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Smart charging puts the pedal to the metal on e-Mobility: Introductory remarks

Electrification Academy webinar

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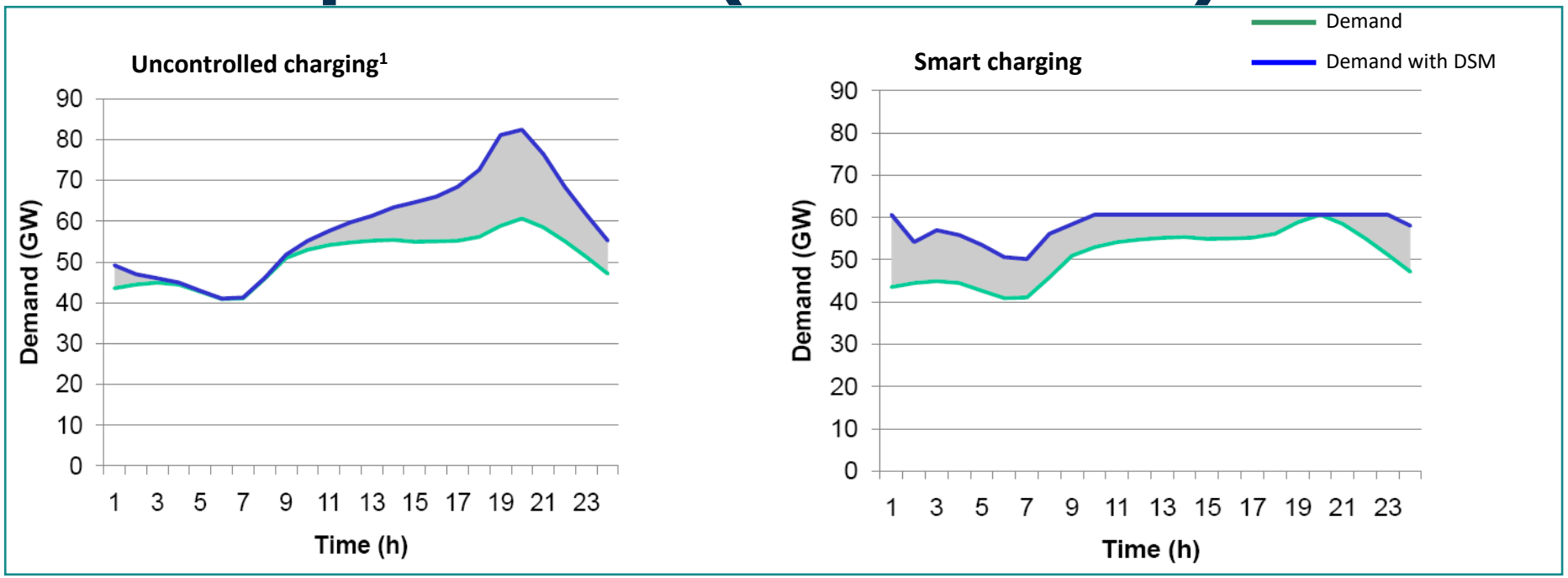
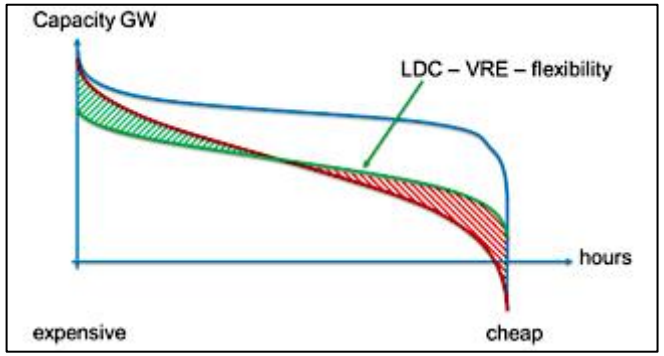
Why is it important? (Wholesale)

