

Fuel Cell Bus Deployment with the example of H2Bus Europe Development

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Supported by:



H2Bus Europe

Hydrogen For Clean Transport

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About Nel Hydrogen

- World's largest pure-play hydrogen company with a market cap of €500 million.
- +250 employees in Denmark, Norway and USA with world-class experience and skills.
- Offering hydrogen technology and solutions for industrial, energy and transport applications.
- More than 3500 hydrogen solutions delivered in 80 countries world wide since 1927.
- World #1 on hydrogen electrolyzers and hydrogen fueling – unrivalled performance and track-record.

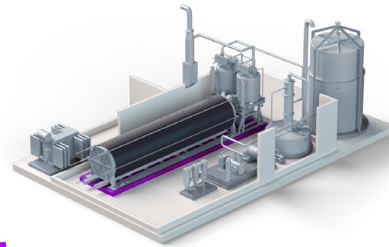


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ALKALINE ELECTROLYSERS

Dates back to 1927



PEM ELECTROLYSERS

Acquired in 2017

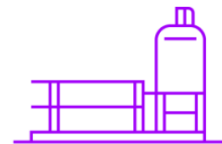


HYDROGEN FUELING

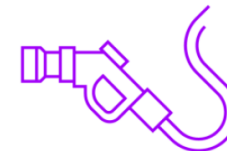
Acquired in 2015



Three business segments



Hydrogen Electrolyzers



Hydrogen Fueling

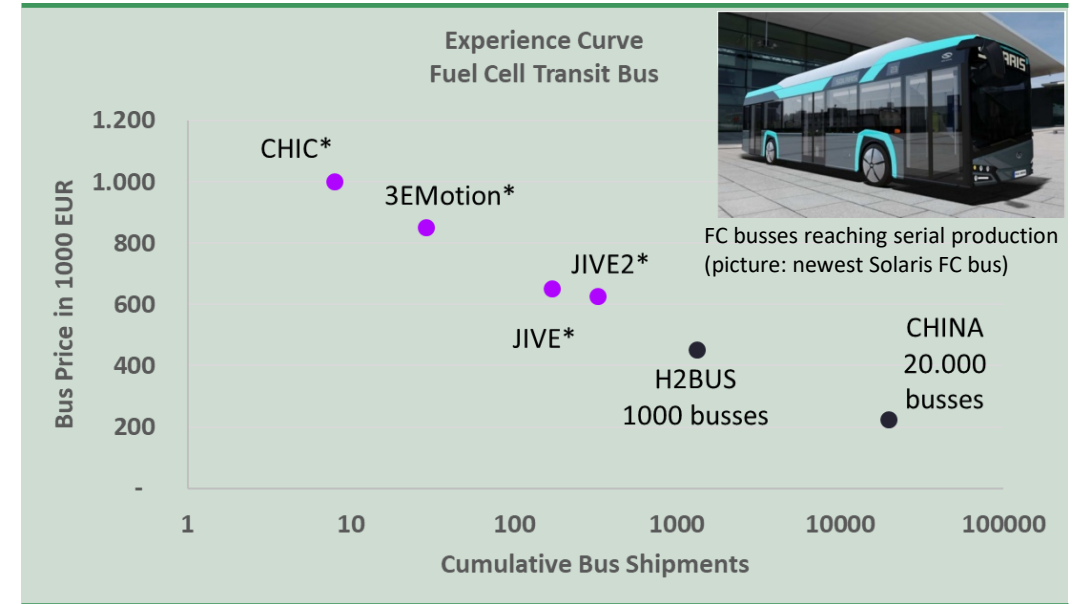


Hydrogen Solutions

Fuel cell buses have been in operation in European cities for nearly two decades.

The most recent demonstration project, CHIC, concluding that:

