



# The potential of electrification of Buses

Peter Danielsson

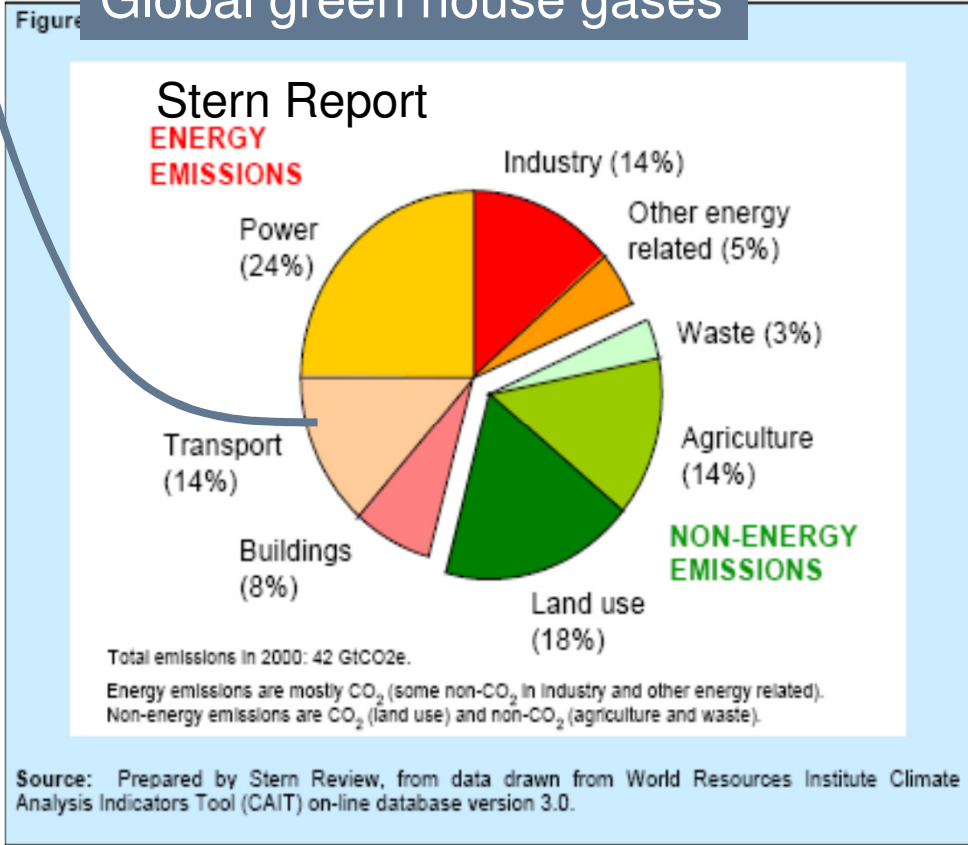
Manager, Vehicle Features

Volvo Bus Corporation

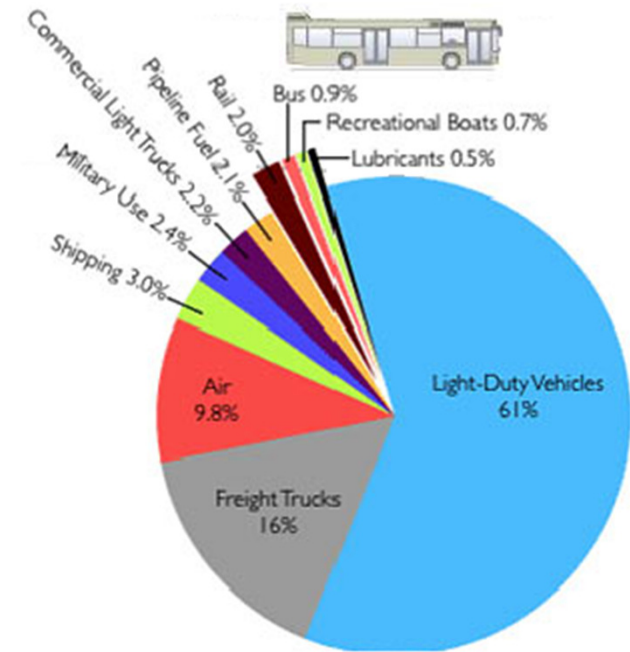
# Green house gases



## Global green house gases