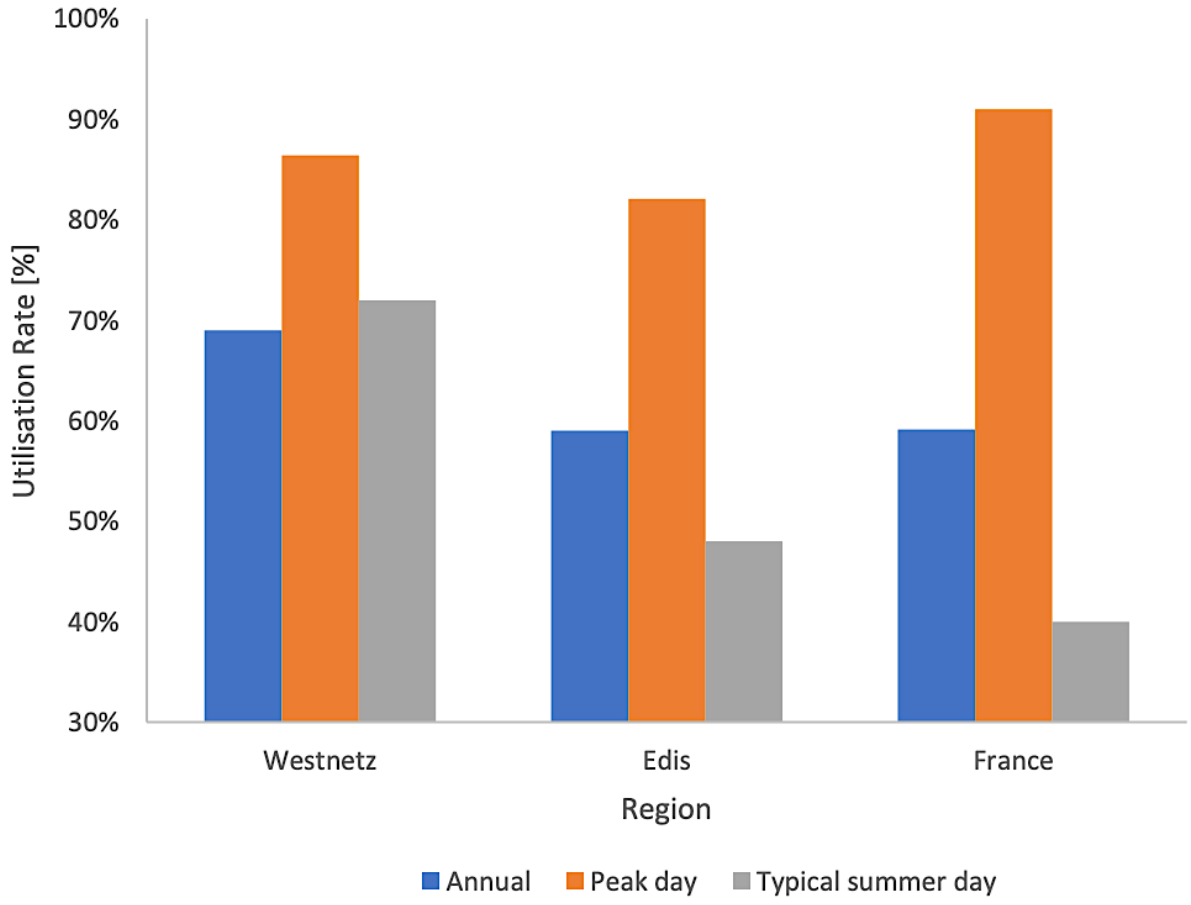


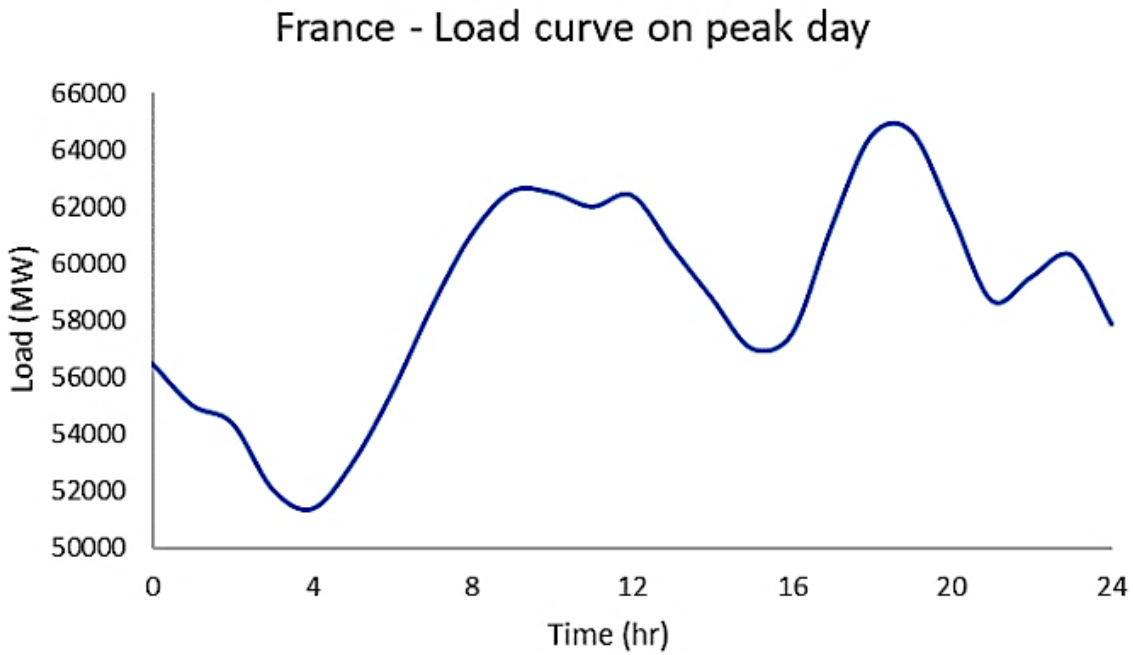
1 UK, assuming 30 million cars in population with 10KW battery



Source: Imperial College London

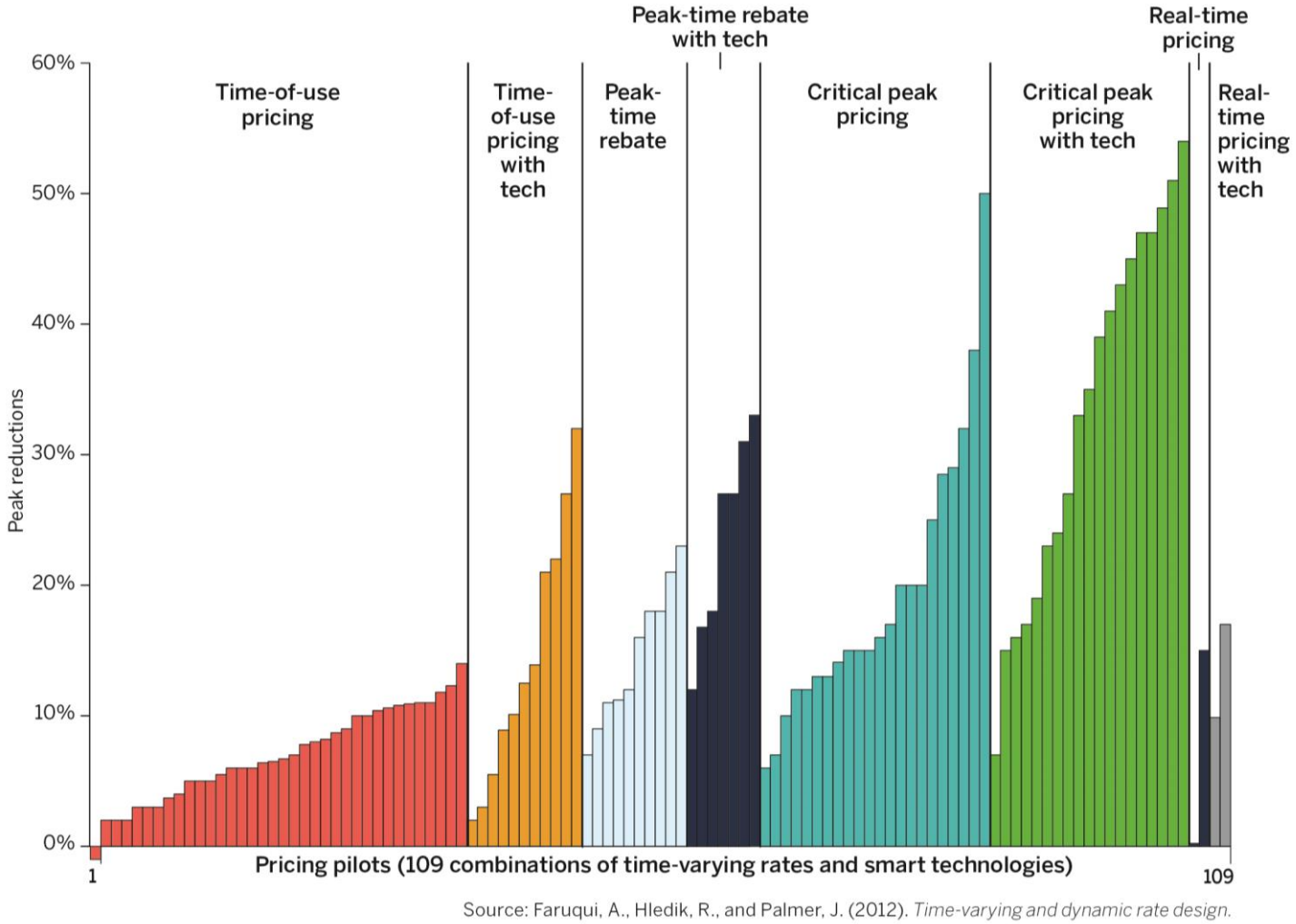
Why is it important? (Retail)





