cerre Centre on Regulation in Europe

ELECTRIC VEHICLES ROLLOUT IN EUROPE

WHAT ENERGY REGULATORY REGIME?

EXECUTIVE SEMINAR
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cerre.eu

Improving network and digital industries regulation

INTRODUCTION

Máximo Miccinilli

Director, Energy

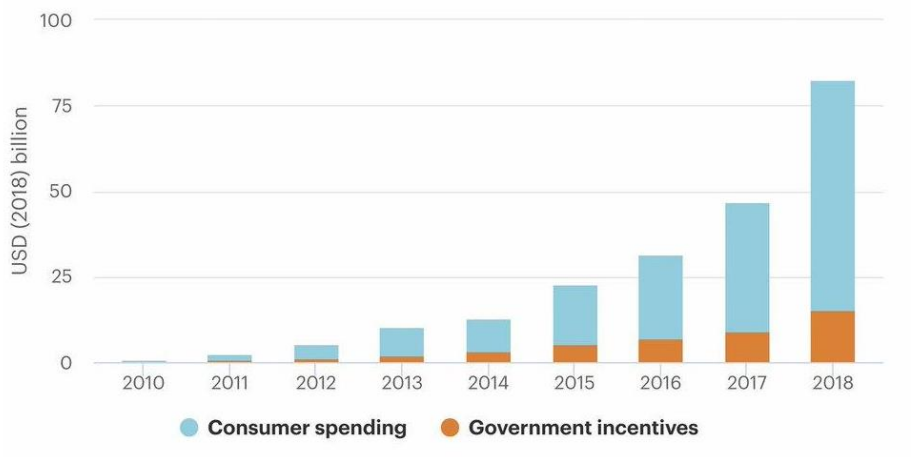
CERRE

The global picture…

- In 2018, the global electric cars fleet exceeded 5.1 million
  → up 2 million from the previous year
- China has the biggest EVs market and Norway leads the EVs car market share
- Public support plays a crucial role for consumers and infrastructure (targets, standards, subsidies, etc.)
- Car manufacturers are promising to significantly increase the number of different electric vehicles models
- Utilities, charging operators and other power operators are boosting investments
- IEA Global EVs Outlook 2019 scenarios: EVs sales = 23 million (130 million stock) and 43 million (250 million stock) by 2030

…is not that great!

Global spending on EV purchases by governments and consumers
IEA Analysis



EVs sales still represent only 3% of global car sales and their reliance on government incentives – around 18% of total spending – has so far remained unchanged.

KEYNOTE ADDRESS

Monique Goyens

Director General,

BEUC

PRESENTATION

Nils-Henrik M. von der Fehr

Joint Academic Director, CERRE

Professor, University of Oslo

NORWAY

Case study

Access to charging

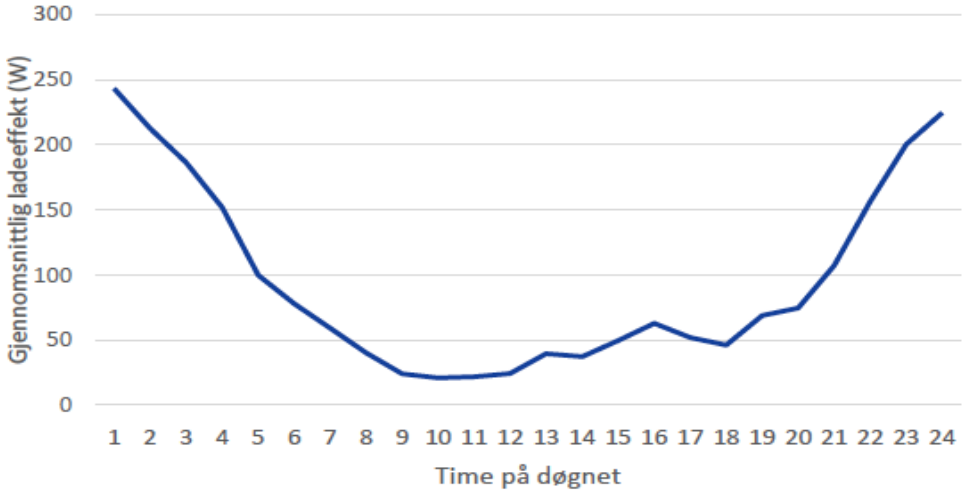
- Home charging
  - In Norway, 75% of households can park on own land
  - Most households rely on electricity for space heating
- Home charging in shared parking facilities is more difficult
  - Availability of outlets, capacity, conflicts over costs and sharing installed in only 18% of housing coops and condominiums
- Many employers offer charging
  - 28% of EV owners use it on a daily basis
- Nation-wide networks of public fast-charging stations

