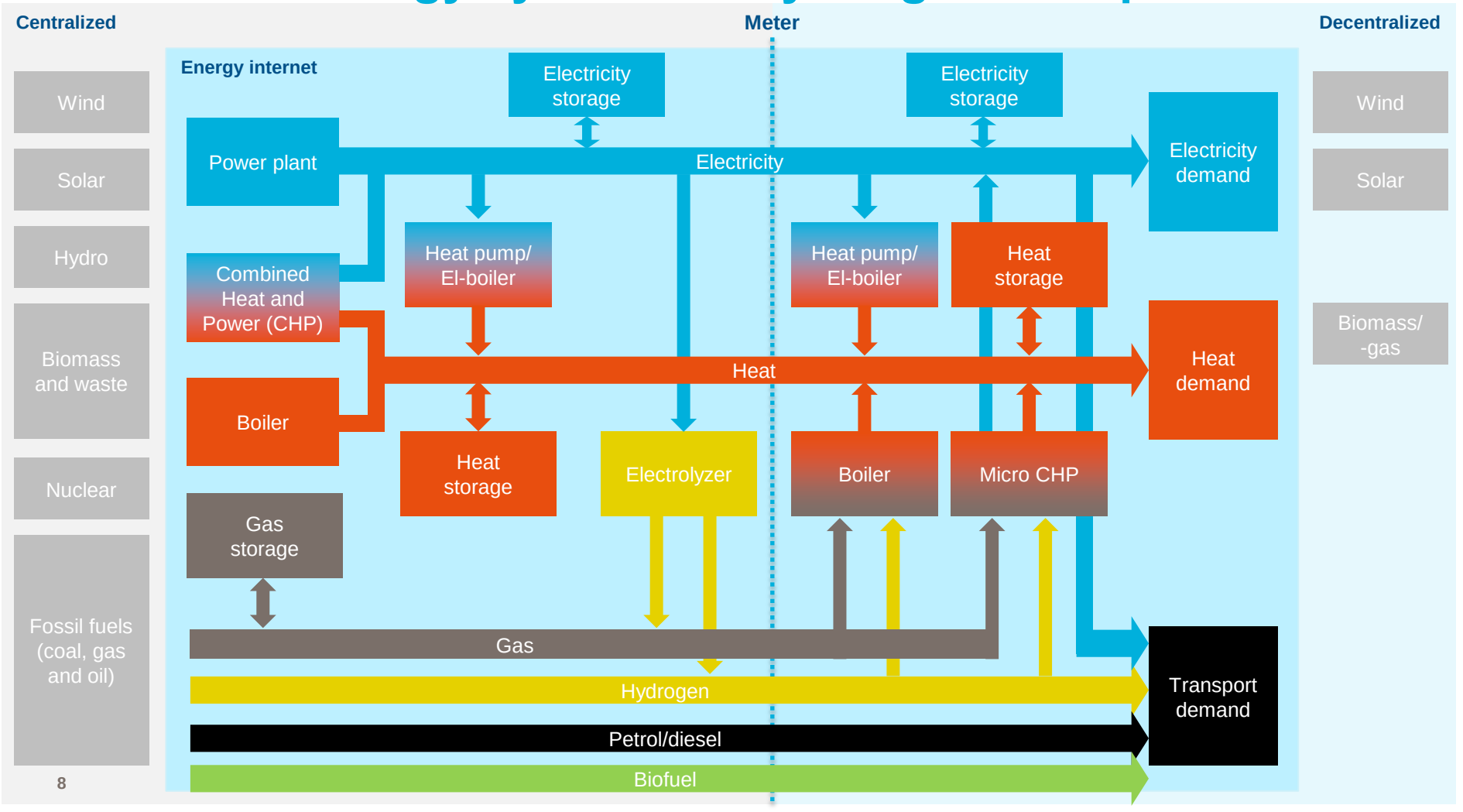
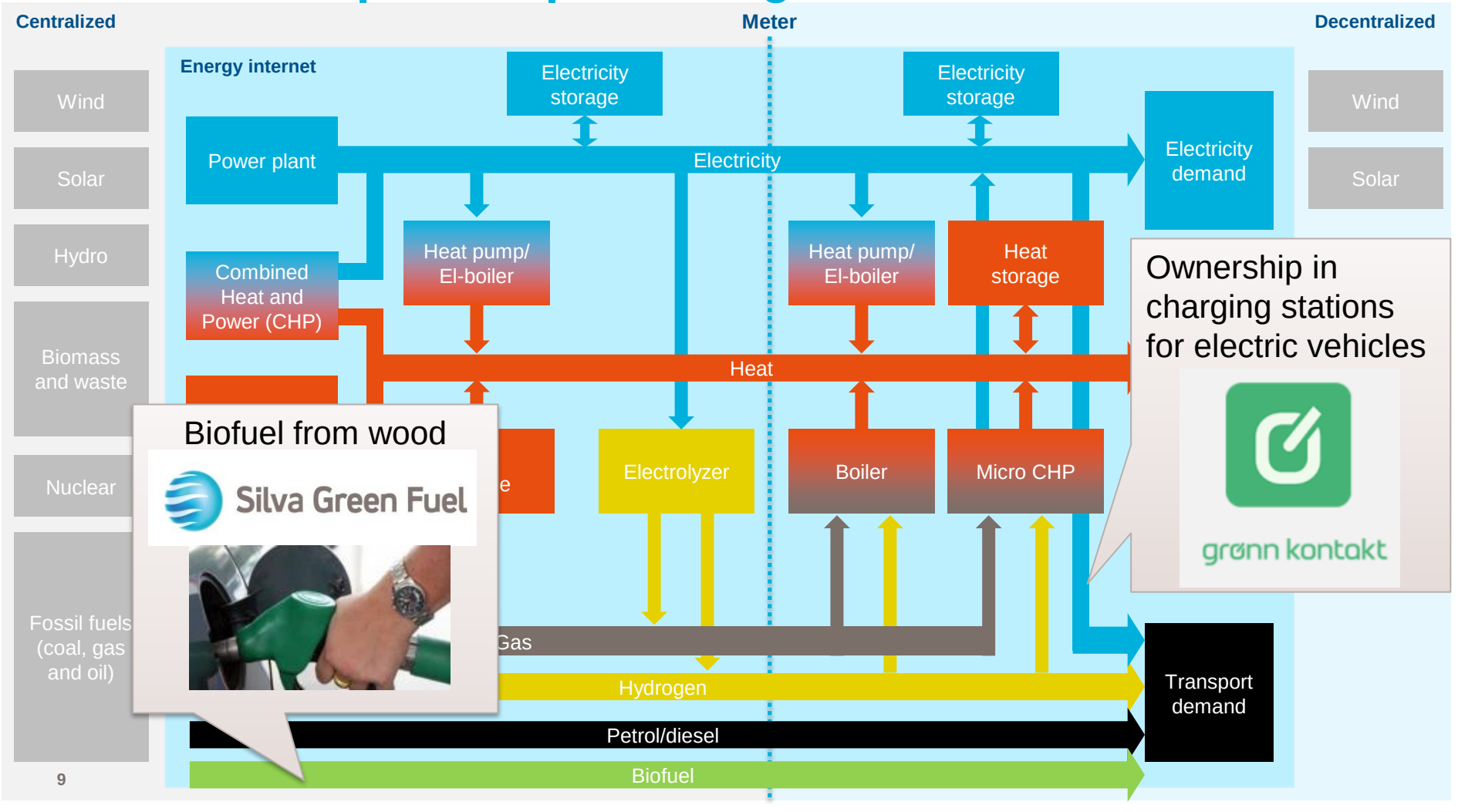
While yesterday's energy system was simple…



Tomorrow's energy system is anything but simple



Statkraft has initiatives within transport, and need to understand impact on power in general