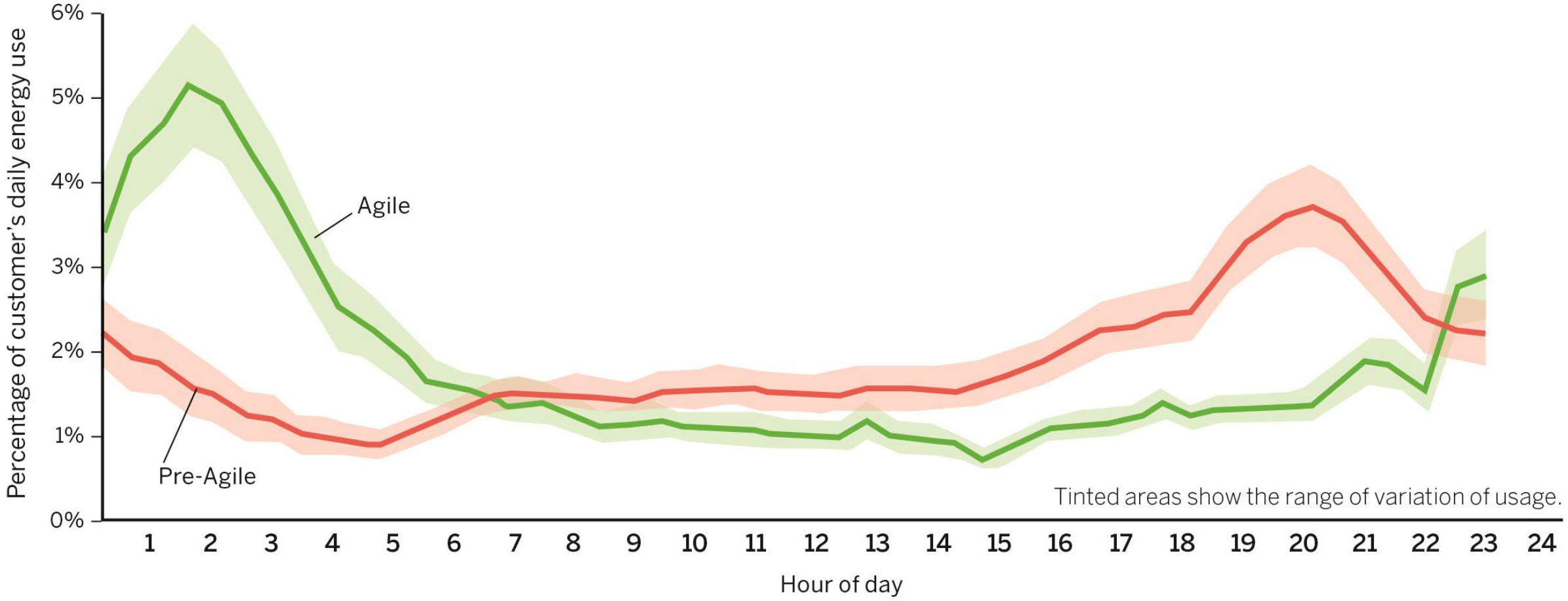
For source data, see RAP's Jan 2018 *Treasure Hiding in Plain Sight: Launching Electric Transport with the Grid We Already Have* (Hogan, M., Kolokathis, C., Jahn, A.) pg 4

Can we do it? Will we do it?



Source: Faruqui, A., Hledik, R., and Palmer, J. (2012). *Time-varying and dynamic rate design.*

Can we do it? Will we do it?



Source: Octopus Energy. (2018). *Agile Octopus: A consumer-led shift to a low carbon future.*

About RAP

The Regulatory Assistance Project (RAP)® is an independent, non-partisan, non-governmental organization dedicated to accelerating the transition to a clean, reliable, and efficient energy future.

Learn more about our work at raponline.org

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SMART CHARGING GUIDE NL

Founded and funded by Dutch DSOs, ElaadNL is a non-profit Knowledge & Innovation Centre in the field of smart charging infrastructure

Drs Frank H.G.A. Geerts MMA
ElaadNL Program director Smart Charging
Chairman National WG Smart Charging
Energy industry > 20 years
e-Mobility > 10 years

RAP®

Leonardo ENERGY

Smart Charging Guide

How can we charge millions of EVs with power generated by the sun and the wind whilst ensuring that the power network remains reliable and affordable?

What is Smart Charging?
Why is it necessary?
What variants are there?
Which parties play a role?
How does it work in the practice?
What do we still have to do to make Smart Charging happen?

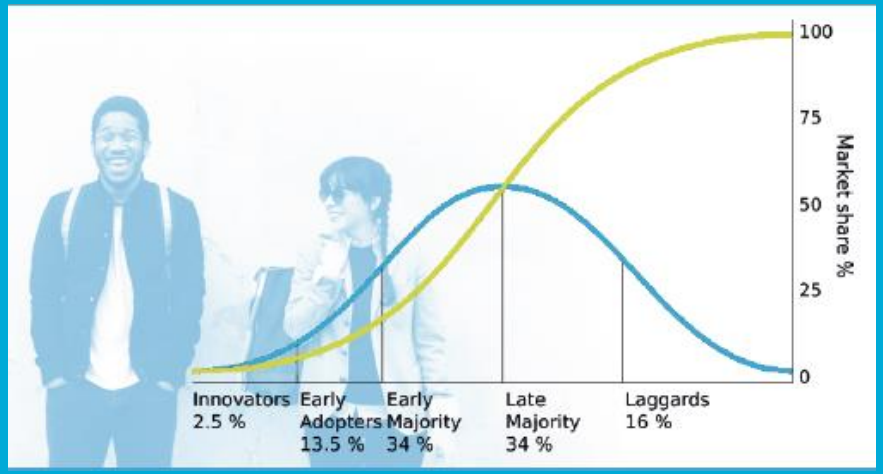
Feedback welcome: frank.geerts@elaad.nl

Third power revolution

Solar panels
Heating & Cooling
Mobility

Household
appliances

Light



The Challenge of 100% EV

1. Is there enough energy?

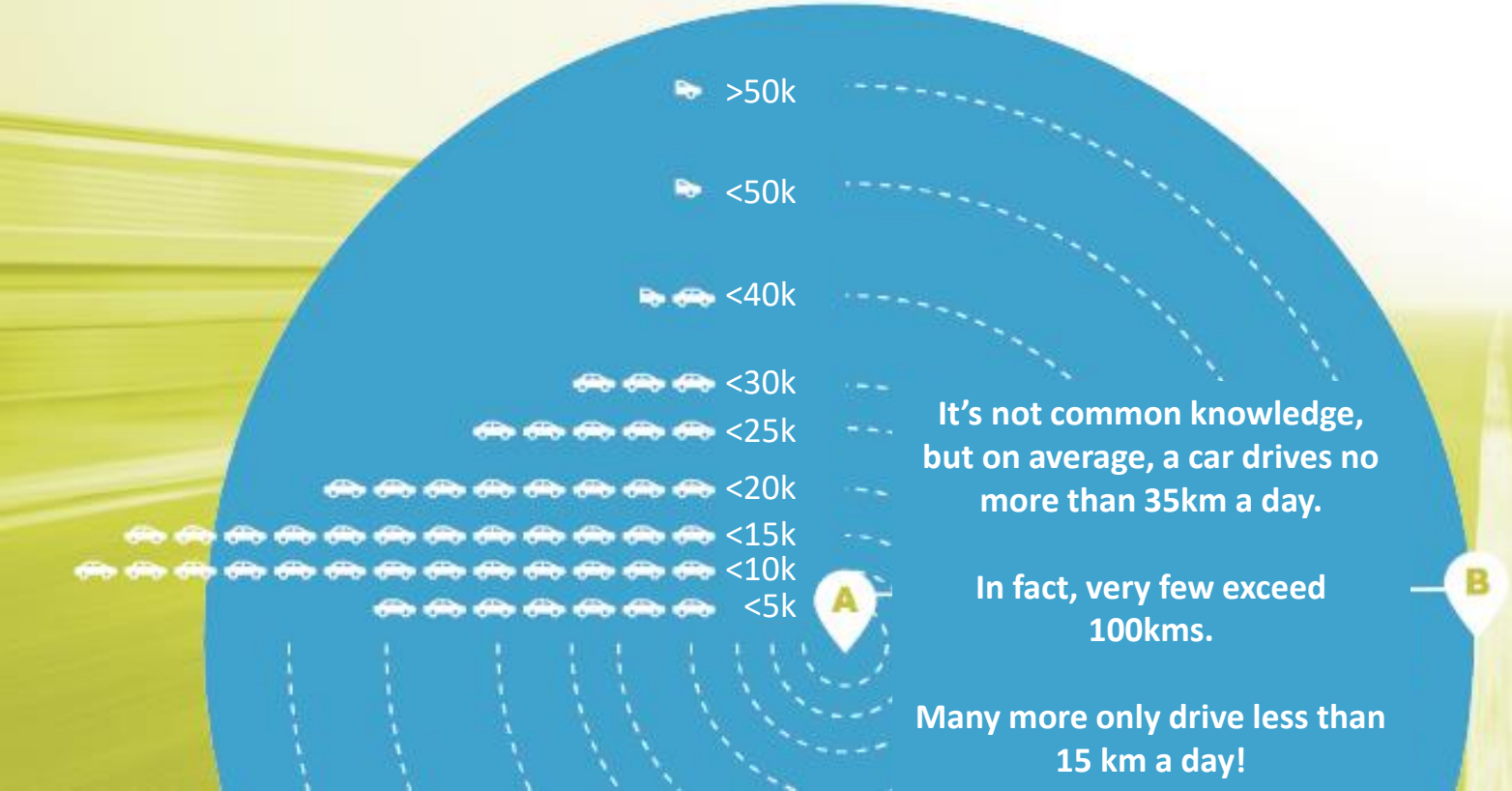
2. Is there enough renewable energy?