Charging stations

- **Policies**
  - Programmes to support charging in apartment buildings
  - Parking regulations require 6% of spaces with charging points
  - Support program for fast-charging station (tenders)
- **Connection to grid**
  - Network owners obliged to accept requests for connection
  - Same terms as commercial users
  - Users cover all connection costs, incl. network upgrades
- **Market for public charging**
  - Public authorities and private companies, incl. electricity retailers range of chargers, payment schemes and payment methods

Time of day charging

- Charging at work starts at 6.00am, peaks at 9.00am and then falls off
- Fast charging peaks at 5.00pm



Charging at home. Source: Skotland, Eggum and Spilde (2016)

Impact on the grid

- Transmission network (132-420 kV): no impact
- Regional networks (33-132 kV): same
- Distribution networks: limited impact
  - Connection charges cover costs of connecting fast chargers
  - Capacity to private homes generally sufficient
  - Connections in shared parking sometimes require upgrades
- Issue of power, not energy

Lessons from Norway

- Norway is unique in a number of respects:
  - High penetration of EVs
  - Cheap hydro
- In the aggregate, electricity demand from EV charging is modest, even at high levels of EV penetration
- EV charging occurs mostly at home, outside of office hours and periods of peak demand; may be further shifted with "smart" tech
- Robust networks can accommodate high numbers of EVs
- Connection charges cover costs of connecting chargers and hence finance necessary network upgrades

PRESENTATION

Ewa L. Carlson

Assistant Professor,

Reykjavik University

THE NETHERLANDS

Case study

The Netherlands | Background

Goals:

- 1 million electric vehicles on the roads by 2025
- By 2030, only zero-emissions cars to be sold
- Currently:

  2018: BEV 5.6% of all new registrations

  2019: 62,000 BEV; 96,000 PHEV
- PHEV rise between 2012-2014 linked to tax incentives towards company cars
- Exemption from registration fees BPM and road taxes MRB for EVs before 2014
- After 2014, level of taxes depends on CO_2 emissions

Charging infrastructure (NL)

Charging points	2011	2012	2013	2014	2015	2016	2017
Public (freely accessible 24/7)	1,250	2,782	3,521	5,421	7,395	11,768	15,288
Semi-public (limited public access)	576	829	2,249	6,439	10,391	14,320	17,587
Fast-charging Semi-public	14	63	106	254	465	612	755
Private*	Unknown	4,500-5,500	18,000	28,000	55,000	72,000	80,000

* *Estimation*

Source: Nederlandelektrisch (n.d)

Charging infrastructure (NL)

- 2017: 7.7 million homes in the Netherlands out of which 35% are flats
- 34% of multiunit dwellings have a parking space on a common ground, a small part - private parking space for e.g. a garage, others – parking in public space.
- Solution: curbside parking in cities
- Flexpower
- Fast charging - some chargers offering maximum power connection of 350 kW and used as corridor charging
- Smart charging

Lessons from the Netherlands

- Charging needs are primarily met by private charging
- Demand-driven charging points help to locate the infrastructure where it is most needed
- Smart charging and charging plazas as a way to reduce peak loads
- Flexpower – an option in Amsterdam