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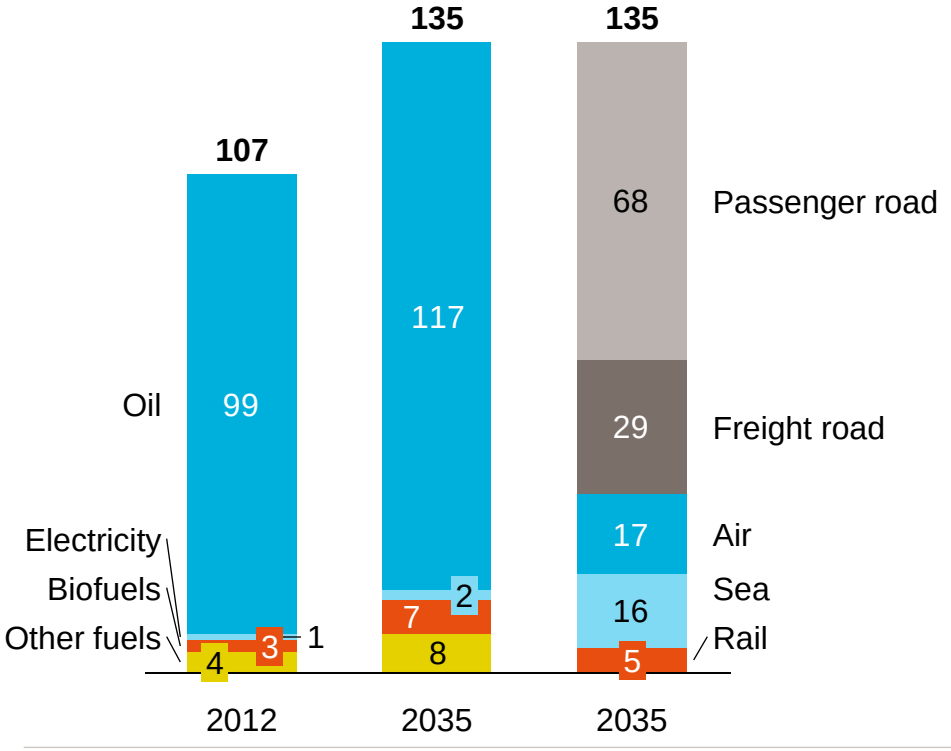
- **Drivers of transport transformation**
- EV technology perspectives
- EV charging company: Grønn Kontakt

A multitude of drivers within transport, in this presentation we focus on alternative drive-trains

Focus of this material

Energy use in transport, world (EJ)



Key drivers / trends

- GDP development & urbanization
- Car ownership share
- Car sharing schemes
- Autonomous driving
- Smarter public transport
- Modal shifts
- Alternative drive-train technologies

- Allow stronger political goals for minimizing CO2 and local emissions

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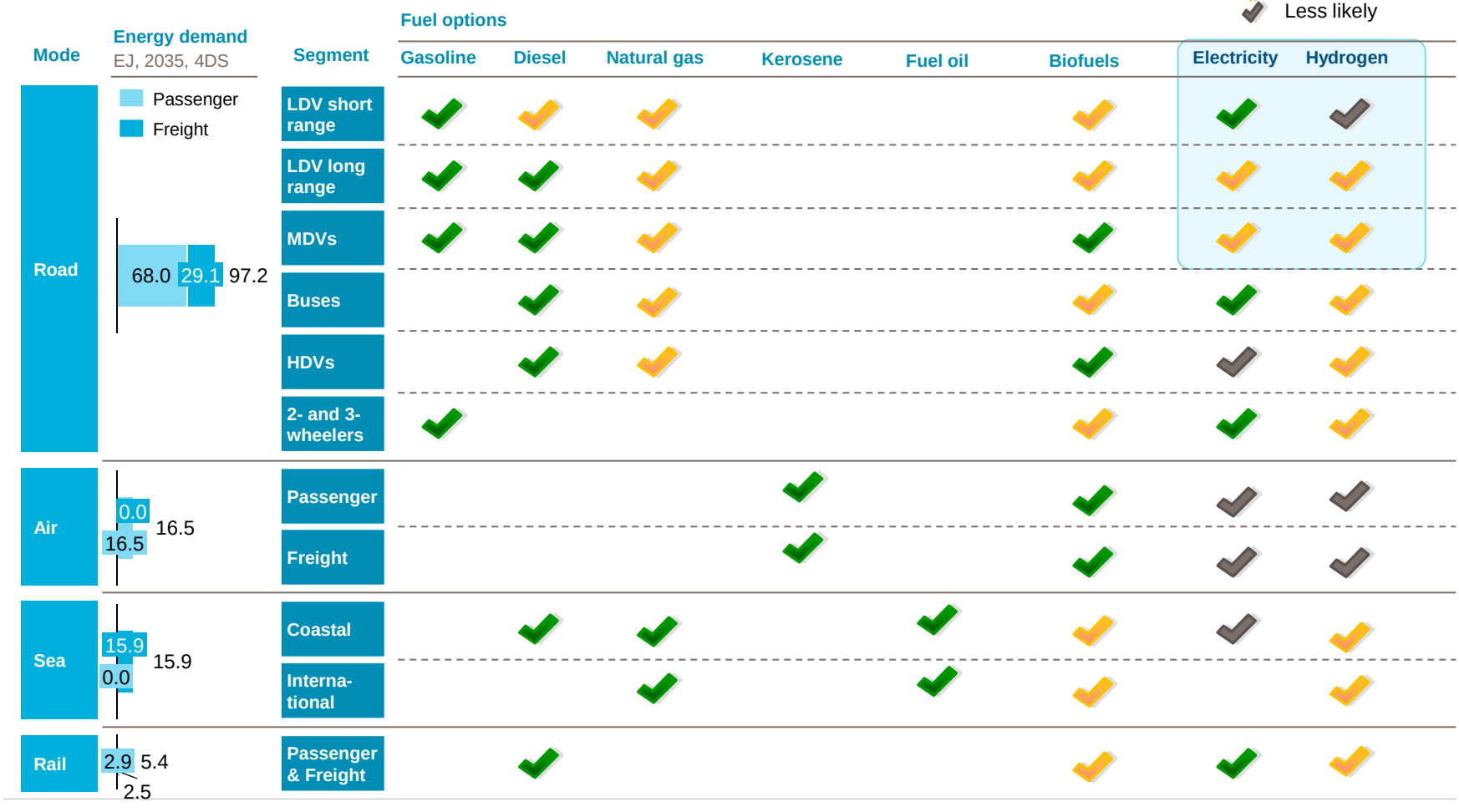
Electricity, biofuel and hydrogen will compete with fossil fuels in selected transport segments

Focus of this material

Key fuel/powertrain
Competing fuel/powertrain
Less likely



Source: IEA Energy Technology Perspectives «Pathways to a clean energy system» (2012); IVT analysis

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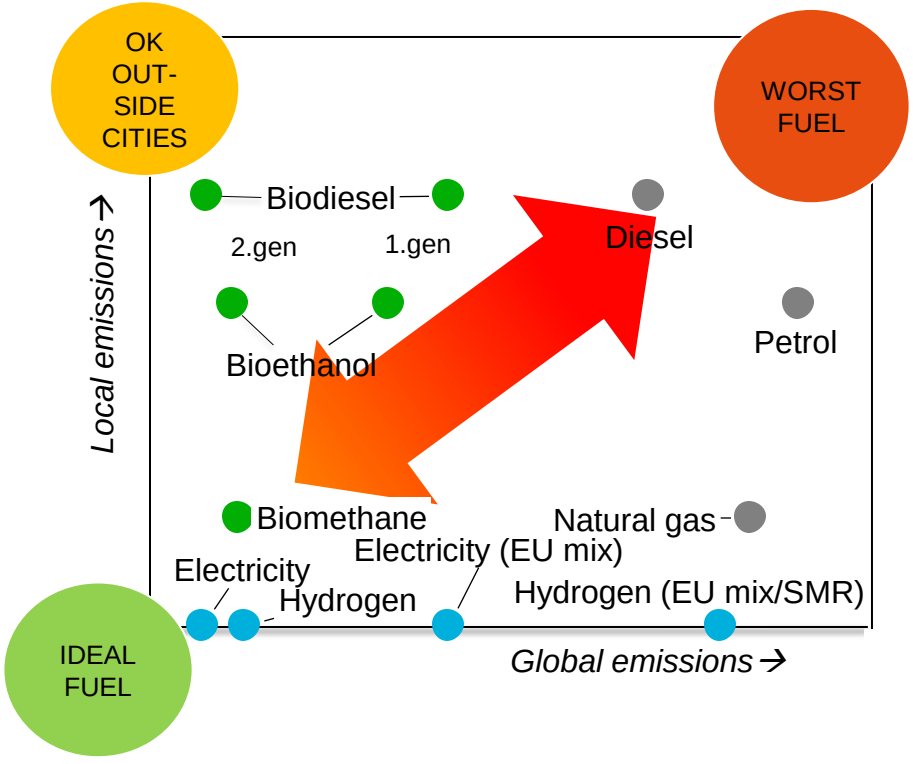
Transport fuels have global and local impact on the environment – the best fuels have low impact on both



