

E-Mobility

The Complexity of the Transformation

CAR – South Baltic Project

10 Partners

IUC Syd

City of Gdynia

PKT Gdynia

Gdansk University of Technology

Rostock Port

Ostfalia University of Applied Sciences

Bornholm Regional Municipality

Denmark's Technical University

City of Lund

Research Institutes of Sweden

2 million euro budget

7 pilot investments

Charging infrastructure

Battery recycling

University research

Battery degradation

Development of E-mobility

Focus on Technology Innovation

30 years as business strategy consultant.

Wrote one of the first books on e-business strategy with David Lundberg: "The Transparent Market" 1998

- "In the future companies will do business on the Internet."

5 books since 2009 on the large-scale transformation to renewable fuels

Latest: "The Blind Guardians of Ignorance" 2020

Has studied many examples of innovations through history

- Financing
- Development steps
- Driving forces
- Business models

E-mobility Debate: Until recently sole focus on cars and charging

Volvo Cars – 100% electric cars 2030
– is this realistic?

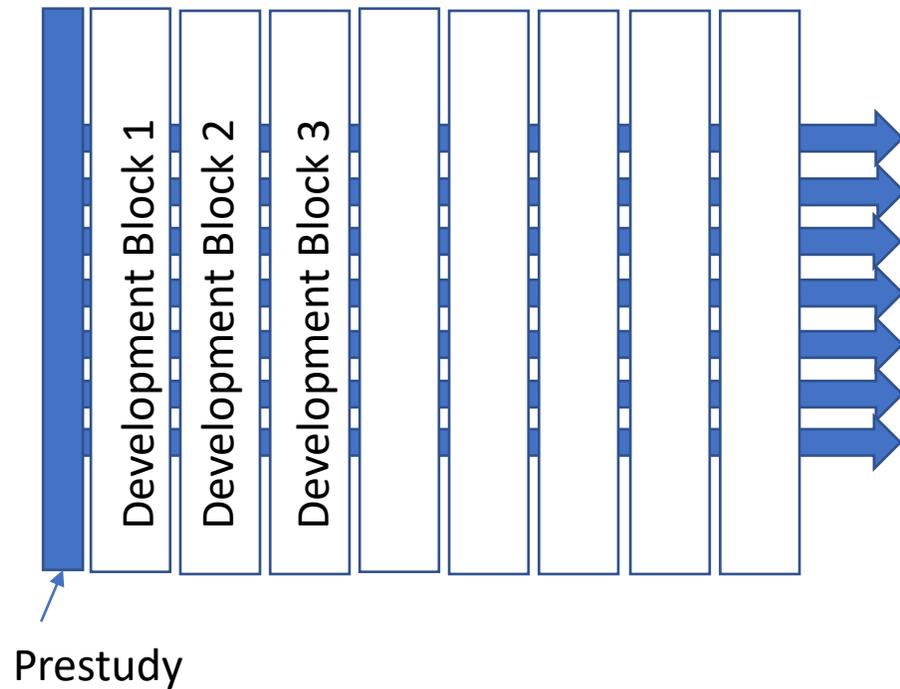
Ford – 100% of cars sold in Europe
electric by 2030 – realistic?

To drive all German cars on
electricity you need approximately
120 TWh:

- Corresponds to 24 nuclear reactors or approx 30,000 large wind turbines
- Same amount for transportation by truck, bus etc – 120 TWh
- Actually more in terms of voltage, due to seasonal variations
- Present production in Germany 600 TWh (Actually 139 in Q1 2021)

Wind generation in Germany 132
TWh in 2020

The Relevant Approach – Development blocks



The development needs to keep pace across sectors –
"Development blocks"

- Vehicles
- Power production
- Power distribution
- Smart grids
- Training of future employees
- Financing of development steps
- Business development

Compare for example Apollo

Rocket

Moon lander

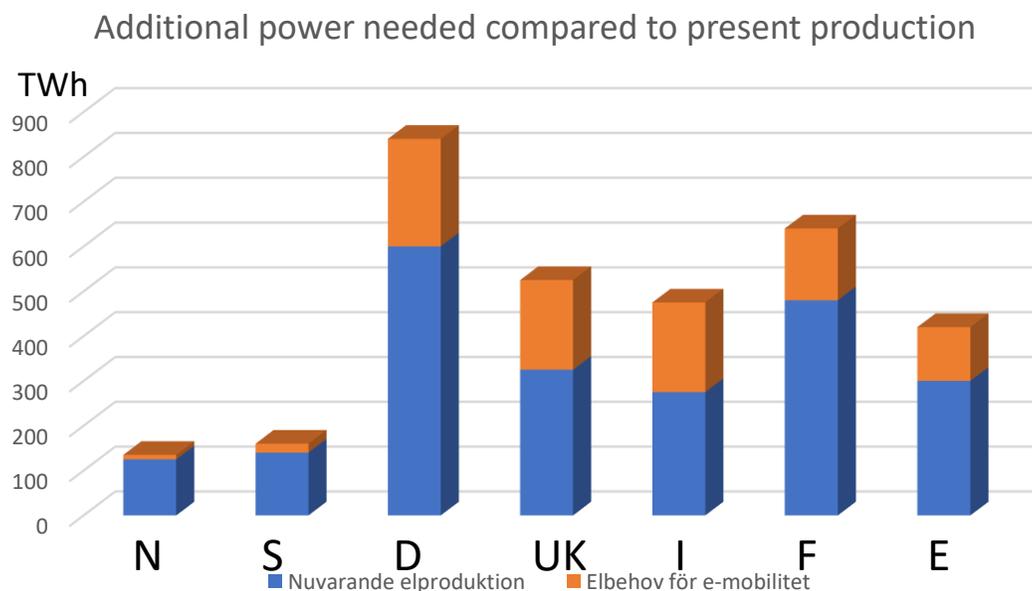
Assembly building

Transport vehicle

Control center

New materials, miniaturization,
public-private collaboration etc

Different complexity of expansion in countries



Large-scale plans can only become realized if countries start to expand power production and distribution

Governments and the EU take it for granted that everything can become Electrified – without planning:

- Transportation
- Industry
- Shipping
- Air travel
- + hydrogen
 - Requires 2x the power
 - No infrastructure in place

E-mobility - ban petrol and diesel cars by 2030!