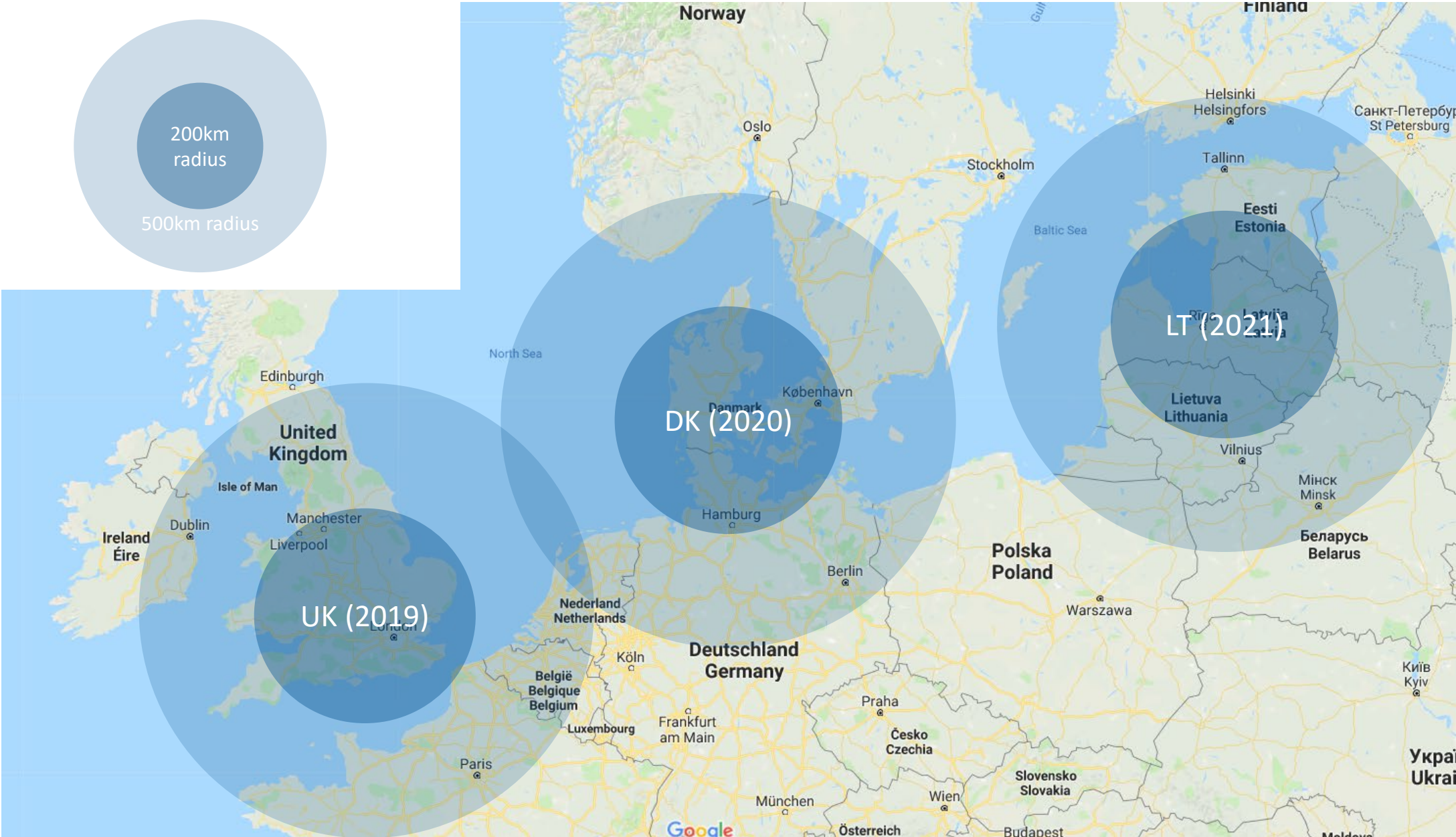
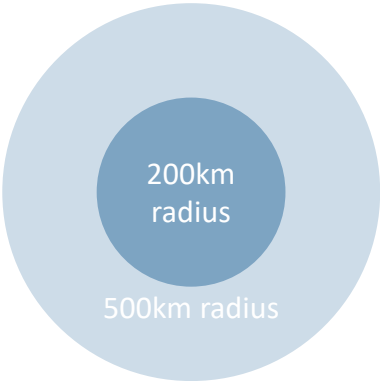
- The technology provides zero emission public transit and can meet the needs of demanding daily bus operations in busy cities
- The technology acts a drop-in replacement for diesel buses, with:
 - Fast refuelling – buses can be refuelled in under 10 minutes (average 5-7 mins)
 - Long range – range is essentially unlimited for daily operation, with ranges up to 400km achieved
- This means the **buses offer the same operational flexibility as diesel** without the need to upgrade electrical infrastructure at depots and without new on-street charging architecture associated with battery electric vehicles. There is also no need for additional buses to meet daily service requirements.
- The early deployment projects also pointed to the need to address the cost challenges of fuel cell buses, which were too high in these low volume demonstration projects.
- These cost issues will be partially addressed by the ongoing JIVE projects which are deploying 290 new fuel cell buses across Europe with a target to bring prices below €650,000.
- This project will go much further than that and bring the fuel cell bus to the point where it offers the cheapest zero emission solution.