3. Can we generate enough power to charge simultaneously?

4. Can we transport enough power to charge simultaneously?

Netherlands Road Mobility

Road vehicle	Number	Km range year	Yearly Average	Energy (TWh)	Power (GW)
Netherlands Electricity numbers (2020)				120	30
Passenger cars	8,500,000	121 billion	13,000	24,2	90
Vans	900,000	18 billion	20,000	3,6	10
Trucks	140,000	10 billion	70,000	1,2	tbd
Buses	10,000	0,7 billion	70,000	0,1	tbd



It's not common knowledge, but on average, a car drives no more than 35km a day.

In fact, very few exceed 100kms.

Many more only drive less than 15 km a day!

The challenge is

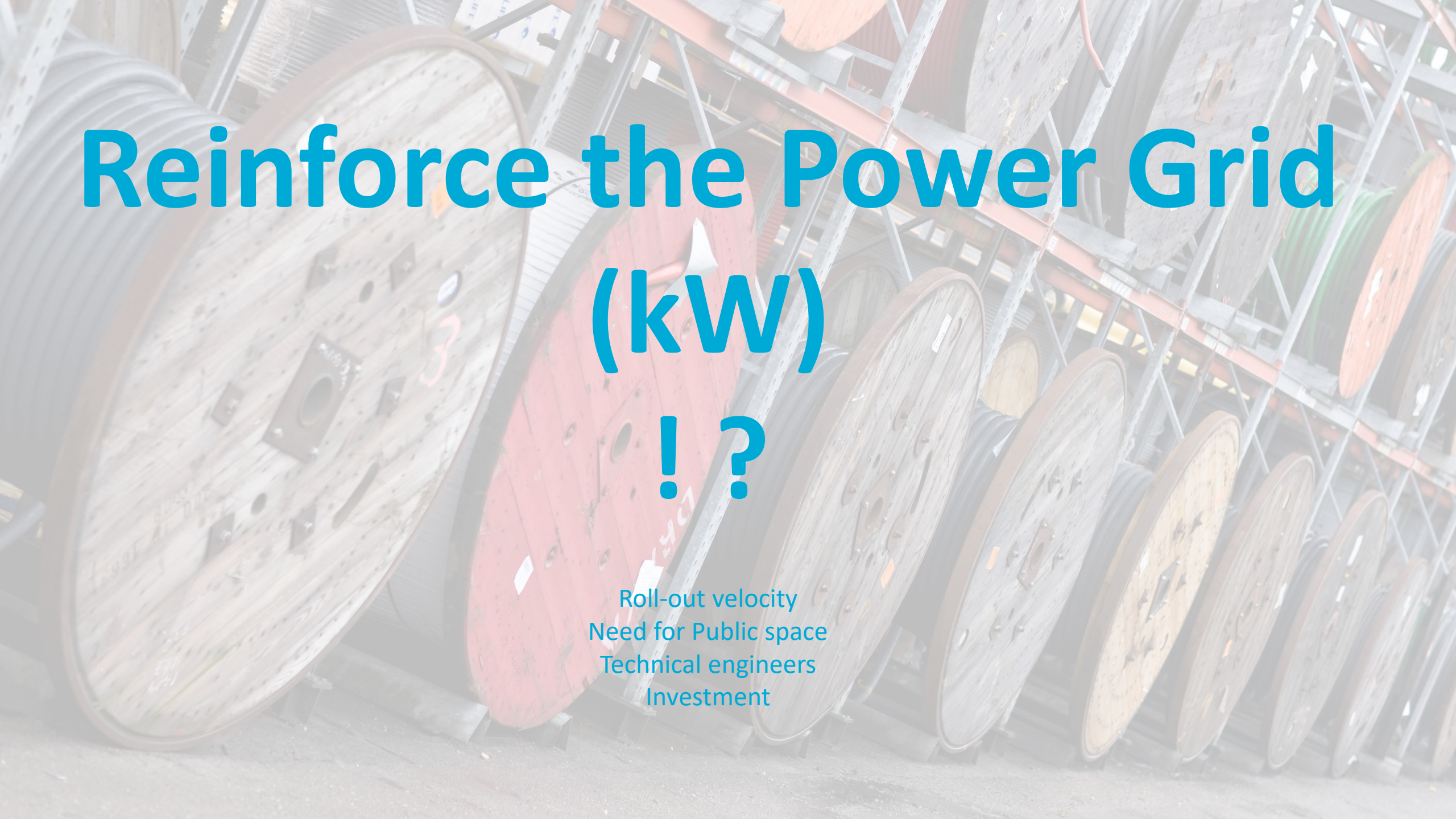
POWER

and not

ENERGY

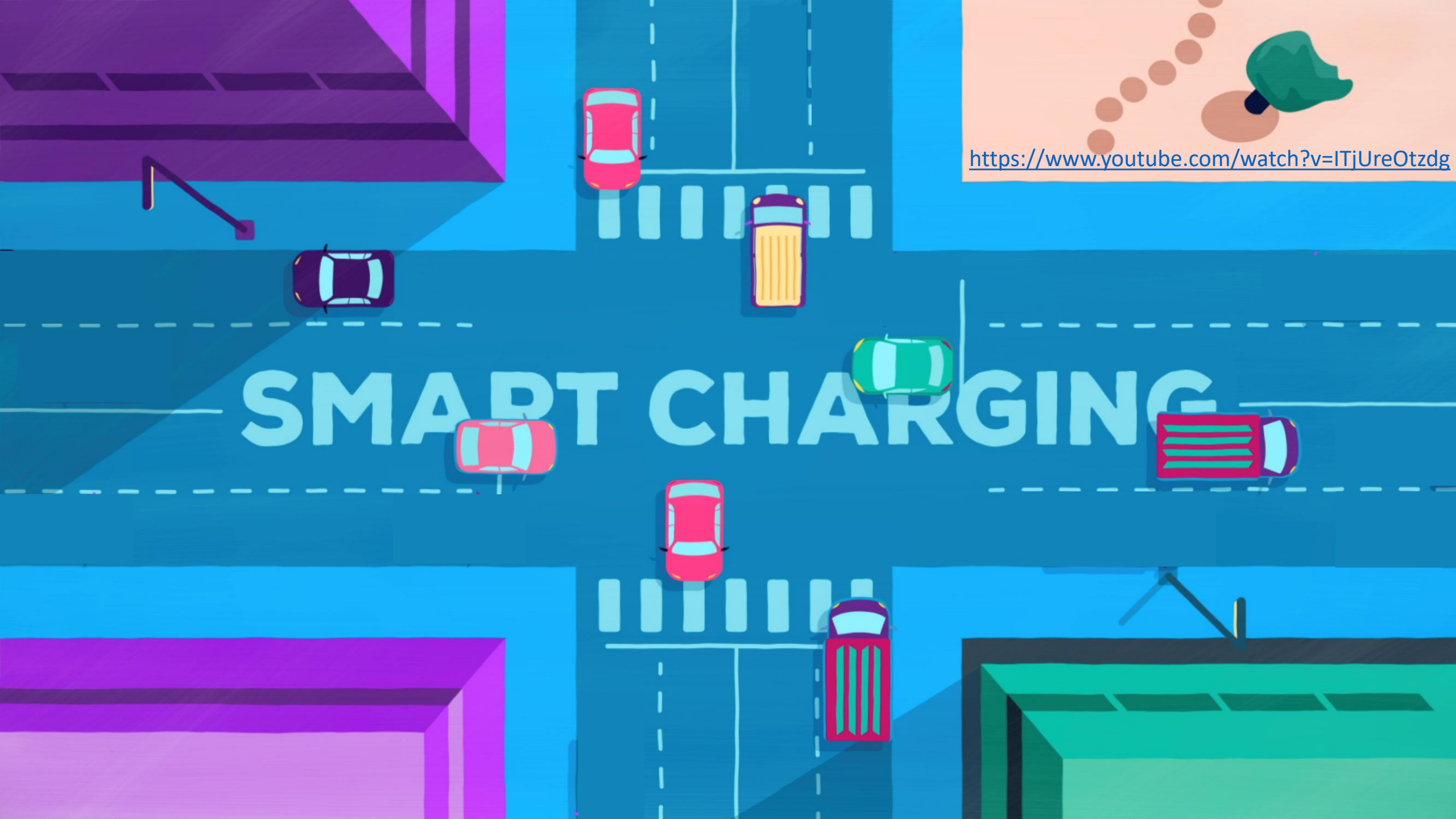
Riding waves of Renewable Power (kW) ! ?

Can you calculate a Business Case
with billions of investment for wind and solar installations
based on business window of 2 hours a day?