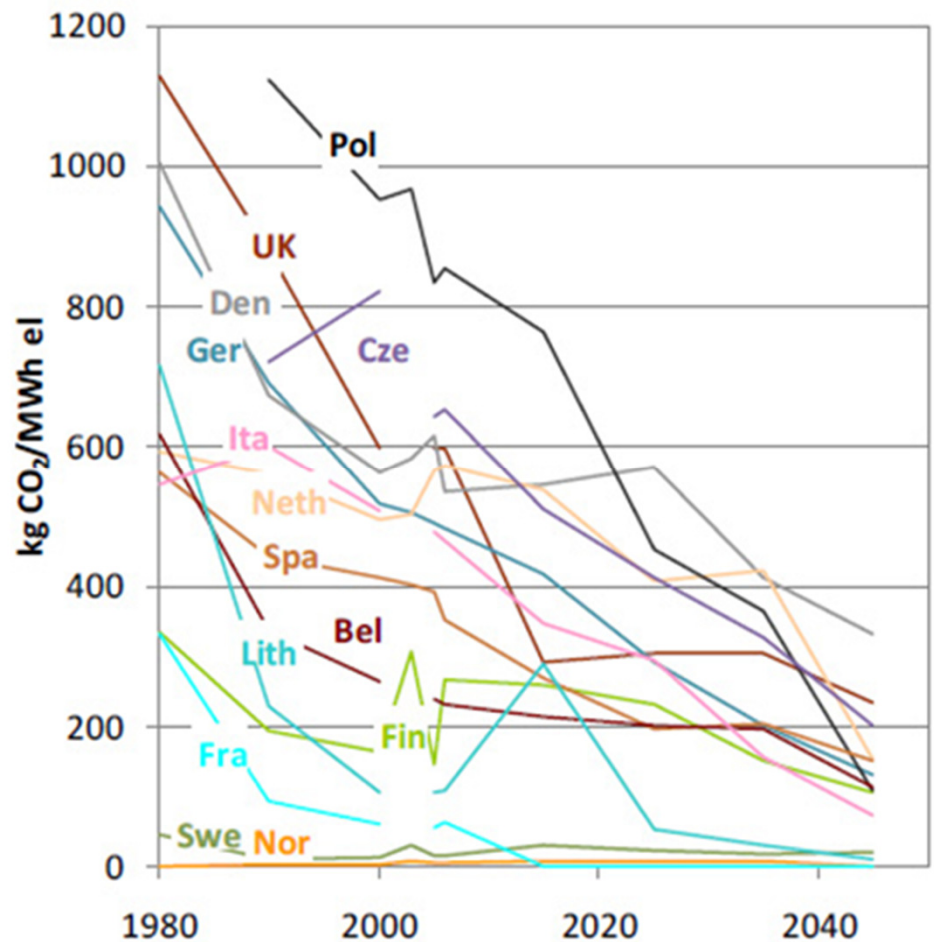
## Transport sector



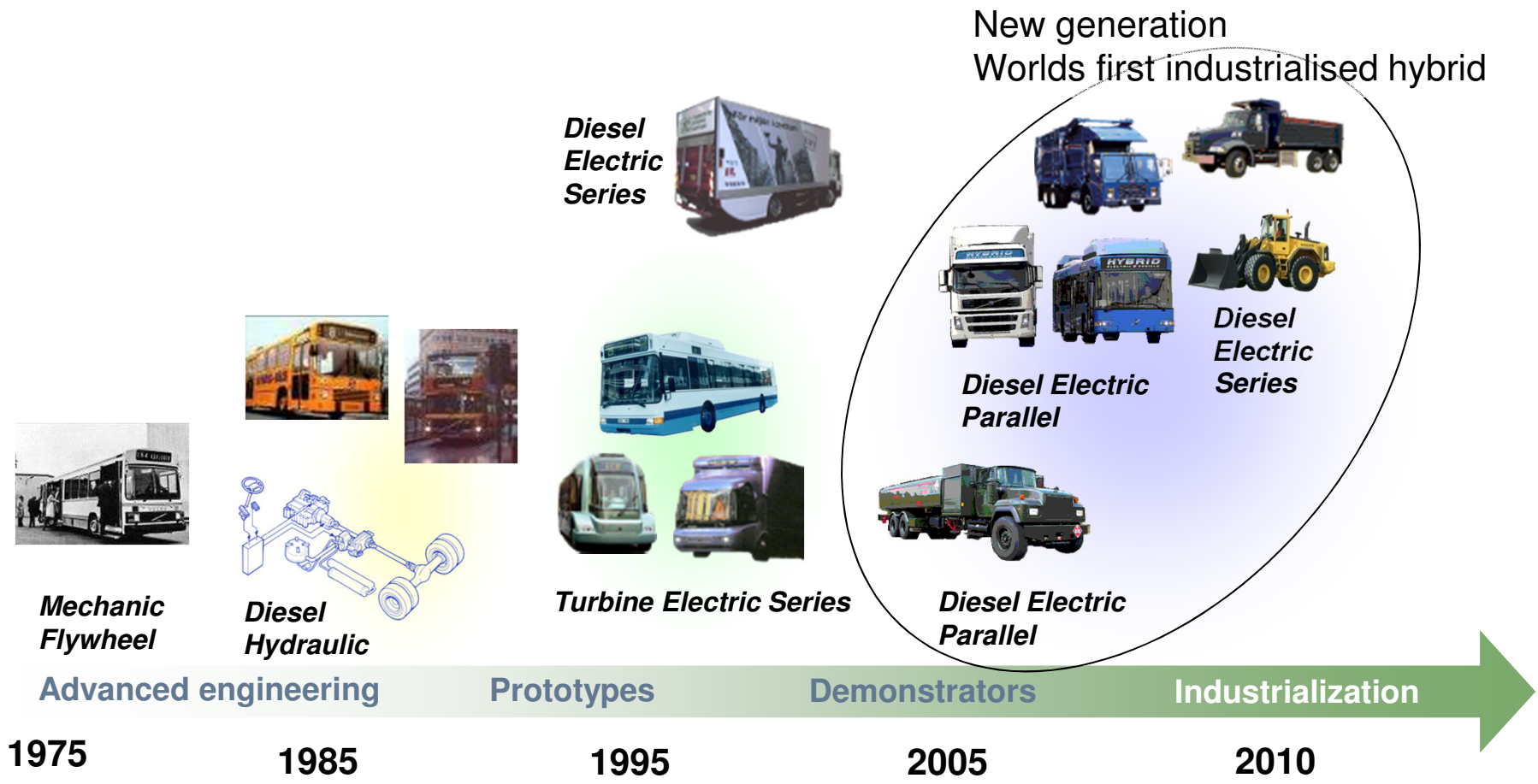
Source: EIA, Annual Energy Outlook 2007 with Projections to 2030, Tables 2 and 7, Report #DOE/AE-055, August 2007 from <http://www.eia.doe.gov>