- **Global emissions** such as carbon dioxide and methane are generally seen to be the source of increasing global temperatures (GWP)
- **Local emissions** such as particulate matter (PM 2.5, PM10) & Nox deteriorates air quality locally and is the focus of more and more cities worldwide

- **Fossil fuels** have high global and high to low local emissions
- **Zero Emission fuels** have zero local emissions and global emissions depend on how/where they are produced
- **Biofuels** generally have similar local emissions as their fossil siblings, but lower global emissions, depending on how and where they are are produced. Their advantage to zero emission fuels is they can up to a % run on existing motors, except for biomethane which requires new motors and filling infrastructure

Sources: NVE “Energibruk i transport” (2016), SSB, Zero “Bærekraftig Biodrivstoff” (2016), Avfall Norge “Biogass20” (2017), TØI (2016) «kjøretøyparkens utvikling og utslipp», Statkraft internal analysis, https://www.tu.no/artikler/12-myter-og-fakta-om-elbiler-og-forurensing/367894

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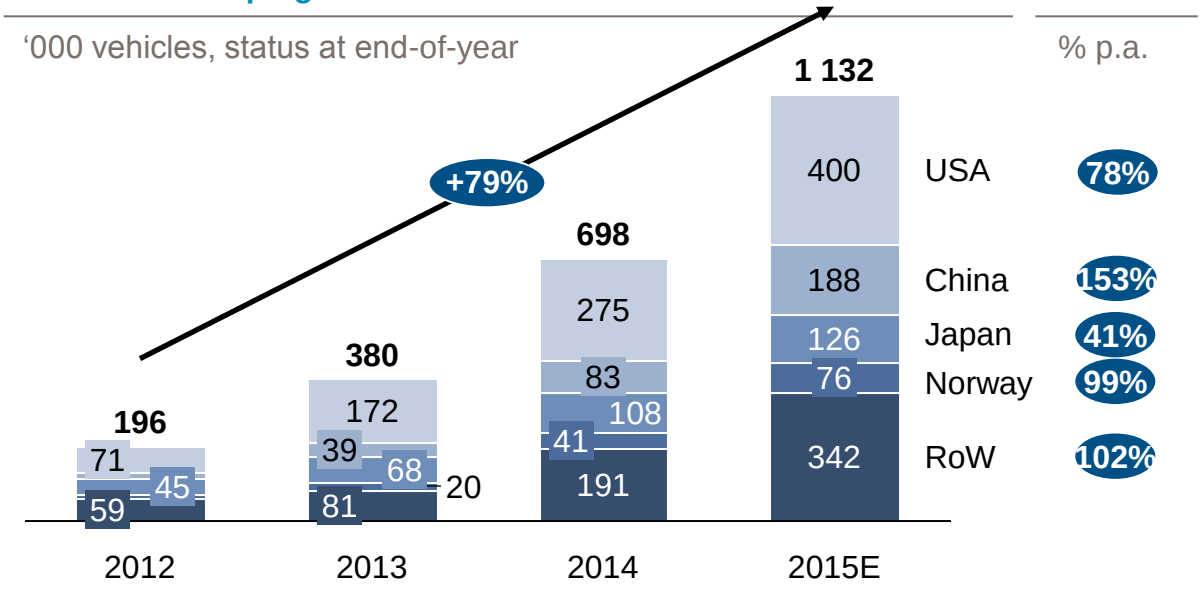
Agenda

- Statkraft and the future energy system
- Drivers of transport transformation
- **EV technology perspectives**
- EV charging company: Grønn Kontakt

The global EV fleet is growing at ~80% p.a., reaching the 1 million units milestone in 2015

Global fleet of plug-in electric vehicles[1]

'000 vehicles, status at end-of-year



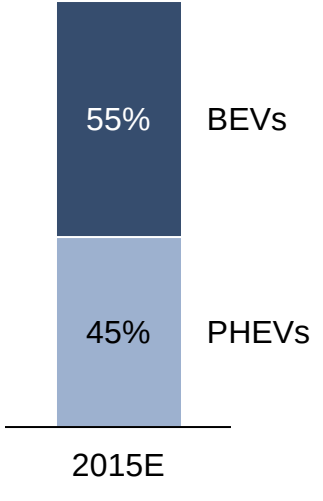
2012-15 CAGR

% p.a.

USA	78%
China	153%
Japan	41%
Norway	99%
RoW	102%

Fleet breakdown by technology

% of EV passenger car fleet



On top of ~1 million passenger cars, the EV fleet counts more than 250 mill 2-wheelers and ~100,000 buses

1 This category includes light-duty battery electric cars (BEVs) and plug-in hybrids (PHEVs) that are highway-capable. MDVs are included in statistics for Norway, France, Netherlands and Japan, but their number remains marginal.

Source: EVI «Global EV Outlook» (2013, 2015); HybridCars.com; IVT analysis

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Key drivers to broad adoption of EVs are cost reduction and some range increase

*"Across the European Union, **74% of consumers expected a range of 480 km** before having to recharge. Yet the **typical distance driven by that group is 80 km per day**. This shows that there is an important disconnect between perceived utility and the actual performance of the vehicle"*

Tran et al., Nature Climate Change (2012)

*"Although **fuel savings and the environment** ranked highest, government incentives to **lower ownership cost** was also an important factor. The survey also indicated that lack of **access to charging stations**, high price and **range anxiety** were key deterrents to adoption. Charging convenience features strongly across different surveys"*

Tran et al., Nature Climate Change (2012)

Key customer concerns

Below items are all correlated

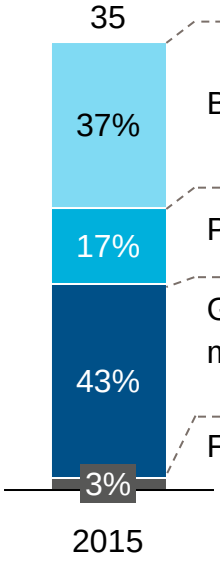
Cost	▸ **Parity with ICEs** required for mass market ▸ Higher costs can be accepted by **early adopters**
Range	▸ **About 500km required** at first glance, even if not needed ▸ Lower ranges will reduce the market size to different needs
Charging infra-structure	▸ **Access to charging points** at work, public places, malls, etc.

Source: «Realizing the electric vehicle revolution», M. Tran, D. Banister, J.D.K. Bishop & M.D. McCulloch, *Nature Climate Change* (2012); IVT analysis

The main driver behind price difference between EVs and ICEs lies in the battery cost

EV purchase cost components

Model Nissan Leaf 30 kWh , '000 USD, before incentives



Battery

Powertrain

Glider & margin

Fees

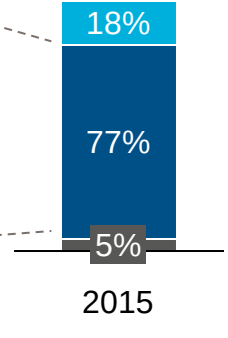
Description

- Battery pack and charger, dimensioned to include safety margin (~5% of pack capacity)
- Price per kWh depends on manufacturer, with Tesla leading the industry
- Electric motor and drivetrain
- Car shell, windows, tyres, interior…
- Will vary widely depending on options; includes potential margins
- Destination & handling service, tax, registration, etc.