THE GRAND DUCHY OF LUXEMBOURG

Case study

Luxembourg | Background

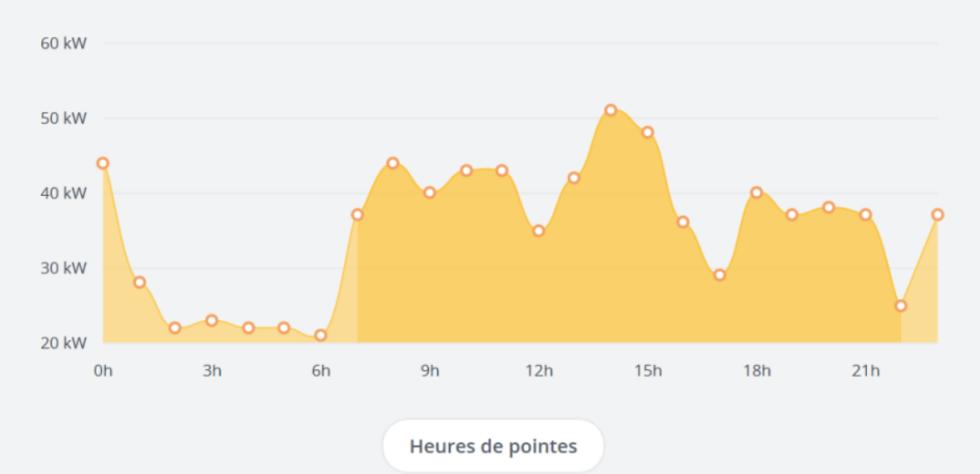
- DSOs are in charge of developing the charging network → the project is part of the government's plan to prepare for the '3rd industrial revolution'
- The core of the charging infrastructure – the public network Chargy – was drafted in 2016 through a ministerial regulation
- Goal:
  - 40,000 electric cars on the road by the end of 2020
  - 100% electric fleet in 2050
- BEV: from 31 in 2011 to 1,567 in 2018
- PHEV: from 30 in 2012 to 1,645 in 2018

Charging infrastructure (LU)

- Chargy – was set up and is developed, operated and maintained by the five distribution system operators
- In 2016, subsequent to a tendering process, the operation of the infrastructure was awarded to Engie Cofely Luxembourg, while Powerdale became responsible for the delivery of charging stations and the operation of an Internet service application, the "Common Operator Platform"
- The first public charging station within this network became operational in 2017
- At the beginning of 2019, Chargy consisted of 486 charging points (aim: 1,600 charging points by 2020)
- Chargy-OK network
- 2019: 14 fast-charging stations outside Chargy

Impact on the grid (LU)

- Study from 2017: in case of a 'light acceptance' (~110,000 EVs), very few or no overloads on the low and medium voltage grids. However, the additional load would use up the entire remaining power reserve of the existing high voltage network.



Source: Powerdale

Luxembourg | Conclusions

- Cooperation with the Netherlands and Belgium in order to facilitate the usage of their charging networks
- 200,000 cross-border commuters every day

Lessons from Luxembourg

- Centrally organised charging infrastructure
- Owned by distribution companies
- Roll-out based on a ministerial regulation
- Still a developing system
- International cooperation important due to a large number of cross-border commuters

REACTION FROM THE EUROPEAN COMMISSION

Sabine Crome

Policy Officer, Retail Markets, Coal & Oil,

DG ENER, European Commission

Open questions for debate

1. Which is the most attractive case study for your sector/organisation?
2. Do you think centralised and decentralised approaches may coexist in Europe?
3. Do you think the Norwegian case is unique and difficult to be reproduced in other markets?
4. Should the EU focus on principle-based regulation and leave local regulation to shape specific urban realities/trends?
5. Do you agree that congestion issues linked to the uptake of EVs are limited today?

PRESENTATION

Friðrik Már Baldursson

Research Fellow, CERRE

Professor, Reykjavik University

Lessons learned from case studies (1/3)

- Phasing in of EVs is dependent on public policy
  - Everyone faces drop in EVs prices (and cheaper fuel), but market penetration differs
  - Policy mix affects choice of PHEV vs BEV
  - Not only subsidies but also local policy (cities) matters
- Access to public charging is important, but most people prefer to charge at home or at work

  → morning-afternoon/evening peaks exacerbated
- Not a problem for grid in Norway and not (yet) in the Netherlands
  - Norway: grid is strong and can accommodate steep rise in EVs numbers
  - NL: EVs only 2% of fleet – what will happen with a much higher share?
- Without countervailing measures, there seem bound to be localised problems in many European countries/cities