*CHIC: <http://chic-project.eu/> / *3EMotion: <http://www.3emotion.eu/> / *JIVE2: Upcoming
*JIVE: <http://www.fch.europa.eu/project/joint-initiative-hydrogen-vehicles-across-europe>



H2Bus Partnership locations (H2Hub™)



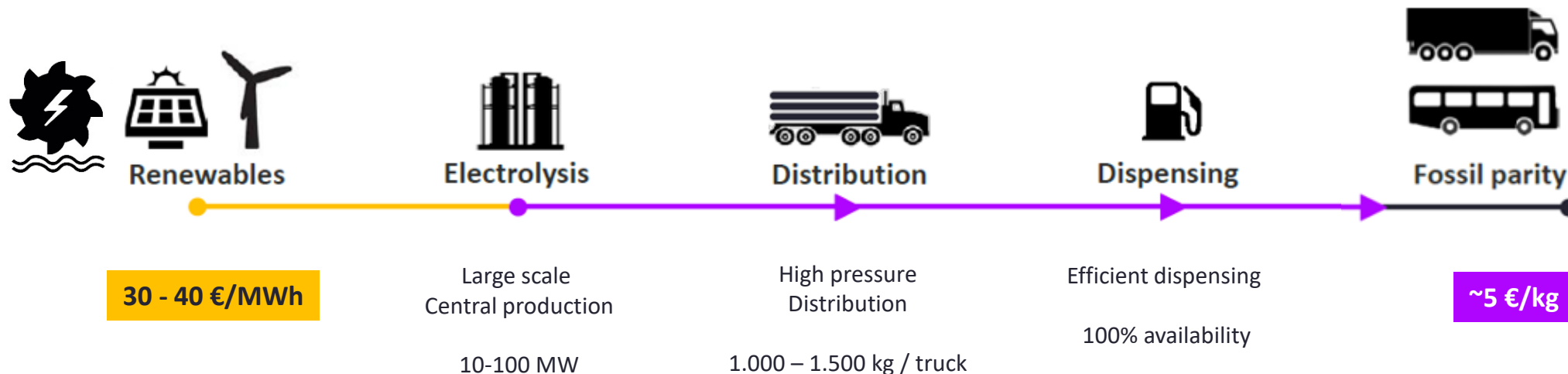


Competitive Hydrogen for HD applications

- Optimized hydrogen supply chain
- Renewable electricity converted to hydrogen centrally at industrial scale to insure low energy cost
- Distributed by truck, and dispensed competitively

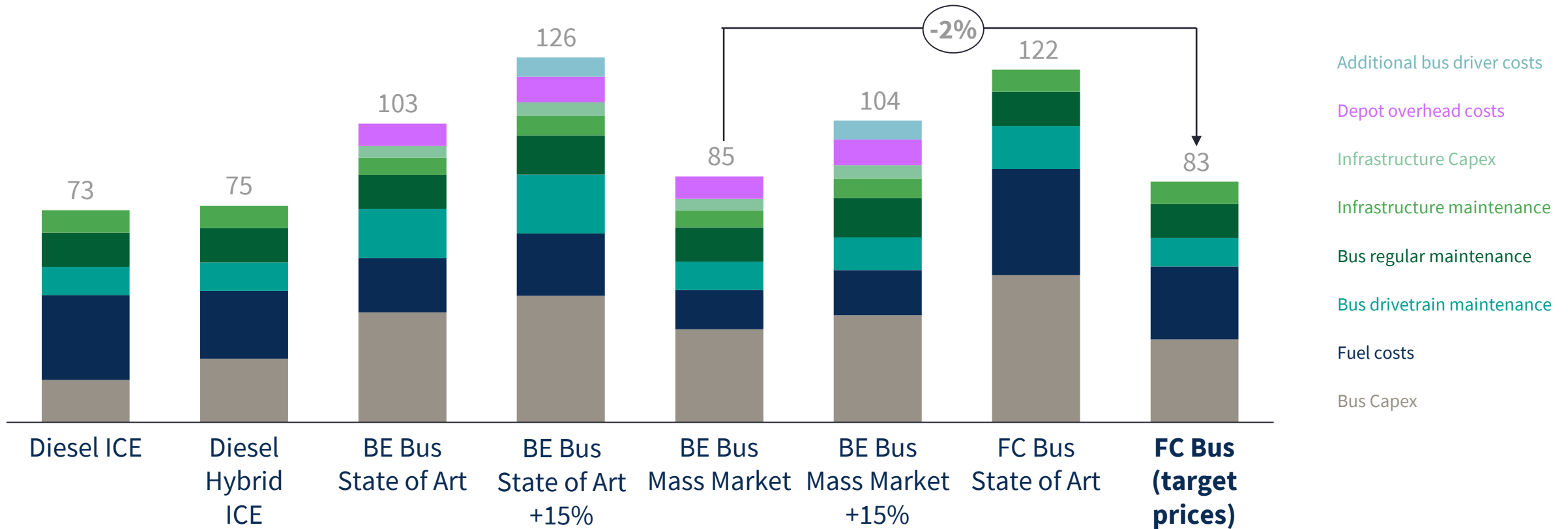
- 5€ dispensed is now possible in favorable locations/conditions = Fossil Parity

- Resulting hydrogen cost depends on local frame conditions



- Under the cost reductions targeted in this project, the fuel cell bus
- will be the most cost effective zero emission bus

Single-deck urban bus annuitised total cost of ownership '000€/bus/year



For the BE market, additional buses have been accounted for in some scenarios to cover existing routes

End of presentation

**Thank you for
your attention**

Questions?

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