Equivalent ICE cost structure

80 kW petrol motor

40-50% lower CAPEX



- Main industry focus is on **reducing battery costs**
- Some efforts also oriented towards **powertrain cost reduction** & efficiency improvement

Source: «A review of the efficiency and cost assumptions for road transport vehicles to 2050», AEA (2012); «Rapidly falling costs of battery packs for Evs», Nature Climate Change (2015); Manufacturers' websites; IVT analysis

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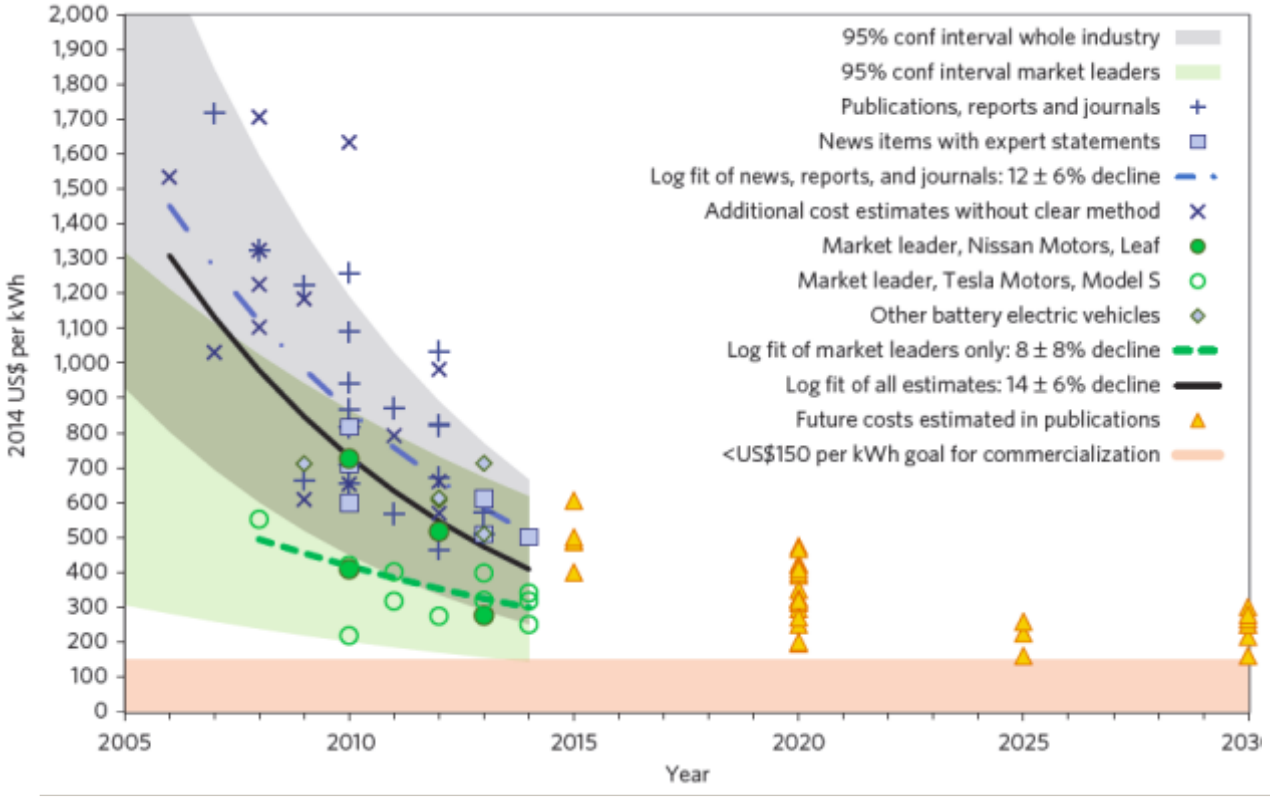
A recent meta-study forecasts the 150 USD/kWh threshold to be reached in the next decade

Battery cost estimates from 85 (historical) and 37 (future) sources



Threshold expected to be reached by the mid-2020's

- **Whole industry reducing costs at 14% p.a**. between 2007 and 2014
- **Industry leaders** (Tesla, Nissan) improving at **8% p.a.** over same period
- At 6-8% p.a. further cost reduction, **industry leaders reach 150 USD/kWh in 2023-26**

Source: «Rapidly falling costs of battery packs for electric vehicles», B. Nykvist & M. Nilsson, *Nature Climate Change* (2015); IVT analysis

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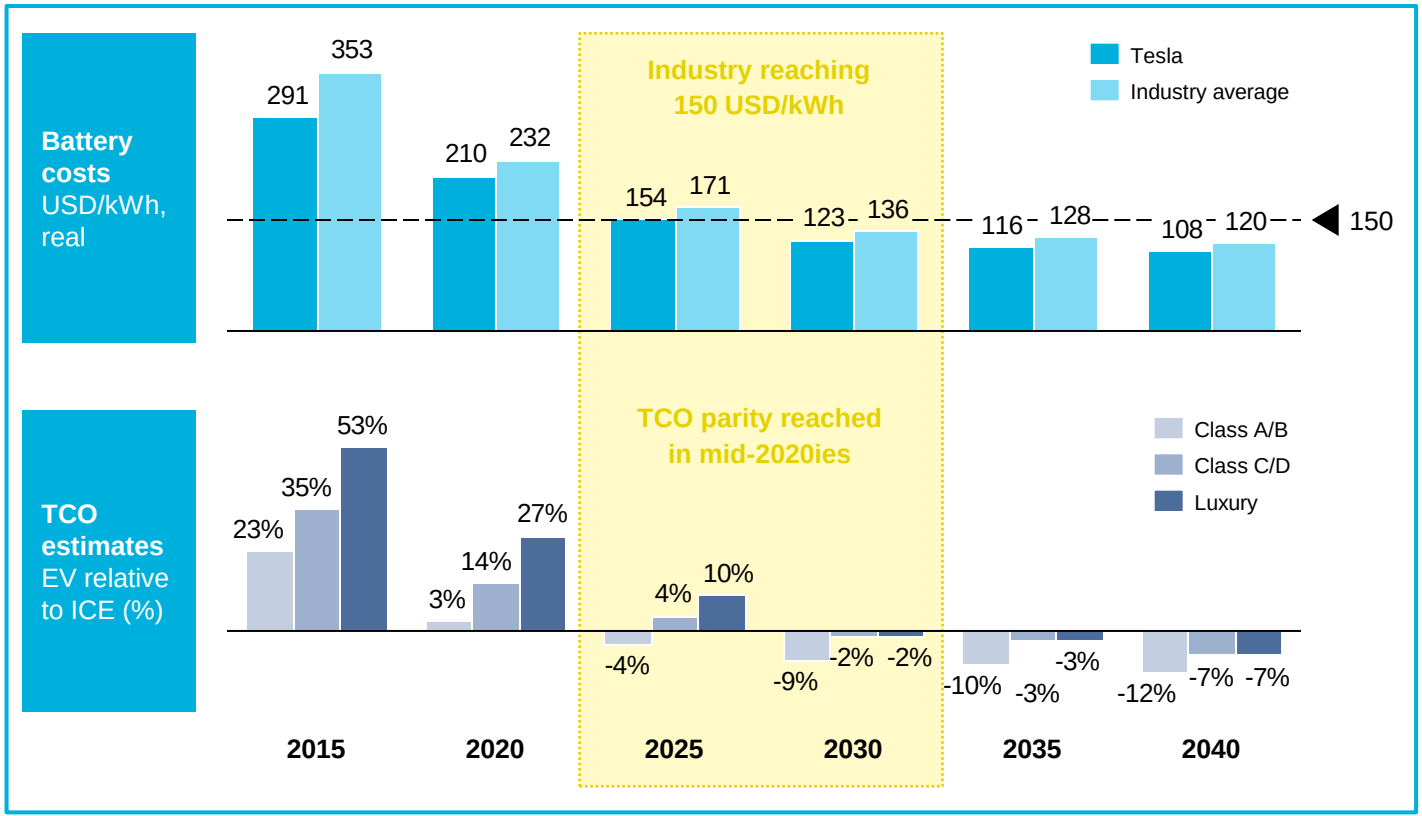
The battery cost threshold is estimated to ~150 USD/kWh for EVs to break through in the mass market