Impact on power system will vary by country and region

	Total electricity consumption MWh/cap p.a.	Household electricity consumption Mwh/cap p.a.	Passengers cars per 1,000 inhabitants	Consumption of EVs with 100% stock share*	Share of current total consumption	Share of current household consumption	Proportional impact of EVs compared to NO
NO	24.0	7.5	514	1.9	8%	25%	1.0
LUX	10.6	1.6	670	2.4	23%	153%	2.9
BE	7.1	1.6	508	1.8	26%	115%	3.3
FR	6.4	2.4	478	1.7	27%	72%	3.5
DE	6.6	1.6	561	2.0	31%	130%	4.0
NL	6.3	1.3	556	2.0	32%	151%	4.1
UK	4.8	1.6	471	1.7	35%	106%	4.6
IT	4.7	1.1	625	2.3	48%	208%	6.2

**Rough approximation based on 0.2 kWh/km and 18,000 km p.a.*

- Rise in stock share to 50% in Norway: 3% increase in electricity demand
- Similar rise in NL: on the order of a 15% increase in electricity demand
- In the absence of smart charging, peak demand could rise considerably more:
  - 12% in Norway – more in most other countries

Lessons learned from case studies (2/3)

EVs not just a challenge but also an opportunity:

- Huge storage potential – technically
- Can potentially provide flexibility services – sorely needed with increasing RES generation
- Smart technologies!
- Cases:
  - Not only technology, but also changed charging behavior needed to realise potential
  - NL: Flexpower network shifts load from peak to off-peak

Lessons learned from case studies (3/3)

Charging infrastructure:

- Norway & NL: decentralised approaches – seem to work well
  - Norway: DSOs guaranteed financing of necessary upgrades has facilitated connection of charging points
  - NL: Bottom-up approach to public charging points – most people do not have access to private parking
- Luxembourg: more centralised approach to public charging provision
  - Shows that there are different options to organise the EVs "Ecosystem" depending on local and regional retailers
  - More decentralised models (e.g. the Netherlands) may also proliferate and coexist across Europe

Policy implications – Charging (1/2)

The rise of EVs and electrification of transport can go smoothly - hand-in-hand with the rise of RES

- Harnessing potential of smart technologies
- Incentives and market structures need to be right
- Doubtful that incentives are correct [elaboration needed]

Challenge: shift charging to off peak

- Time of use pricing/tariffs
- Even dynamic pricing - supply/demand balance
- Technology dependent

May not suffice for localised problems

- Command-and-control regulation may be more appropriate
- Flexpower (NL) an example of a promising approach

Policy implications – Charging (2/2)

Strategic placement of (public) charging points/stations can shift charging in space – i.e. to places with less strain on the grid

- Although most people will probably still prefer to charge at home

Norwegian regulation provides a possible model

- Owners of charging points must pay full network cost
- Efficient choice of locations – but may raise cost of charging

Dutch approach to allocation of charging points could also be a useful model

Policy implications – EVs as storage

- EVs can provide important storage and flexibility in a decarbonised power system
- Time-of-use tariffs, network charges and command-and-control will be important for changing charging behavior in time and space …
- … but will not be sufficient to exploit storage potential
- Vehicles need to be plugged in while parked!
- V2G technologies and associated market structures need to be developed
- Challenge: having enough charging/de-charging points
- And owners need to be rewarded rather than penalised for staying plugged in

Conclusions (1/2)

- Europe is in the very early stages of a shift to EVs
- Goes hand-in-hand with transition to RES
- Opportunity to utilise synergies
- Great uncertainty about how fast transition will happen
- Recently, it has moved much faster than envisaged not so long ago
  - … predictions have been raised
  - … more optimism about deployment of “smart” technologies

Conclusions (2/2)