Reinforce the Power Grid (kW) ! ?

Roll-out velocity
Need for Public space
Technical engineers
Investment



https://www.youtube.com/watch?v=ITjUreOtzdg

M2M Communication

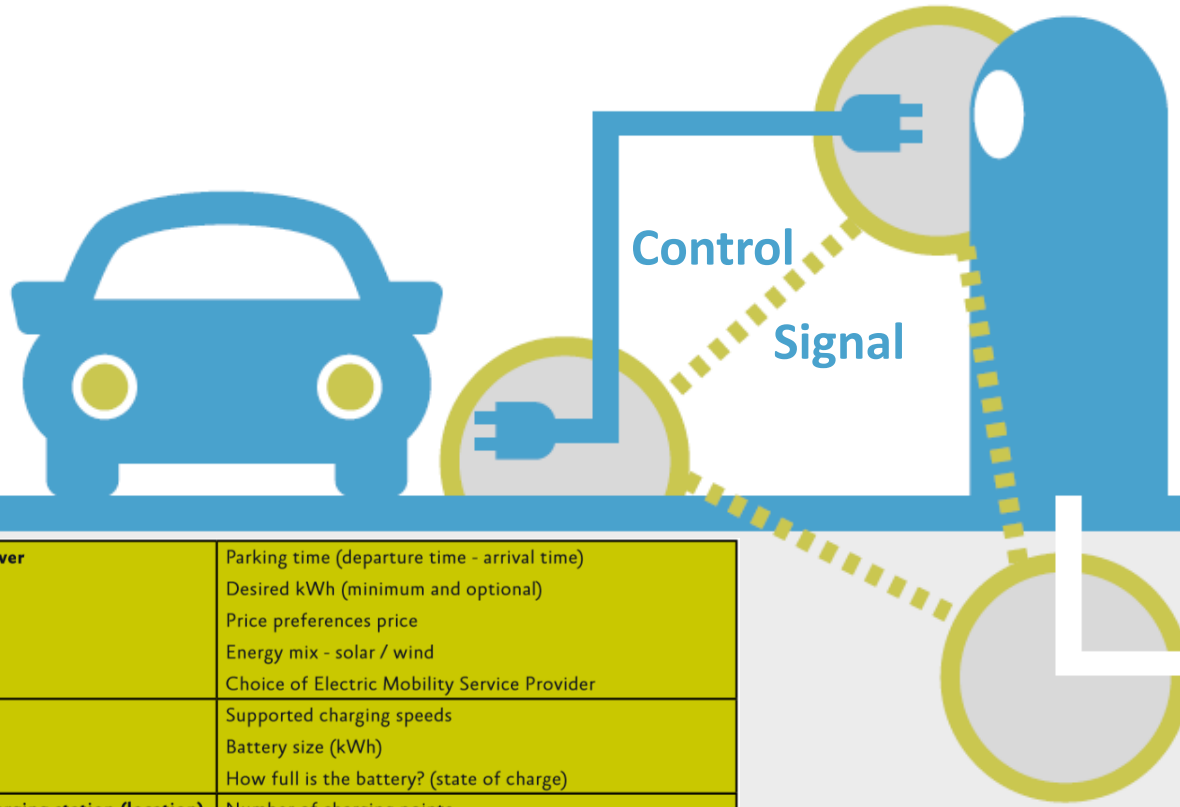
Legal

Technology

Organization

	Local stand-alone	Central to the cloud
Car	Battery management system	Connected car
Charging station	Controller	Back office systeem
Power grid	Smart meter & local smart grid	Grid management system operators
Related energy systems	Home energy management system & Building energy management system	Online energy management platforms

Intelligence



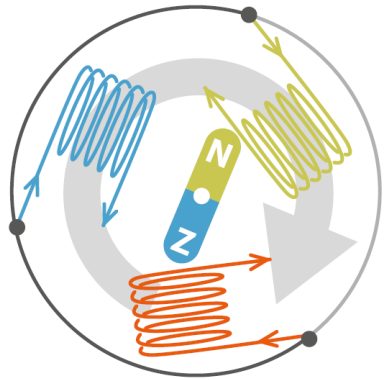
Time and power and direction

	Ampere's per phase (A)	3 phase power (kW)	Km per hour charged
EN			
Standard	12	8,3	40
Accelerated	16 - 32	11 - 22	55 tot 110
Delayed	>6 en <12	4,1 - 8,2	20 tot 40
Paused	0	0	0
V2G	>6 en <16	4,1 - 11	-20 tot -55