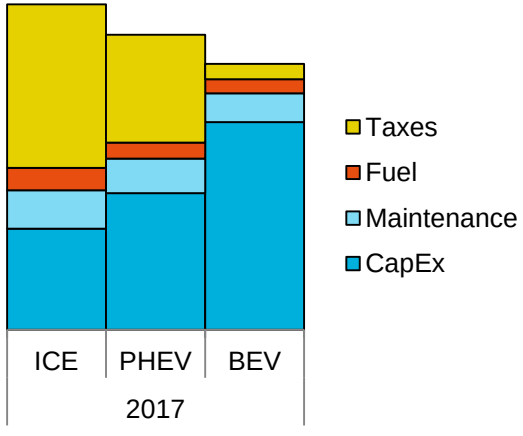


- **TCO parity** is reached for mass market **before 2030**
- Key threshold to reach is **150 USD/kWh battery cost**, in line with literature results
- Market for small cars (150 km real range) opens up **before 2020**

Note: TCO estimates assume 15,000 km yearly driven distance (OECD average), 15 years car lifetime, no fuel taxes, no retailer margin, 4% WACC

Source: «Rapidly falling costs of battery packs for electric vehicles», B. Nykvist & M. Nilsson, *Nature Climate Change* (2015); AEA (2012); IVT analysis

Price parity for EVs is reached in Norway because of generous incentives



Total cost of ownership for EV's are lower than for ICE

Incentive	Introduced	Explanation	Future
Exemption from registration tax	1990	Tax based on emissions and size of car, makes ICE more expensive, e.g. VW Golf 6000-9000€	Continued to 2020
VAT exemption	2001	Levied 25% VAT	Unchanged to e 2017, consider slow ramp down
Reduced annual licence fee	1996	EV 52€ vs Diesel 360-420€/year	May be removed from 2018
Free toll roads	1997	Oslo area saved costs can be 600-1000€/yr for commuters	Will increases for EVs, but even more for ICE
Access to bus lanes	2003	High value for users in regions with rush hour delays	Local authorities can introduce restrictions if zero emission vehicles hinder buses
++*			

* Other incentives include access to free parking and in some cases free charging for public parking spots, support schemes for building chargers both for private and public use, lower tickets fees for ferries

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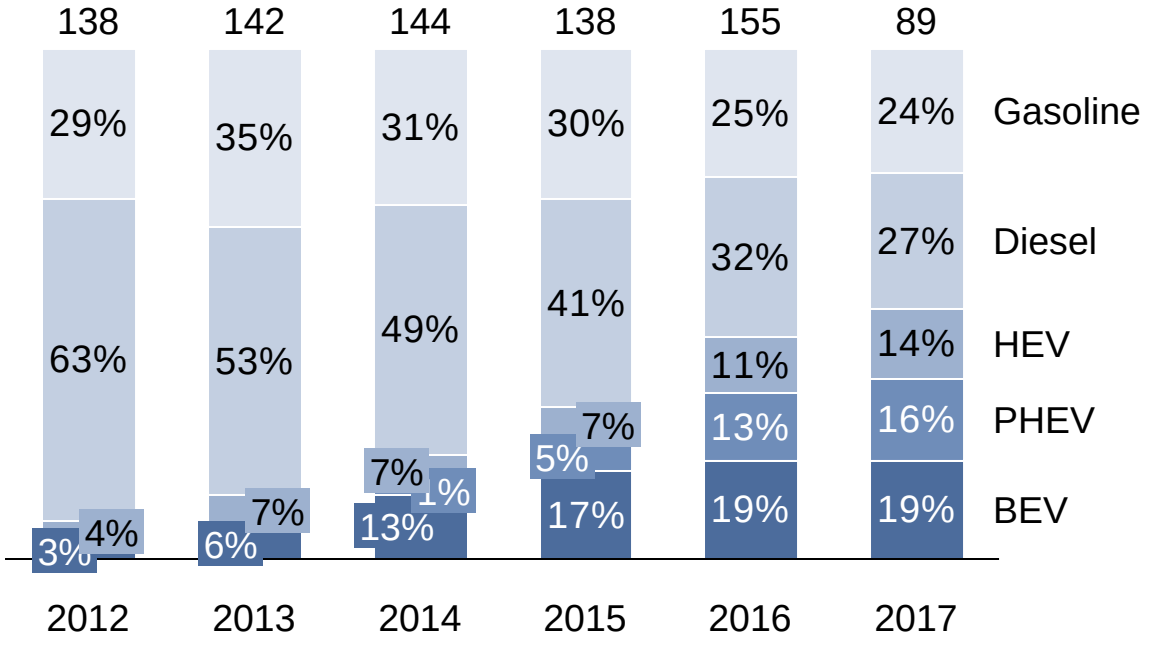
Norway is the case example of what could happen when price parity is reached and understood by consumers

Breakdown of new passenger car sales

Total in thousands, 2017 figure as of end of July



EVs make up >30% of new sales

- **Growing share of EV (hybrid or full electric) in new sales**, reaching 32% in 2016
- Representative of **potential impact of ICE/BEV cost parity** with increased customer awareness and public infrastructure build-out

Source: OFV, IVT analysis

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- **EV charging company: Grønn Kontakt**

GRØNN KONTAKT

grønn kontakt in a nutshell

- **Owners:**
  - Statkraft (41%)
  - Agder Energi, a regional utility (41%)
  - 21 other energy companies (18%)
- **Partner agreements:**
  - Circle K
  - Coop
- **Transaction-based, highly scalable business model**
  - Currently ramping up by building 1-3 FC stations per week
  - Aiming at profitability by year-end 2017

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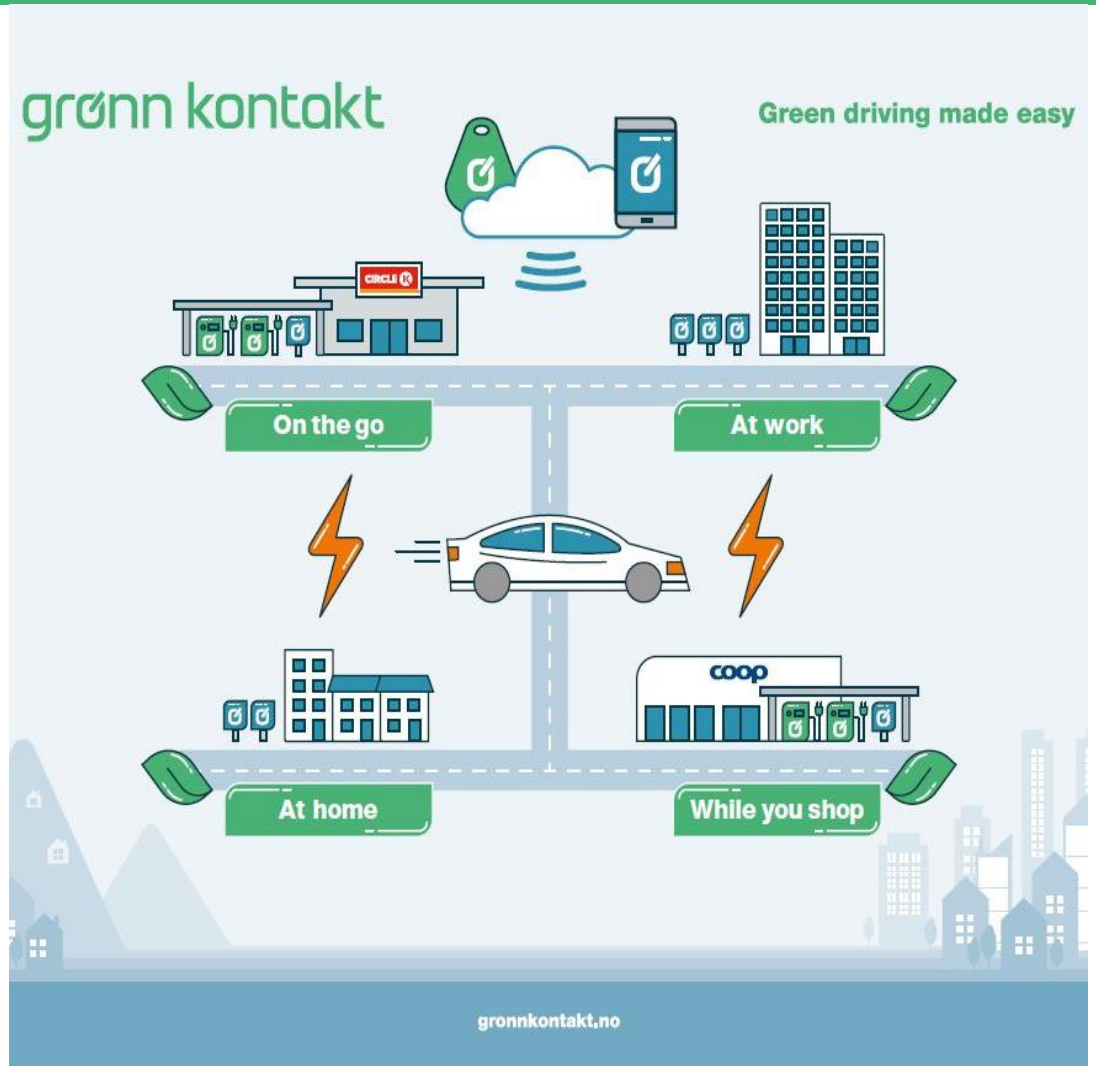
agder energi