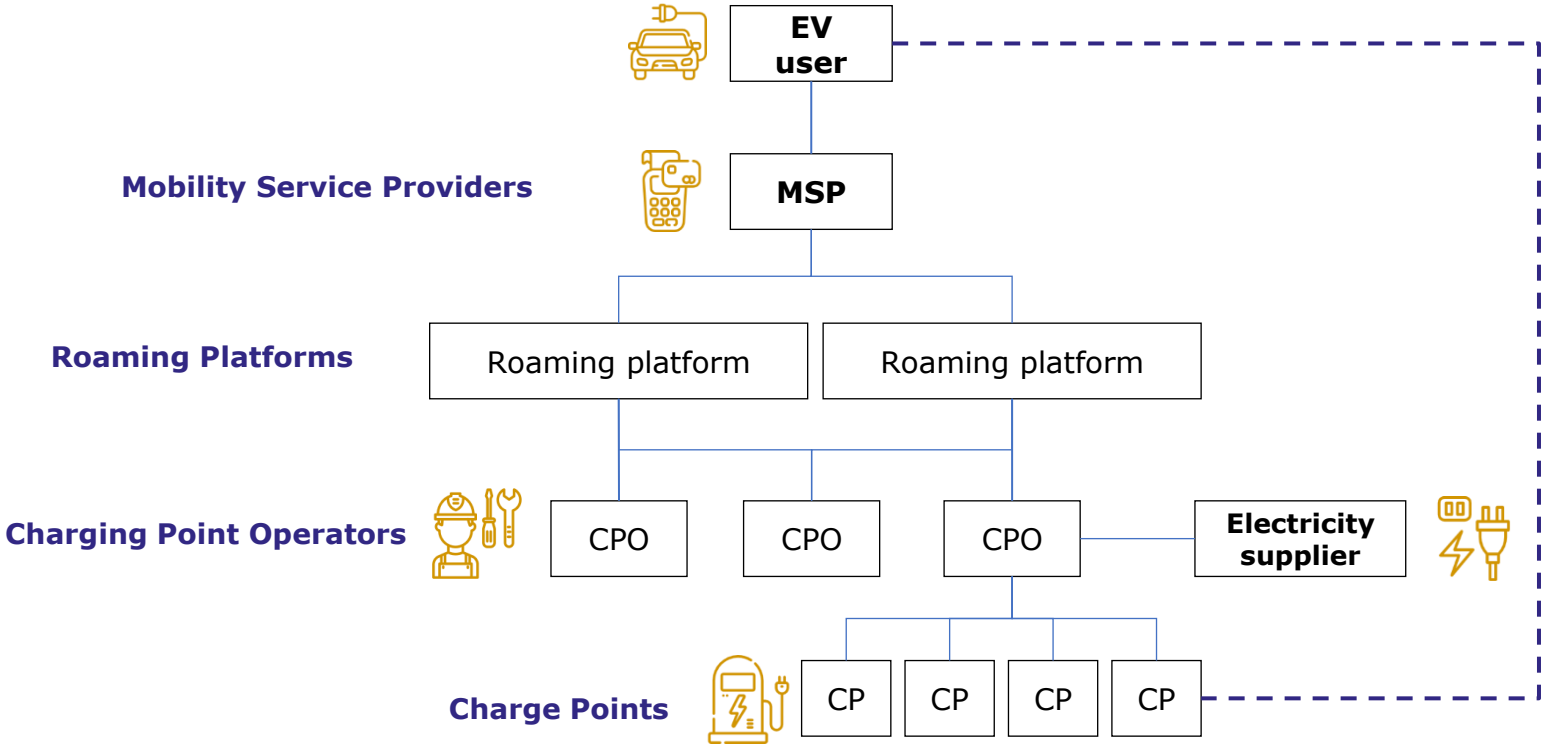
Regulation or changes in pricing and market structures aimed at avoiding overloading and inefficiencies in the power system due to electric vehicles need to be goal-oriented

- Time as well as spatial aspects need to be taken into account
- Foresight but also flexibility to be able to adapt to developments in market & technology, and to regional and local specificities
- Encourage uptake of new and efficient technologies and development of markets

Open questions for debate

1. The Alternative Fuels Infrastructure Directive (AFI) will be revised soon. What should be the agenda and priorities for this piece of legislation?
2. How do we involve DSOs at local and national levels when planning EVs infrastructure in the main urban areas? Do we need a new regulatory model/approach?
3. How do we ensure transparency and fair pricing for consumers across Europe?
4. How do we tackle "unintended effects" of a growing EVs markets in Europe such as more congestion and less use of public transportation?

How can we build a sustainable and efficient ecosystem for EVs?



Centre on Regulation in Europe

Avenue Louise, 475 (box 10)
1050 Brussels, Belgium

+32 2 230 83 60

info@cerre.eu

cerre.eu

@CERRE_ThinkTank

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