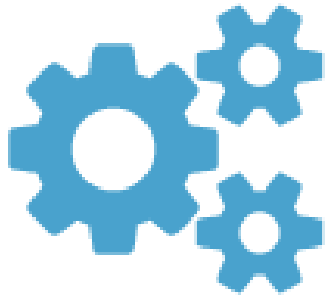
Data

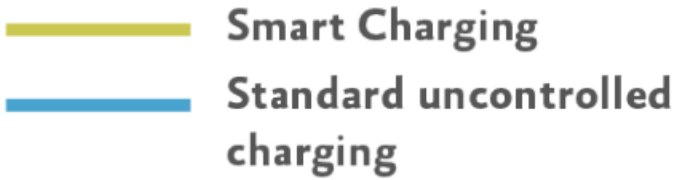
Driver	Parking time (departure time - arrival time) Desired kWh (minimum and optional) Price preferences price Energy mix - solar / wind Choice of Electric Mobility Service Provider
Car	Supported charging speeds Battery size (kWh) How full is the battery? (state of charge)
Charging station (location)	Number of charging points Supported charging speeds
Local electricity grid	Contracted maximum capacity grid connection
Related local energy system	Presence of solar panels, static battery, home, office, etc. Consumption or generation of related energy systems

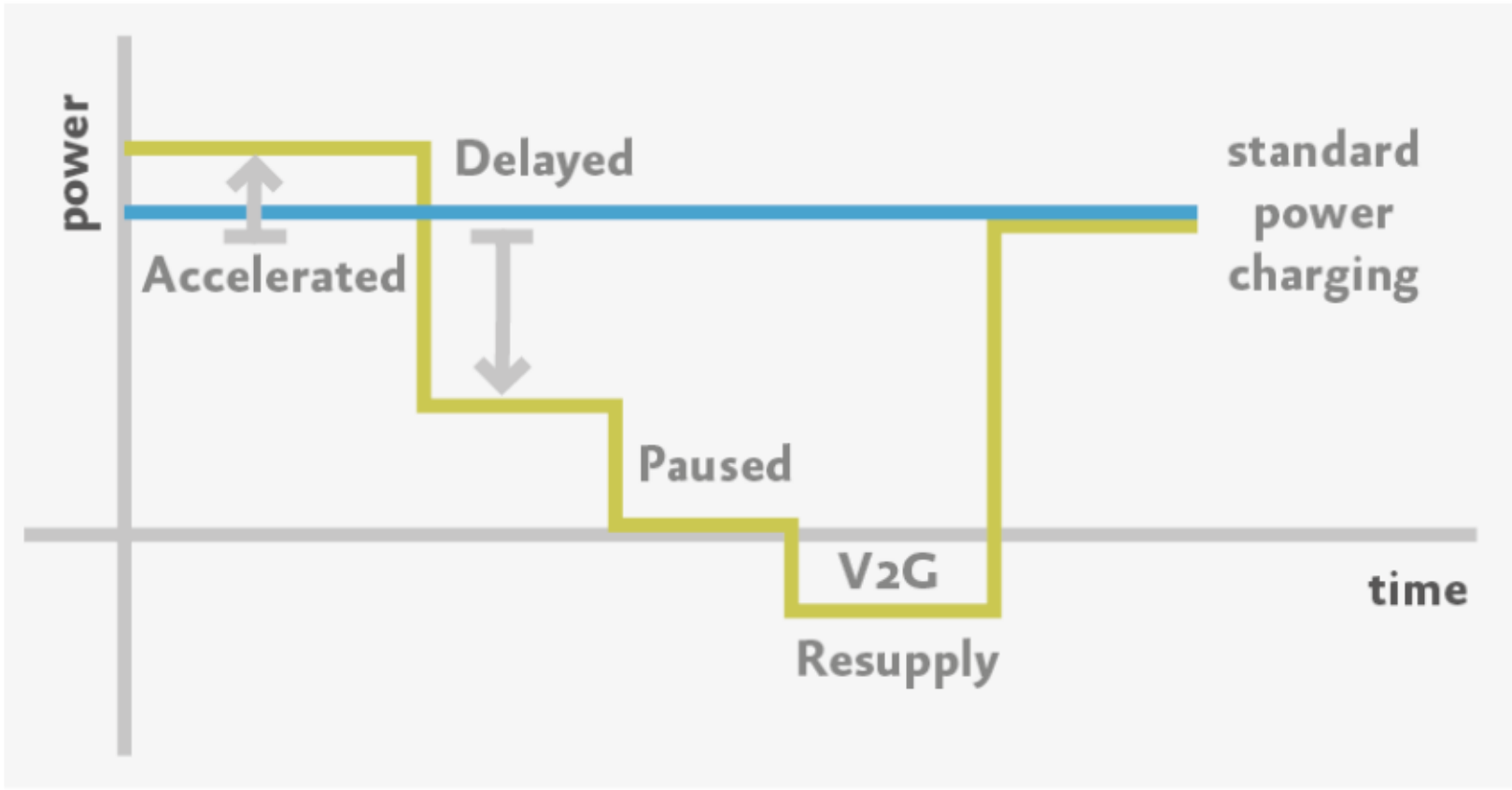
https://www.youtube.com/watch?v=gpcsGS42KPE