CIRCLE K ™

coop

A one-stop-shopping solution for charging



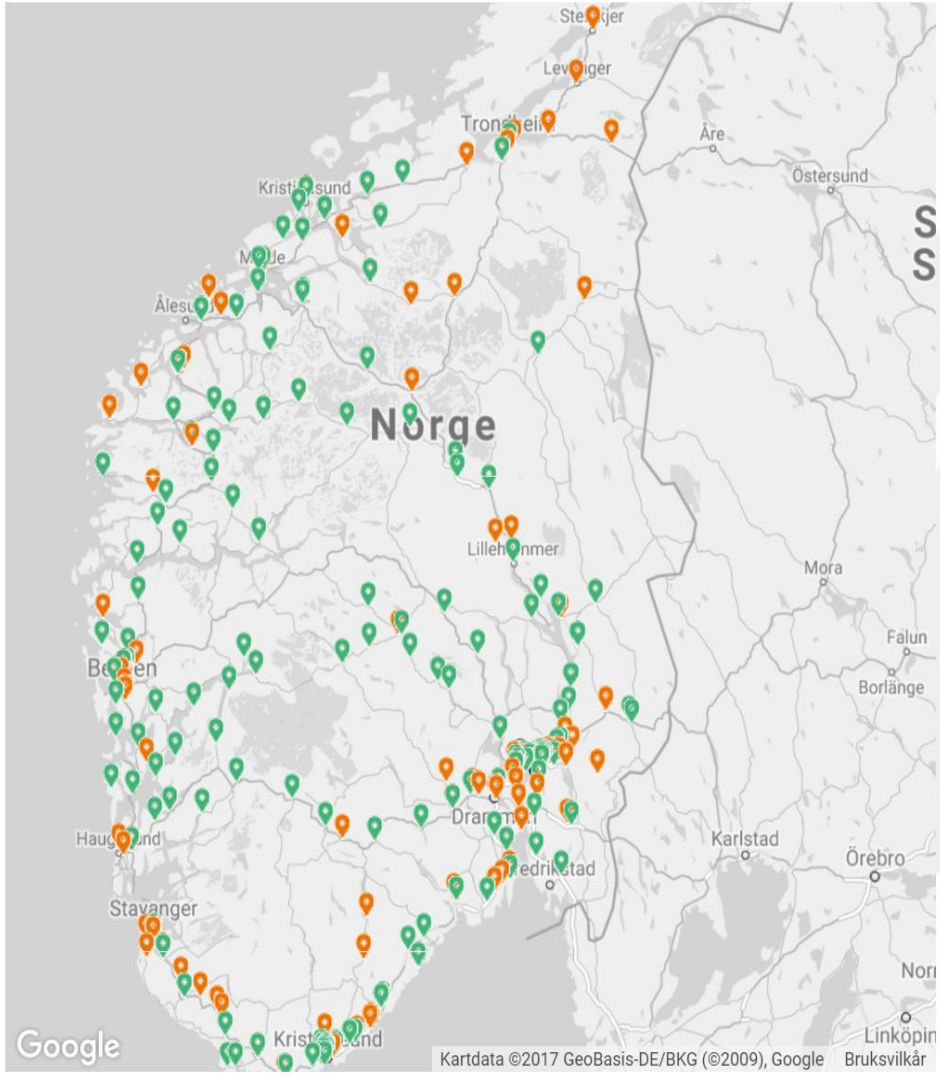
FAST CHARGING

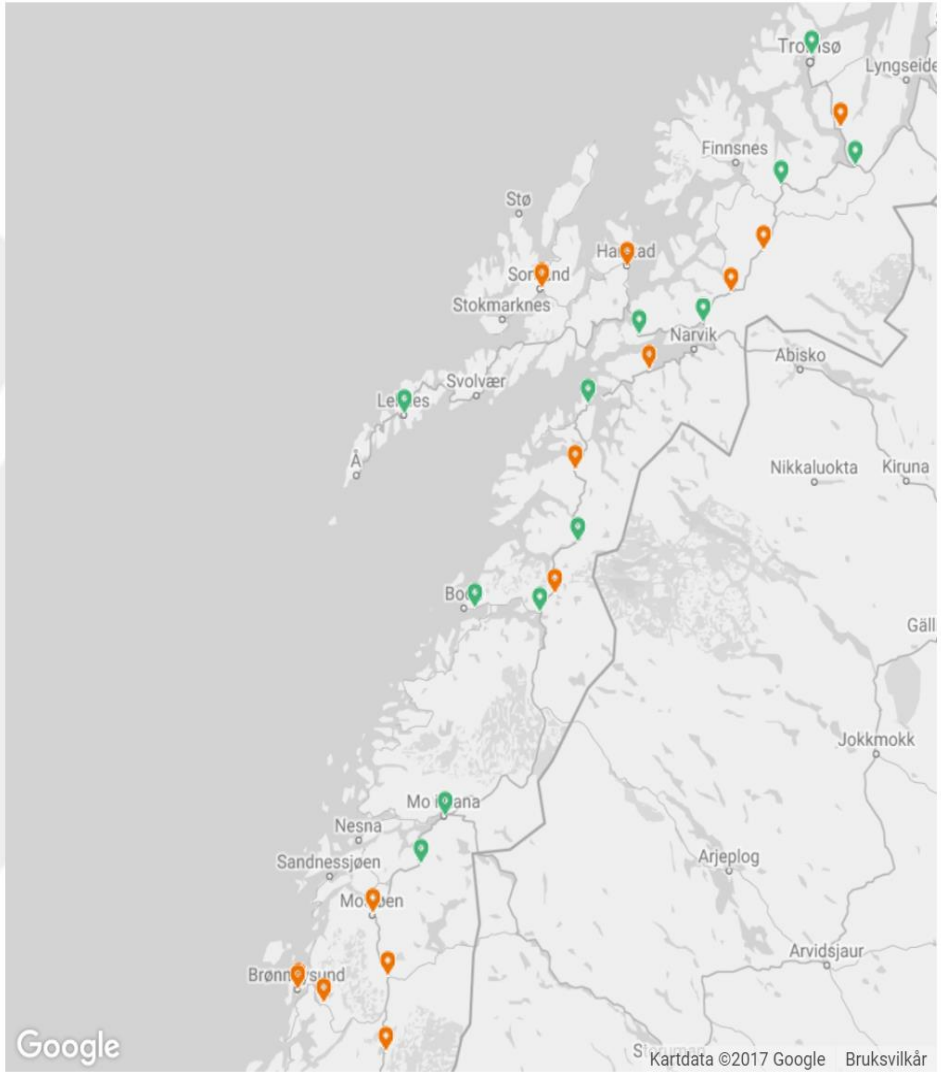
What are we building?