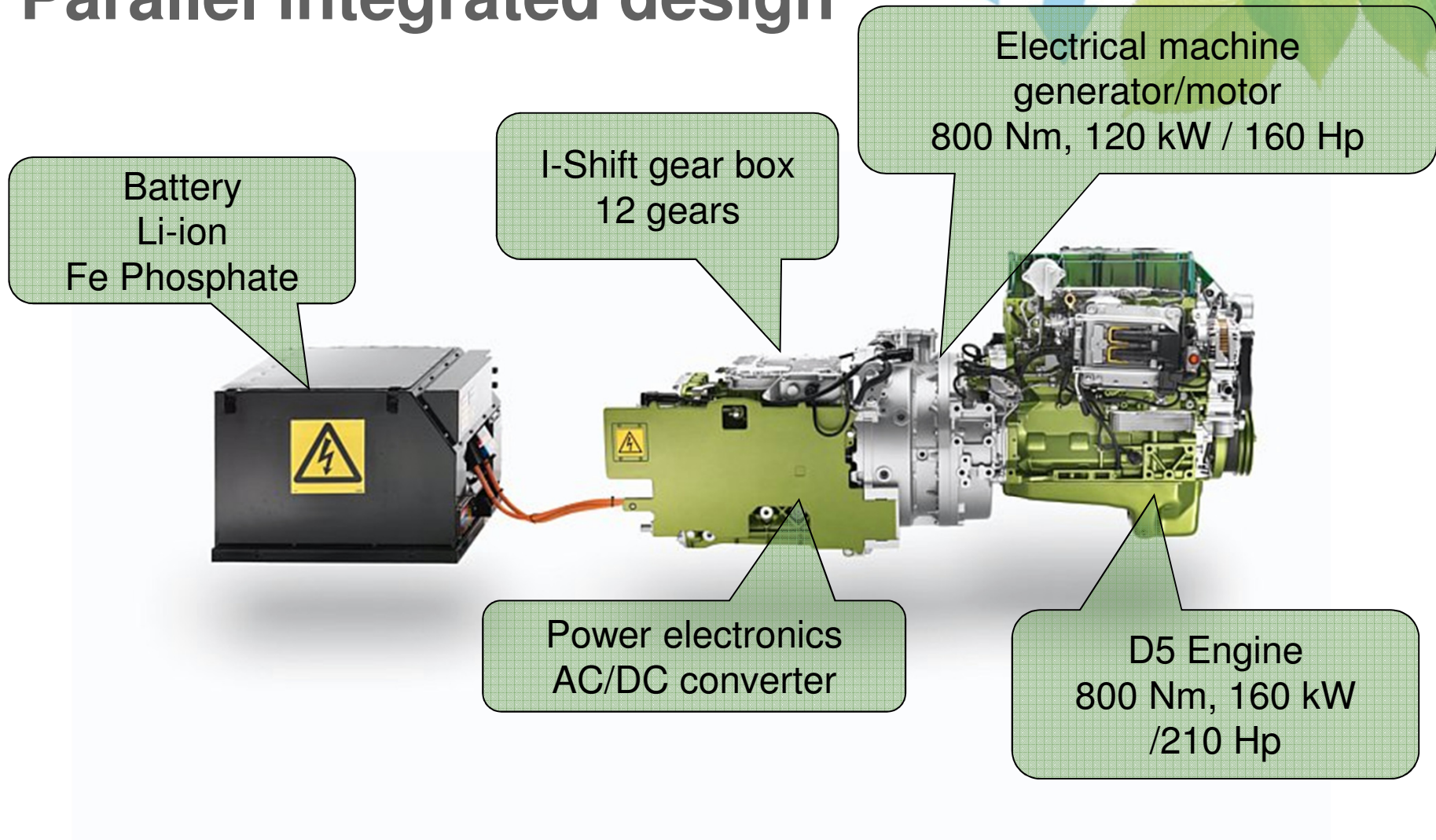
# Carbon dioxide emissions from power production, European countries



