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There is a problem…Urban air pollution has major effects on health.

Air pollution costs European economies €1.5 trillion a year in diseases and deaths.

Air pollution dangerously high for almost half of U.S., report finds.

*CBS News*
Where does the pollution come from in the US?

Fossil fuel burning transportation is a major contributor. It is responsible for 27% of greenhouse gas emissions in the US. US EPA, 2014
Where does the pollution come from in EU?

Fossil fuel burning transportation is a major contributor. It is responsible for 21% of greenhouse gas emissions.
There a quest for solution…There is a political will to make changes.

- COP21 agreement
- Diesel vehicles are being banned in Europe
- Introduction of low emission zones in cities
- Commitment from transit agencies to move to 100% ZEB by 2025 or 2030
There is a target... Clean transit is required to meet emission reduction targets.

- Public transit takes cars off the road
- Major mover of people in dense urban areas
- Zero-emission public transit is a reality today with electric buses
- Public transit impacts disadvantaged communities
There is a solution…Fuel cell electric buses provide an operable and affordable zero-emission solution for public transit.
Zero-emission electric buses are a reality.

- Electric powertrains are mature
- Growing worldwide commercial deployments
- Efficient drive
- Benefited from progress in battery technology
- Low noise and passenger comfort
Hydrogen fuel cell buses are electric buses integrate-able to any existing infrastructure.

- Same electric drivetrain as battery electric buses
- Battery-fuel cell hybrid configuration
- Fuel cell module is on-board battery charger
- Most OEMs offer common platform for their zero-emission buses
Fuel cells enhance the performance of electric buses.

- Longer range (400 km plus)
- No compromise on passenger load
- Fast refilling (less than 10 min)
- Recyclable
- Improve vehicle efficiency by using heat from the fuel cells
Fuel cells enhance the performance of electric buses.

• Improve vehicle efficiency and battery lifetime
Transit buses should transport passengers.

- Passengers represent 1/3rd of bus gross weight
- Longer range can be achieved with more batteries (up to 650kWh of batteries for 450km)
- But it increases bus weight up to 2,000kg
- Fuel cell buses are lighter and can provide a longer range with a full passenger load
Fuel cell electric buses can replace diesel buses without significant changes to operational requirements.

- No need to adapt routes and schedule
- Better asset management
- No roadside infrastructure
- 1:1 replacement of conventional buses
Fuel cell electric buses are affordable.

- Bus cost has dropped by 100% since 2010
- Funding and incentives are available to bridge price gap with conventional buses
- Higher fuel economy than conventional buses
- Attractive operating cost
EU Case - Fuel cell electric bus cost reduction driven by:

- Optimization of electric bus platform
- Hybridization of fuel cell with battery
- Reduction of fuel cell module size from >200kW to less than 100kW
- Integration and fuel cell system cost reduction with volume production

Fuel Cell Electric Bus Cost
(12 m bus in Euro)
US Case - Fuel cell electric bus cost reduction driven by:

- Optimization of electric bus platform
- Hybridization of fuel cell with battery
- Reduction of fuel cell module size from >200kW to less than 100kW
- Integration and fuel cell system cost reduction with volume production
- FCEB will be within $50k of BEB by 2020+

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**Source:** New Flyer
China Case - Major gains being achieved even with modest scaling.
Driving volume by simultaneously creating demand for trucks and buses.
Starting a new energy revolution.

• Bus demand stimulates hydrogen production projects
• Hydrogen allows a different route to get low carbon energy into our cities
• Hydrogen can solve problems of energy supply and grid instability
• Hydrogen fuel cell bus deployments open the road for trucks and rail applications
Hydrogen provides scalability for large bus depots.

- Hydrogen infrastructure is fully scalable
- 1 bus = 30 kg of H₂ per day
- 20 buses = 600kg/day
- 75 bus station with 2x 4.5t storage of liquid H₂ will have a footprint of 400m² (4,300ft²)
Years of road experience with performance equivalent to conventional buses.
Product Flexibility and Scalability

FCveloCity® fuel cell module for heavy-duty vehicles

• Zero-emission solid state power module
• Flexible platform from 30kW to 200kW
• Safe (built-in safety features)
• Quality tested
• Durable (25,000hrs stack life in service)
• Fuel efficient
Committed to sustainable mobility, and clean air for everyone.