grønn kontakt

|| Our network by the end of 2017 ||

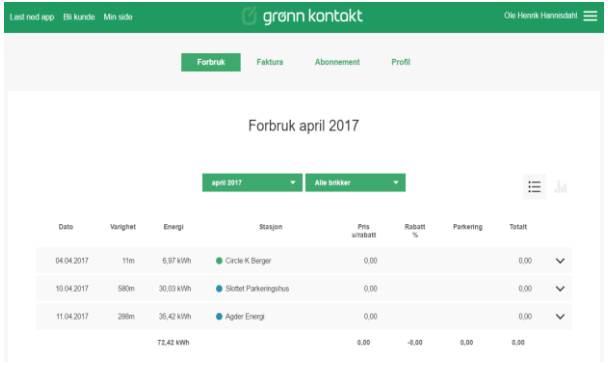
Existing End 2017

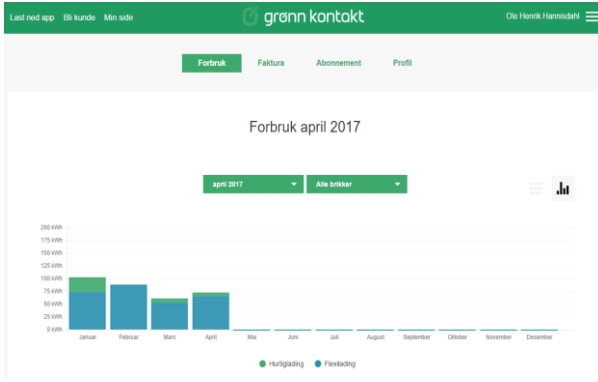


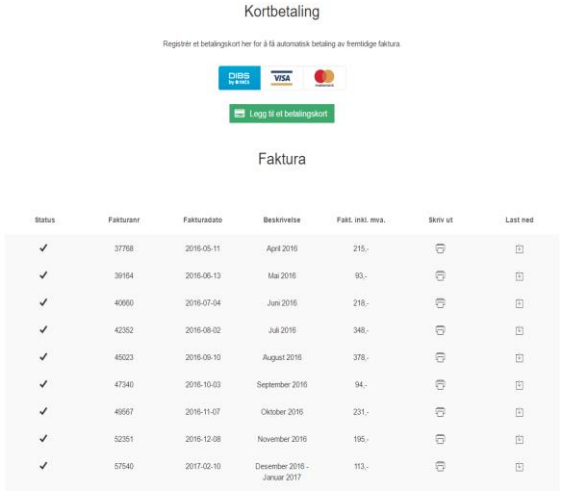


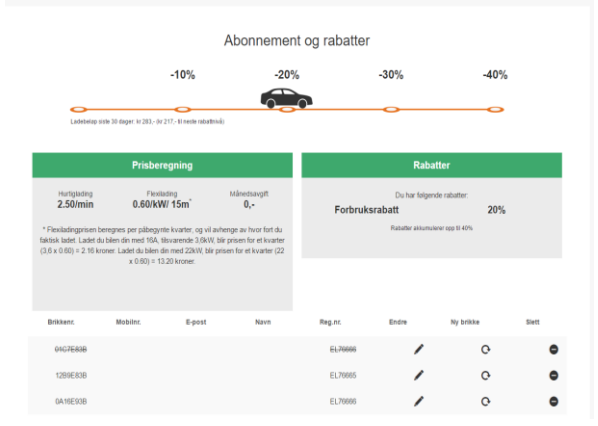
Min Side: Our self-service customer portal

- Link users (family members, employeees etc) who can use charging app on your account
- Manage, order and block RFID tags
- Full overview over invoices and status
- Discount overview
- Option to add Visa / Mastercard for payment
- Usage statistics, can also be downloaded
- Etc.



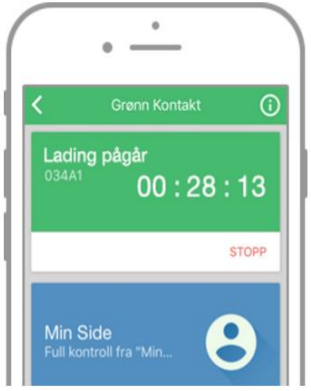


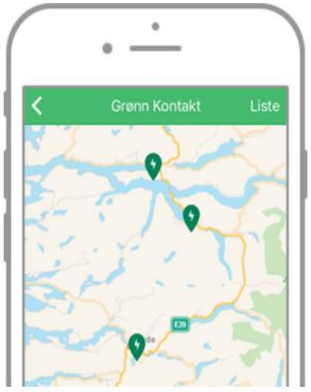


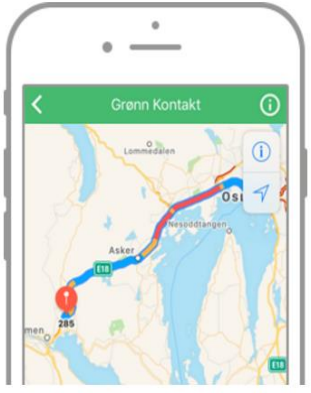


The GK App

- Start and stop charging easily
- Find chargepoints
- See chargepoint status
- Navigate to charge points
- Automatically logged in to «Min Side»: No password or separate login needed from your own phone.