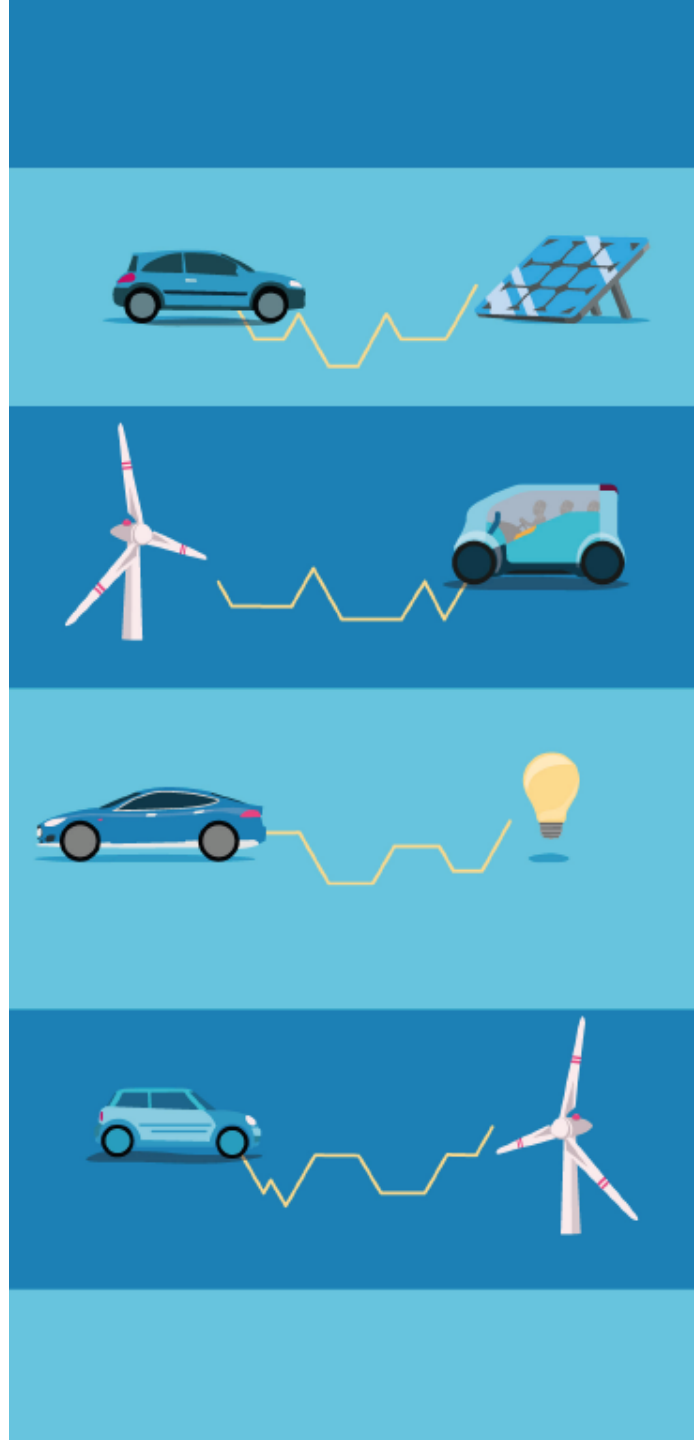


Control signal individual charge session







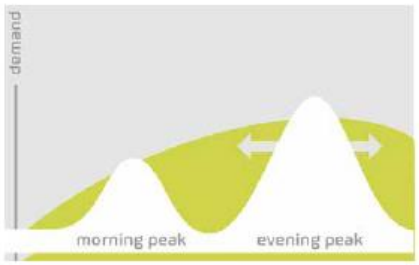


Control signal group of charge sessions

Valley filling

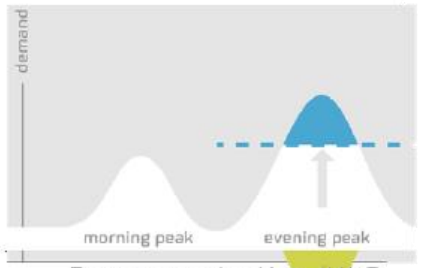
Stimulation (sun)

Stimulation (wind)



Load shifting

Energy conservation



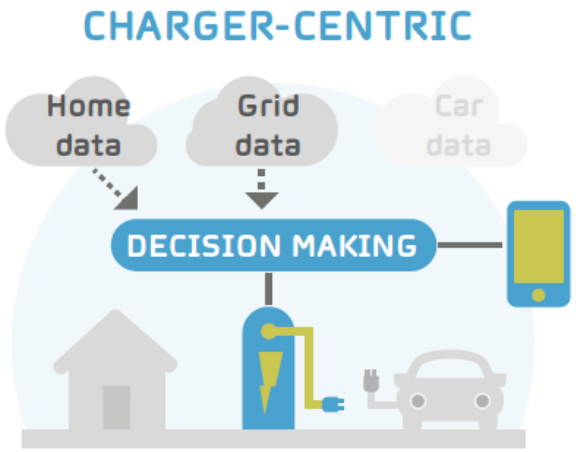
Power production (V2G

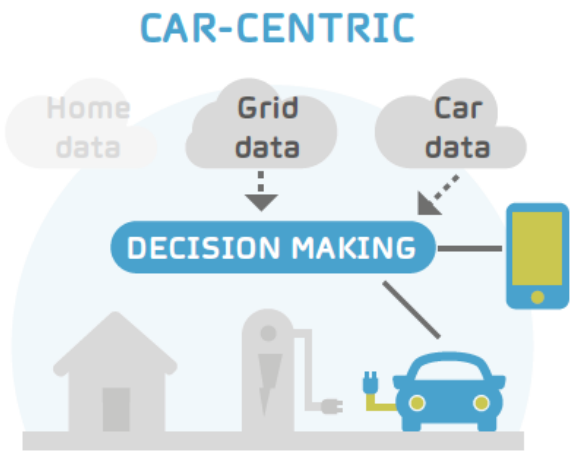
Peak clipping

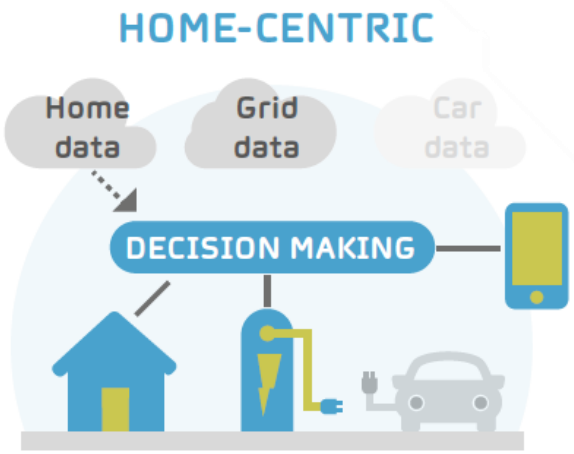
- **Valley filling:** more or faster charging at periods of low energy demand.
- **Stimulation:** faster charging when more sustainable (or cheap) electricity is available.
- **Load shifting:** slower charging at times when peak loads are imminent; EVs then charge faster at other times.
- **Energy conservation:** at the time of charging, the speed is reduced to less than the technical maximum for the entire charging period.
- **Peak clipping /peak shaving:** less rapid charging at times when there is a risk of peak loads.
- **Power production:** resupply of energy from the EV.

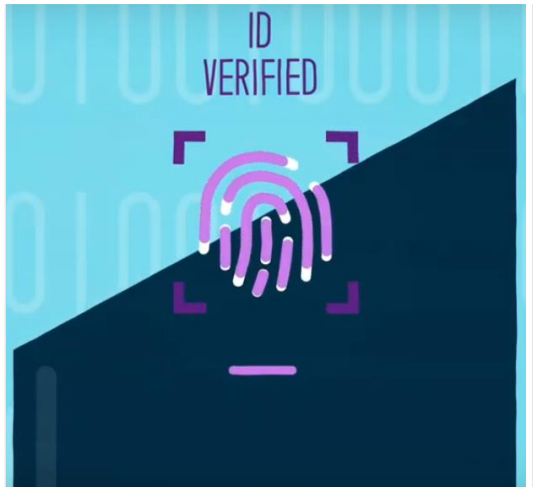
Open standards and protocols

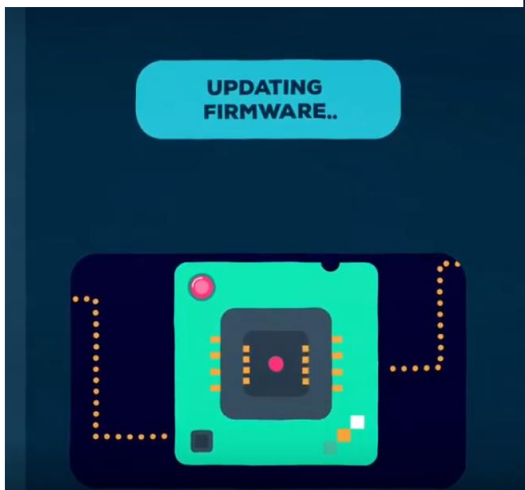
https://www.youtube.com/watch?v=H74ZPV_gdmk





