



Regionomics: smart e-mobility solutions

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April 22, 2016

Introducing VDL Groep

- No-nonsense Dutch family-owned company
- Aimed at manufacturing industry
- Wim van der Leegte:
'Boegbeeld Nederlandse Industrie'
- 11.046 employees (10.441 in W-Europe)
- 87M€ R&D (#7 in The Netherlands)
- Combined turnover in 2015: 2.7B€



Subcontracting



Finished Products



Buses & Coaches



Car Assembly

E-mobility per today: the cons

- Characteristics of electric cars and buses:
 - > Initial purchase price is high
 - 1-2 times diesel
 - < Range is limited
 - Max 200-250km on batteries, >400 km diesel
 - Impact of heating and cooling is significant
 - Fast charging and range extenders (ZE)
- High vehicle weight of heavy duty transport (buses)
 - 12,0 kg/km batteries and 0,4 kg/km diesel
 - 'Refuelling' electrically @ 50-600kW and H₂-Diesel @ 6.800-16.000kW
 - Reliability (technology as uncertainty)

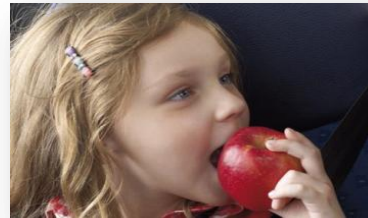


A2	E 25		
Amsterdam			236
Rotterdam			122
Eindhoven			79
A 73	Nijmegen		288



E-mobility per today: the pros

- Less interior and exterior noise
- No local air pollution
 - No particle matter, NO_x, etc.
 - CO₂ neutral in combination with wind and solar energy
- More efficient
 - More efficient drive, lower energy consumption
 - Use of alternative energy sources (wind, solar, waste-hydrogen)
- Political
 - Liveable cities (London, Hamburg, Paris, Netherlands (5.000 E-buses in 2025))
 - 80% CO₂ reduction per 2050 in Europe



More than words: zero emission agreement

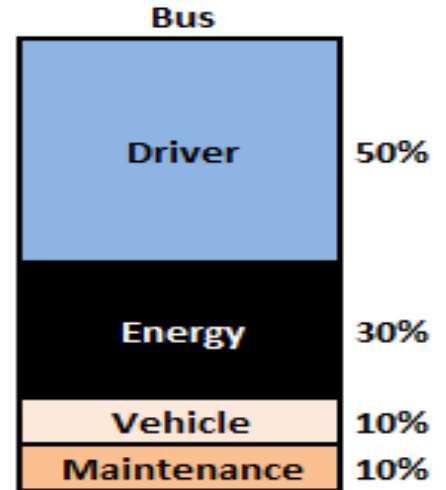


More than a vehicle: system approach



More than initial cost: TCO rules

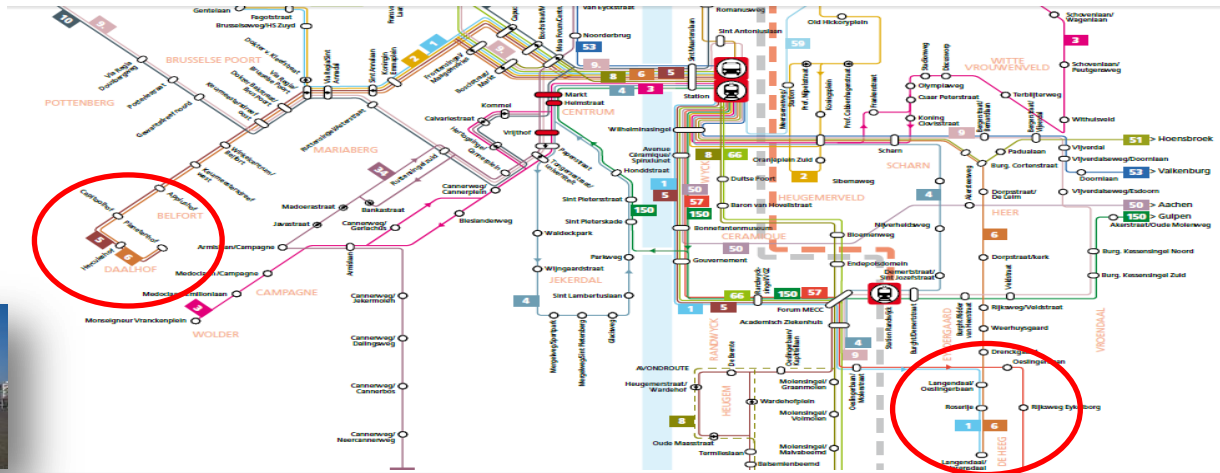
- Total cost of driver as important as total cost of vehicle + operation:
 - Optimal use of driver during e-operation
 - Leaving rest of operation as much as possible the same as before



More than physical system: E-logistics

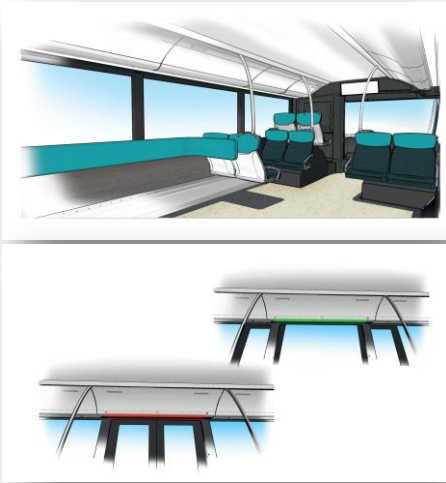
Operational data:

- 10x 12m buses
- Total 2.765 km/day
- Total 8.020 minutes/day
- Total 295 minutes dead time / day (4,0%)
- Max 365 km/bus/day
- Max 1.060 minutes/bus/day
- Max 45 minutes dead time/bus/day (4,0%)



More than pilots: ZOB (Eindhoven)

- 43 VDL Citea Electric 18m articulated buses for Hermes (Connexxion – Transdev)
- Delivery of a total zero emission system solution
- Phased implementation of a complete Zero Emission fleet before 2025



More than design: mass deployable vehicles



More than buses: other heavy duty

- Advanced development software electric AGV (autonomous driving)



- Development e-truck, electric small size public transport, city distribution

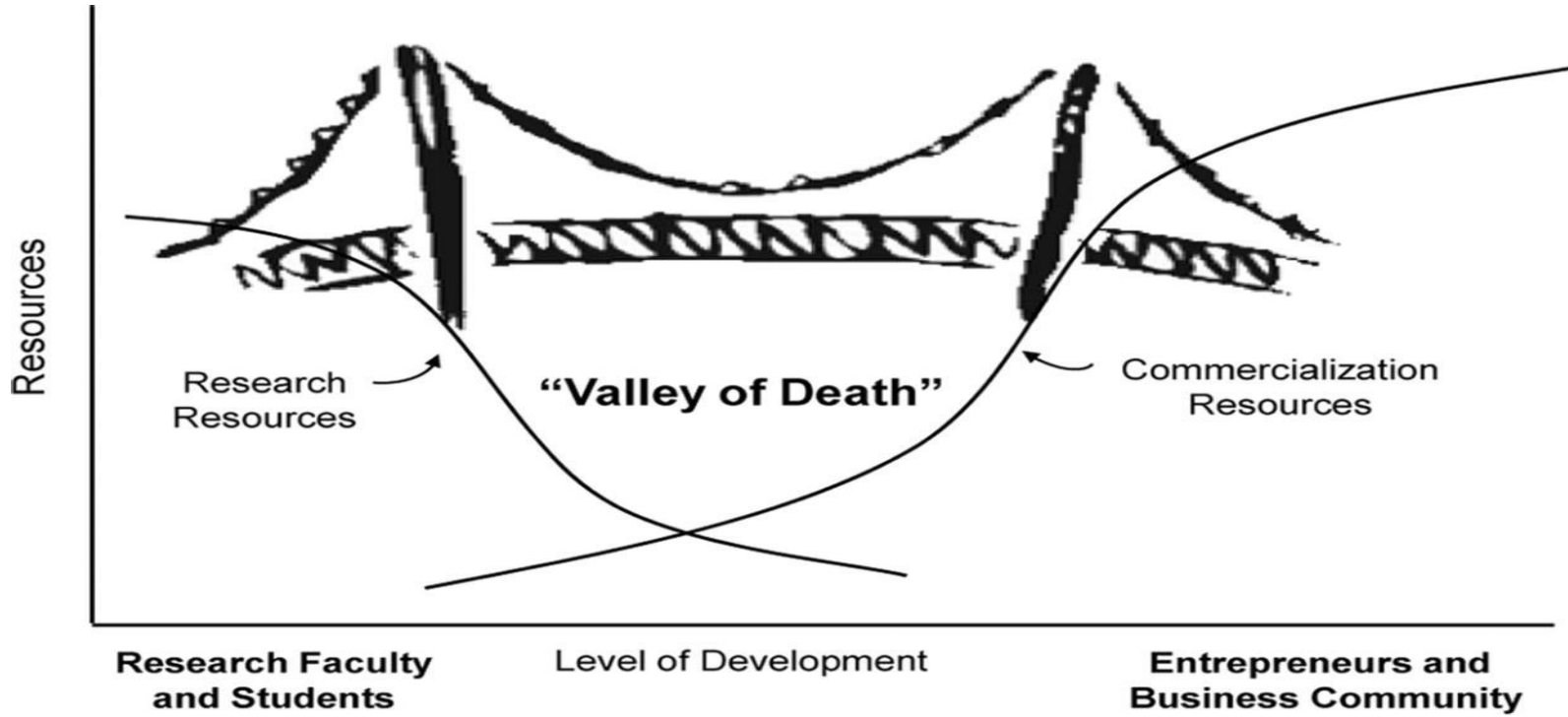


More than e-mobility: smart mobility

- Reducing emissions as a first priority
- Adding sensors and connectivity as a next step
- Automating tasks to drive efficiency and safety, but in manageable steps and per use-case
 - Optimal route for AGVs
 - Automatic docking at busstop
 - Congestion avoidance through telematics
 - Self-driving buses in controlled environment
 - Transport on demand?
- Always safety first



More than funding one-offs: towards mass-market



Regionomics and smart mobility

- Fund scalable ideas (including manufacturing), not only cute ideas
- Being first should be rewarded, not come at a penalty
- Stimulate employment in (Western) Europe; brains and hands
- Innovate in steps, there is more in smart mobility than autonomous driving vehicles



Activities VDL ETS BV

- Energy(supply)
- Energy storage
- Charging infrastructure
- Monitoring and maintenance charging infrastructure
- Building blocks for electric vehicles
- Battery-assembly / re-conditioning
- Hydrogen technology
- Simulation software
- Autonomous driving
- New business models
- ... and a lot more to come



Questions?

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WDL

The image features the letters 'WDL' in a bold, stylized font. The letters are white with a thick black outline. The interior of the letters is filled with a pattern of horizontal stripes: red at the top, white in the middle, and blue at the bottom, resembling the flag of the Netherlands. The 'W' and 'D' have a slanted, dynamic appearance, while the 'L' is more rectangular. The entire logo is set against a solid dark blue background.