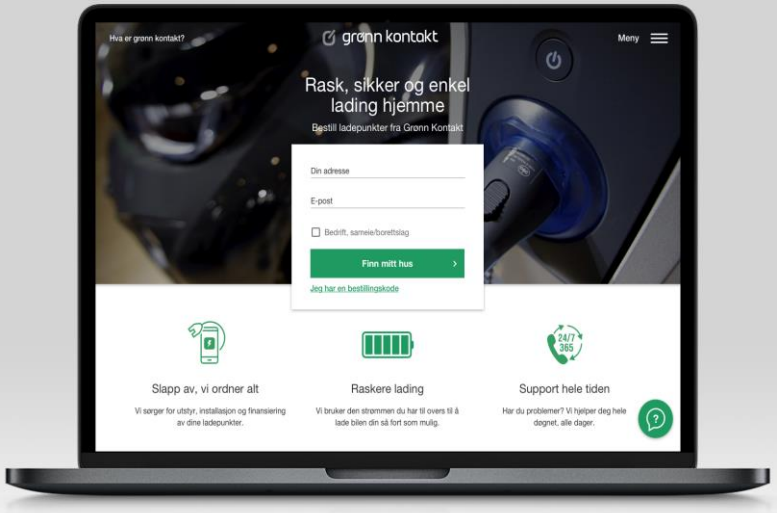


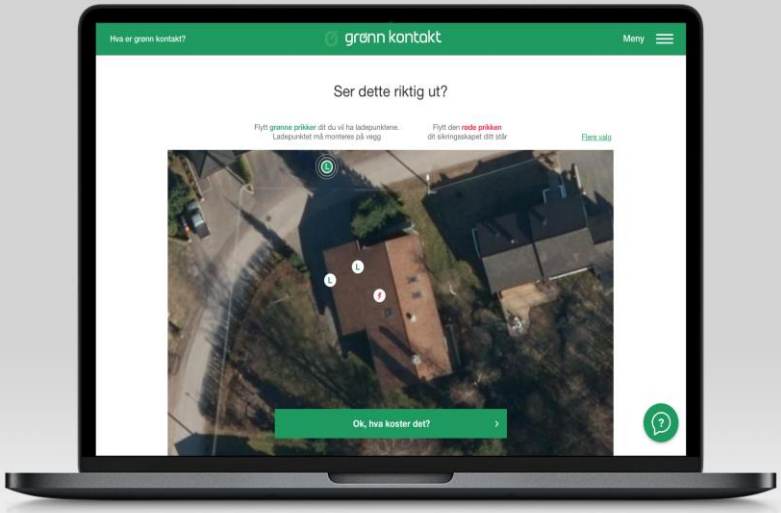
HOME / WORK CHARGING

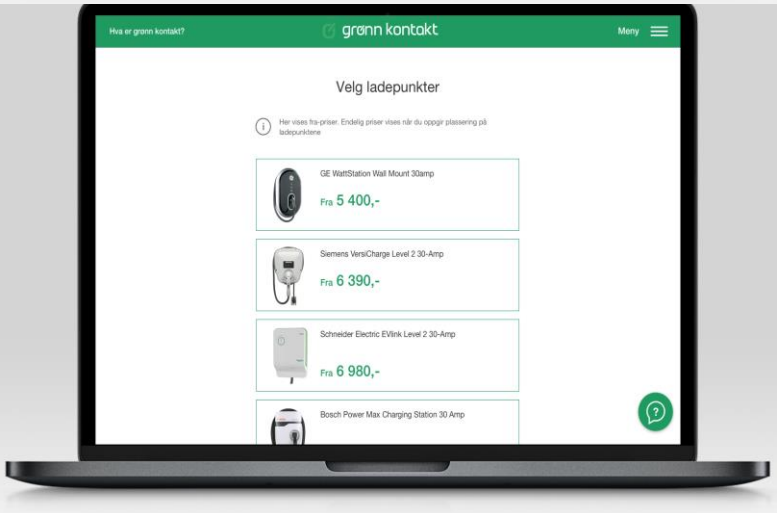
Charge with residual capacity in building

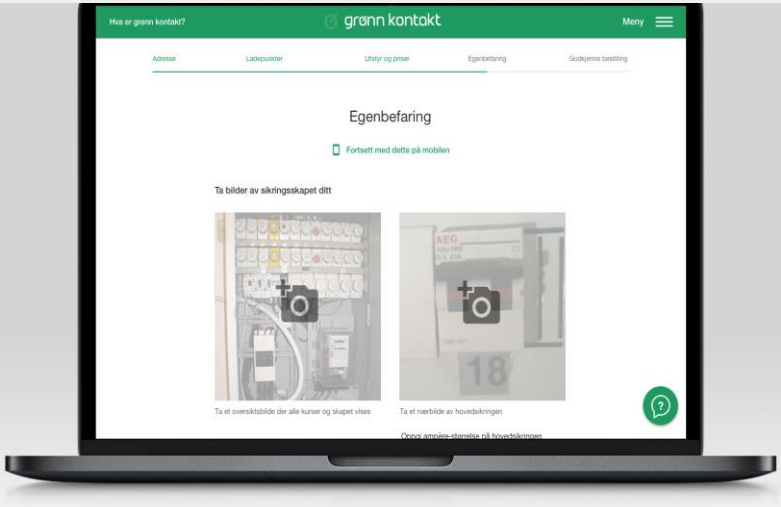
- **Local controller**
  - Can control and load balance 1 to 1.000 chargers
  - Runs all hardware which supports OCPP 1.6
  - Unit cost < 100€, affordable in private homes
  - Does not require digital metering or other 3rd party hardware
  - Load balancing with building permits new charging options, i.e. :
    - «Charge my car as fast as possible» (max out my main fuse)
    - «Charge my car when the sun is shining» (input from local PV controller)
    - «Charge my car as cheaply as possible» (get price data from spot market and set charging profile accordingly)
  - Owner can rent out his charging point when not using it
    - Set time & tariffs through «Min Side»

User – friendly ordering process







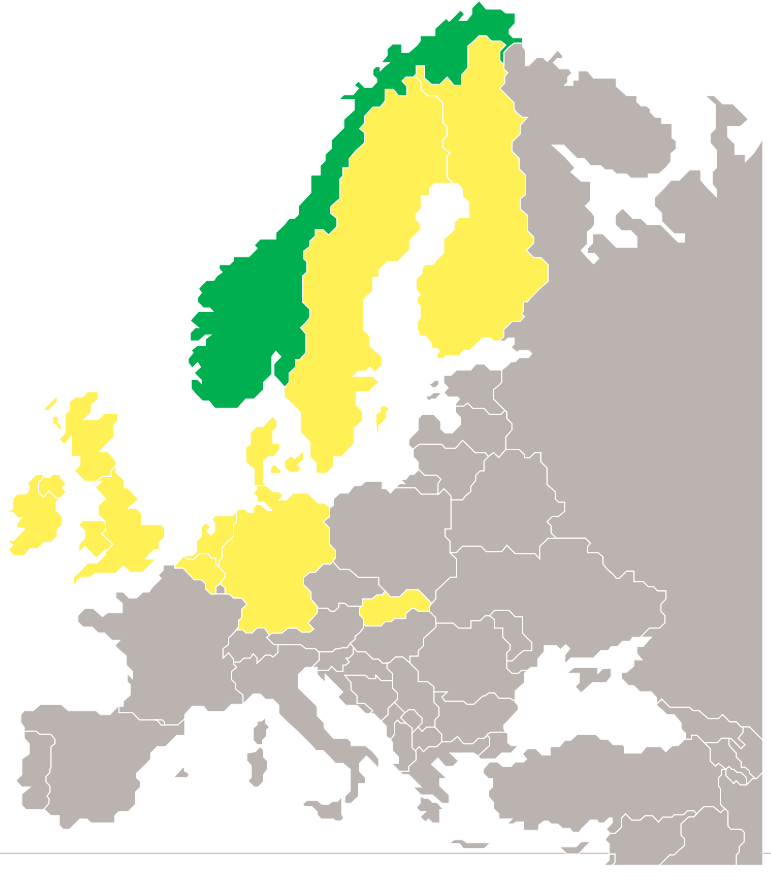


One stop shopping

- **Easy, web-based ordering process**
- **GK takes care of everything**
  - Ordering
  - Installation
  - Financing
  - Billing and transaction management
  - Operations and monitoring
- **Customer chooses**
  - Basic setup
  - HW Choice: Which charger do you want?
  - Financing options: One-time payment, or monthly payment
- **Standardized offers for e.g. dealers or housing communities possible**
  - Offer can include specific options, i.e. specific charger, bundled with specific electricity provider, bundled with fast charging, etc.

STRATEGIC ELEMENTS – FOR DISCUSSION

Possible geographic expansions?



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Potential value chain & roles within EV charging – how will this play out?

OWNER
of charging poles/infrastructure

- Own infrastructure

CPO
Charge Point Operator

- Construction, O&M, energy services

MSP
Mobility Service Provider

- Payment, Web, Customer channels
- Includes «Aggregater role»

IT platform

IT platform

Today GK can do all 3 roles in value chain, but core is CPO + MSP.

Undecided whether slicing it up will create value and workable model.

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Future customer segments – how to approach and extract value?

Relevant trends impacting charging (/mobility overall)

- Increasing EV range
- Less parking spots
- Mobility as a service
- Car/ride sharing
- Autonomous cars

Charging segments	Share today	Share future?	Willingness to pay	Bundling/partner opportunities
On-the-go (DC/AC)	Small	Small	Highest	Retail close by (coffee, wash, McD++)
Destination (DC/AC)	Small	Small	Medium?	Retail close by (coffee, wash, McD++)
Offices (AC)	Small	Medium	Low	Retail close by (coffee, wash, McD++)
Public parking (AC)	Small	Small	Medium	Parking companies clearly Retail close by
Villas (AC)	High	Medium	Low	Power, PV, Home battery, Insurance, Telco, Cable
Apartments (own parking, AC)	Small	Medium	Medium?	Power, PV, Home battery, Insurance, Telco, Cable

Questions?

- Statkraft and the future energy system
- Drivers of transport transformation
- EV technology perspectives
- EV charging company: Grønn Kontakt

THANK YOU

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