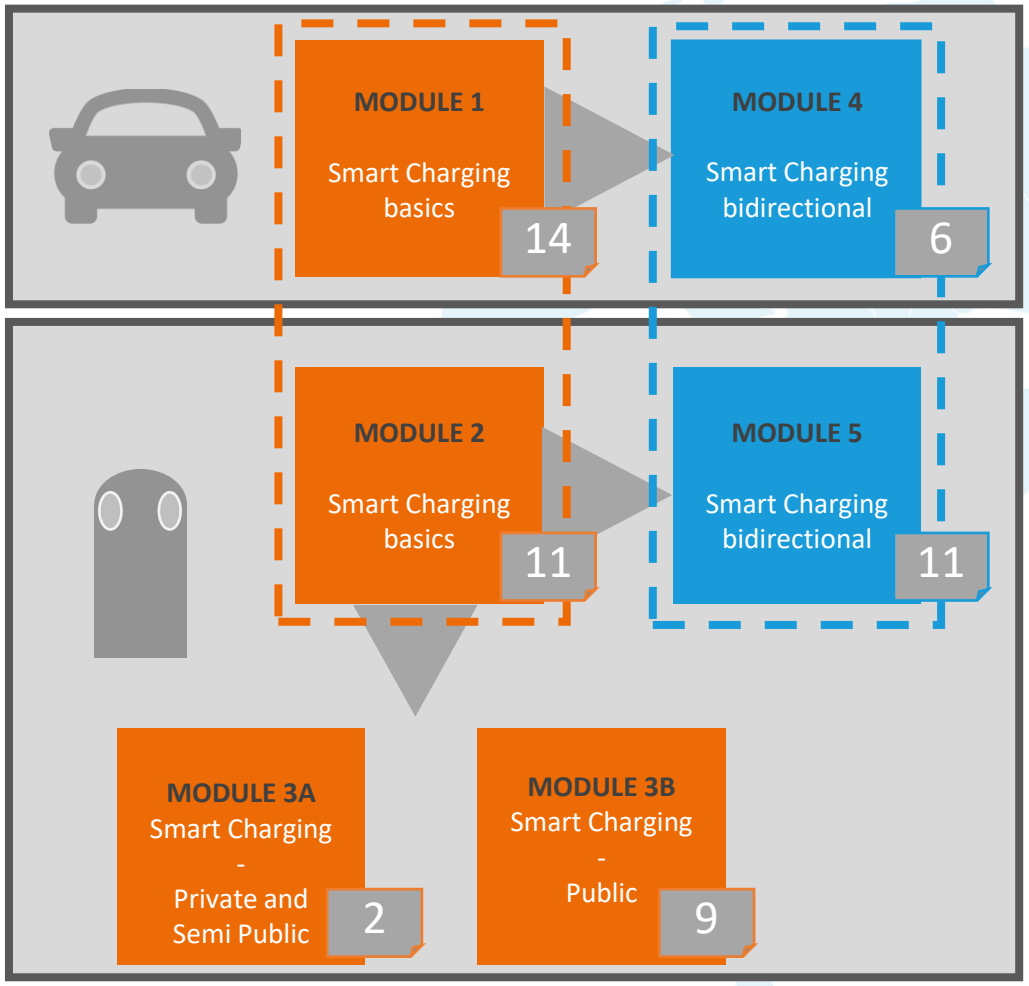






https://www.youtube.com/watch?v=M2lMS5GysNg

Smart Charging Requirements



National Agenda Charging infrastructure

Government

Consumer

https://www.youtube.com/watch?v=M32bzsBswAk

CPO

Commercial Businesses

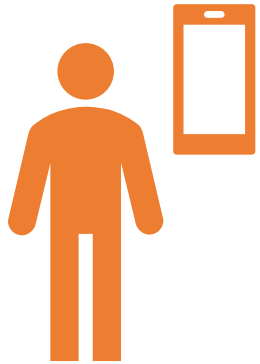
Car manufacturer

Power Grid Operator

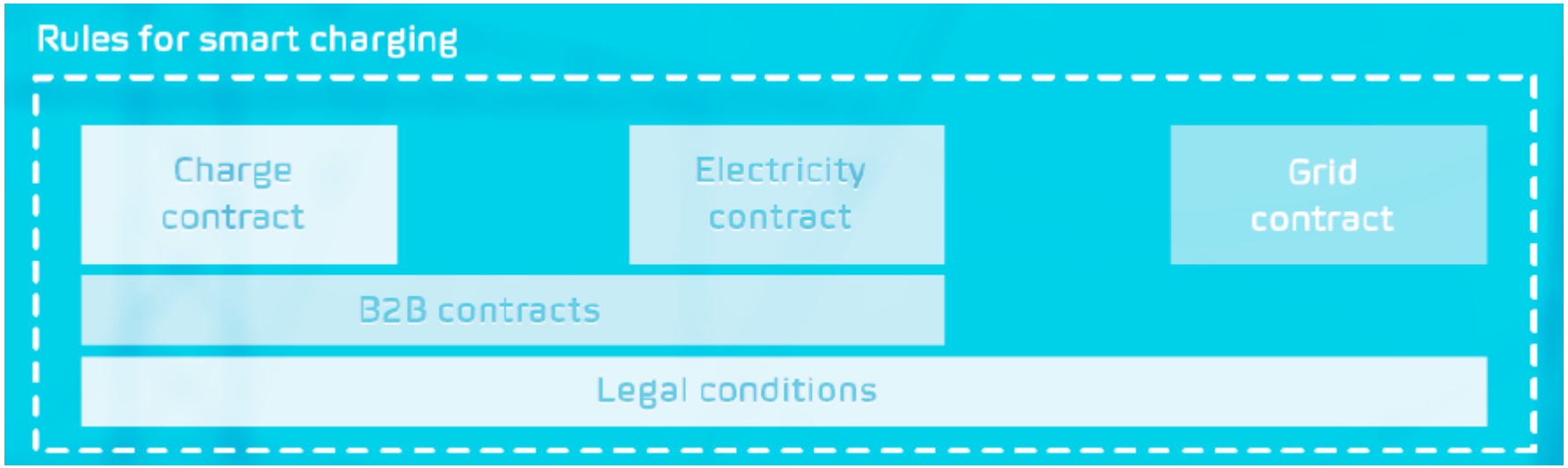
Smart Charging concerns

* Knowledge about
Relevant Laws and regulations

1. Business case (23)
2. Communication / information (6)
3. Transparency charge sessions (11)
4. Data, access and privacy (9)
5. Technology compliance (7)



National
Agenda
Charging infrastructure



1. The New Consumer Agenda with a vision for EU consumer policy from 2020 - 2025
2. REGULATION (EU) 2019/943 on the internal market for electricity
3. DIRECTIVE (EU) 2019/944 on common rules for the internal market for electricity
4. Revision of the Batteries Directive (2006/66/EC), include open access to battery data for properly functioning smart charging

https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R0943

https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32019L0944

https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0696

Legal

Rules for Smart Charging

- Charge contract
- Electricity contract
- Grid contract
- B2B contracts
- Legal conditions

Organisation

- Consumer
- Commercial businesses
- Grid Operators
- Government

Motives → Interests

M2M Communication

- Car
- Charger
- EMS
- Security

Technology

- Intelligence -SCMS-
- DATA
- SC Control signal
  - Hardware restrictions: Car | Charger
  - Optimize: Session | Group
- LOCATIE
- Local Electricity Demand & Supply

Smart Charging Model provides a helicopter view of complementary elements

1. Smart Charging Technology Ready
    - Electric vehicles
    - Charging infrastructure
    - Data access, protocols and cyber security

2. Power System Ready
    - Flexible prices electricity supply
    - Flexible tariffs for Power Grid access
    - Security of Supply safeguard signals

3. Commercial scale-up to exceed drivers' expectations
    - Electric Vehicles
    - Charging infrastructure
    - (Smart) Charging services

https://www.elaad.nl/uploads/files/Smart_Charging_Guide_EN_single_page.pdf

SMART CHARGING GUIDE

NL

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