Norway: E-mobility requires 8% of present electricity

Sweden: 15%, 20 TWh, (corr. to 4 reactors)

Germany: 40%, 240 TWh, (corr. to 48 reactors)

UK: 60%, 200 TWh, (40 reactors)

Italy: 73%, 200 TWh, (40 reactors)

USA: 140%, 1400 TWh, (280 reactors) – important market!

(To run cars and transportation on electricity. Seasonal variations not included. Even in Baden-Württemberg temperatures sometimes drop below minus 10 for a week in December or January.)

Sweden local shortages already 2020.

No, or vague, plans for expansion in most countries.

High expectations.

EU-Commission Maros Sefkovic (FAZ März 2021):

In the EU to be produced batteries for 8 million cars by 2025!

Big hurry to produce batteries. No hurry to expand power production and distribution?

Vice Chancellor Scholz on television 15 June 2021:

“100 TWh annual capacity to be built.” But not only for mobility – to make industry sustainable.

“Need to shorten time for approval of expansion to a year.”

Hydrogen: Baseline power need 2* battery-electric...

... and no infrastructure in place for large-scale production and distribution

Not very different with hybrids

Average distance driven 40-50 km per day per car

With hybrids longer distances would be facilitated by petrol/diesel/natural gas

Bulk of car transportation done with cars driven relatively short distances per day

Possible vision for long term: Vehicles with <100 km battery range and frequent charging via electric roads and stationary chargers

Similar to development of mobile computing:

Ubiquitous access to the Internet

No need to think or plan

But it requires substantial development and investment...

...and a focused strategy shared by all players

Possible/Impossible?

Sweden built 12 nuclear reactors from late 50's to early 80's (of which 6 have been closed down)

Illustrates the possibility to build capacity.

Political and business agreement needed.

Can it be done?

Who needs to understand this in detail?

Governments?

Automotive companies?

Utilities?

Is it a system change we are talking about?

- Yes, definitely and most adults need to participate!

Electrification of heavy transportation

Charging

- Stationary
 - Fast or slow
- While driving
 - Inductive or konductive via rail
 - Pantograph

1 charging post per car not realistic...

- Electric roads probably necessary...

Power supply

- Without smart grids
 - Larger expansion of production
- With smart grids
 - Smaller expansion of production
 - Use of surplus power and control of bulk of charging to off-peak periods
- Cold winter weeks problematic

National strategies needed

Goal 5 Years:

- No of cars and trucks?
 - Depends on market segments
 - Little expansion of capacity possible
- Expansion projects: Power generation and distribution
- Start to build large-scale charging infrastructure
- Establish businesses and build business models

Goal 10 years:

- No of cars and trucks?
 - Prioritized segments – TBD!
 - Ban of sales of petrol and diesel cars impossible!
- Amount of power available for transportation?
- Large-scale charging infrastructure available?
- Expansion of e-mobility businesses

Goal 15, 20, 25 years

Automotive companies

2021: Everything is possible

No restrictions for strategic thinking

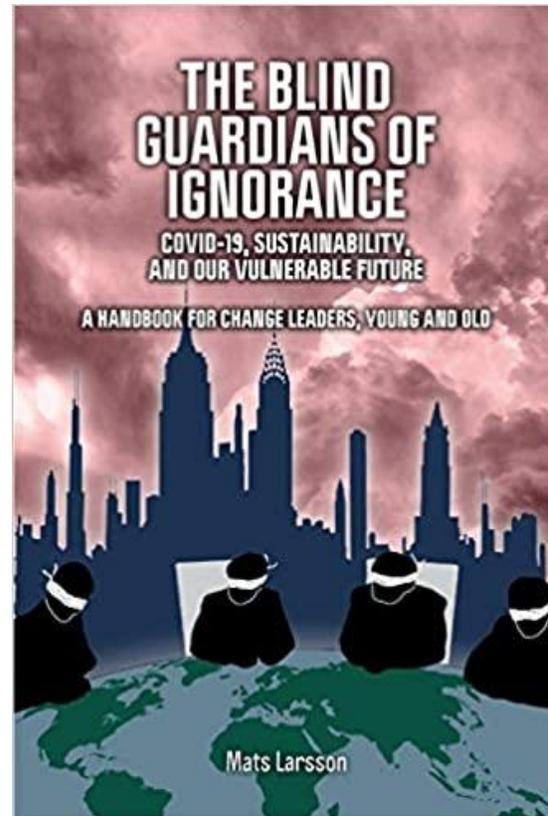
- 100% electric
- 100% electric in Europe

2030: Sales of electric and hybrid cars expanded for all makers

Expansion of power and charging infrastructure not likely to keep up with demand

How many electric cars and trucks can be sold each year – given the restrictions?

Latest book "The Blind Guardians of Ignorance" 2020



Thank you for your attention!