# Hybrid development history

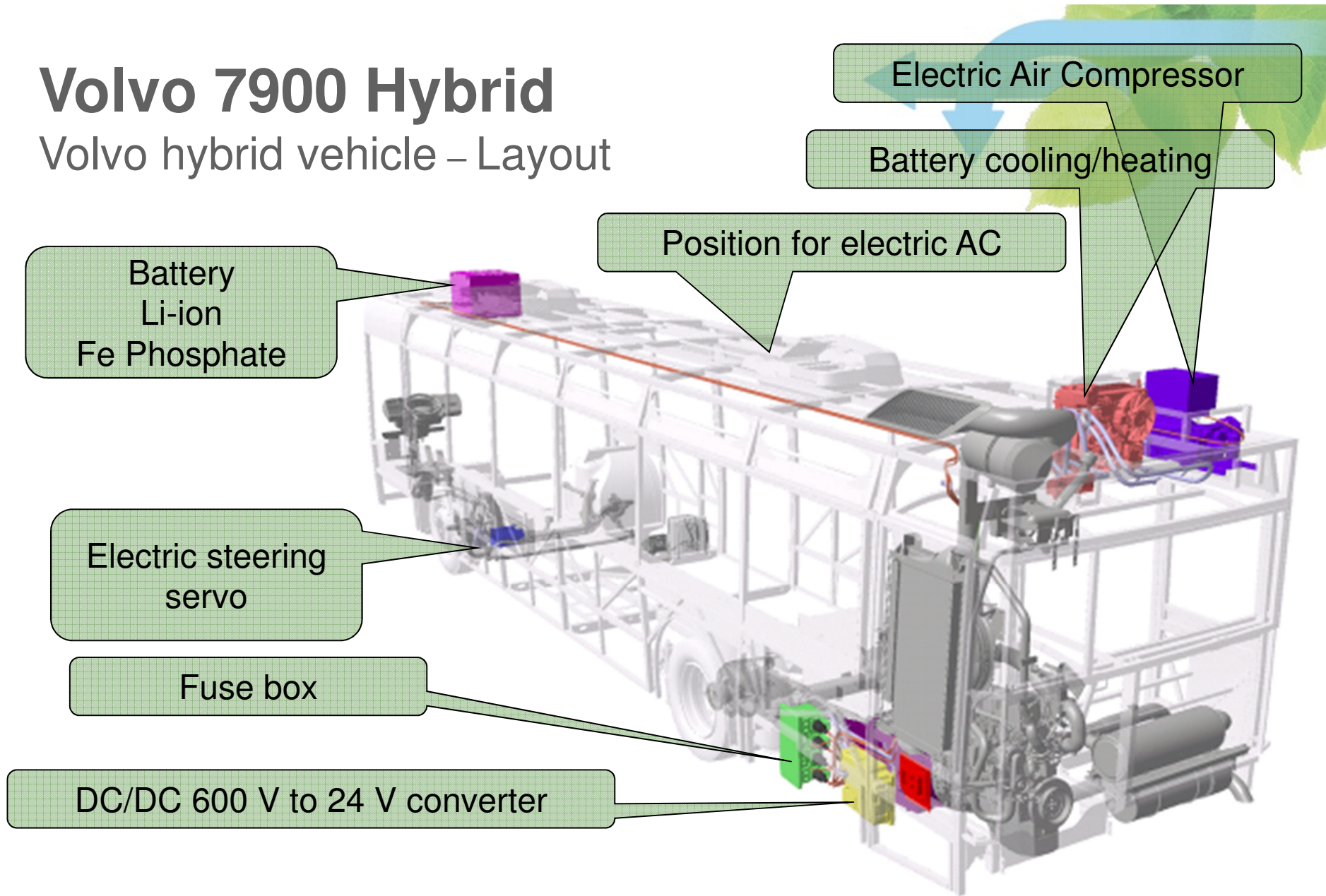


# Parallel integrated design

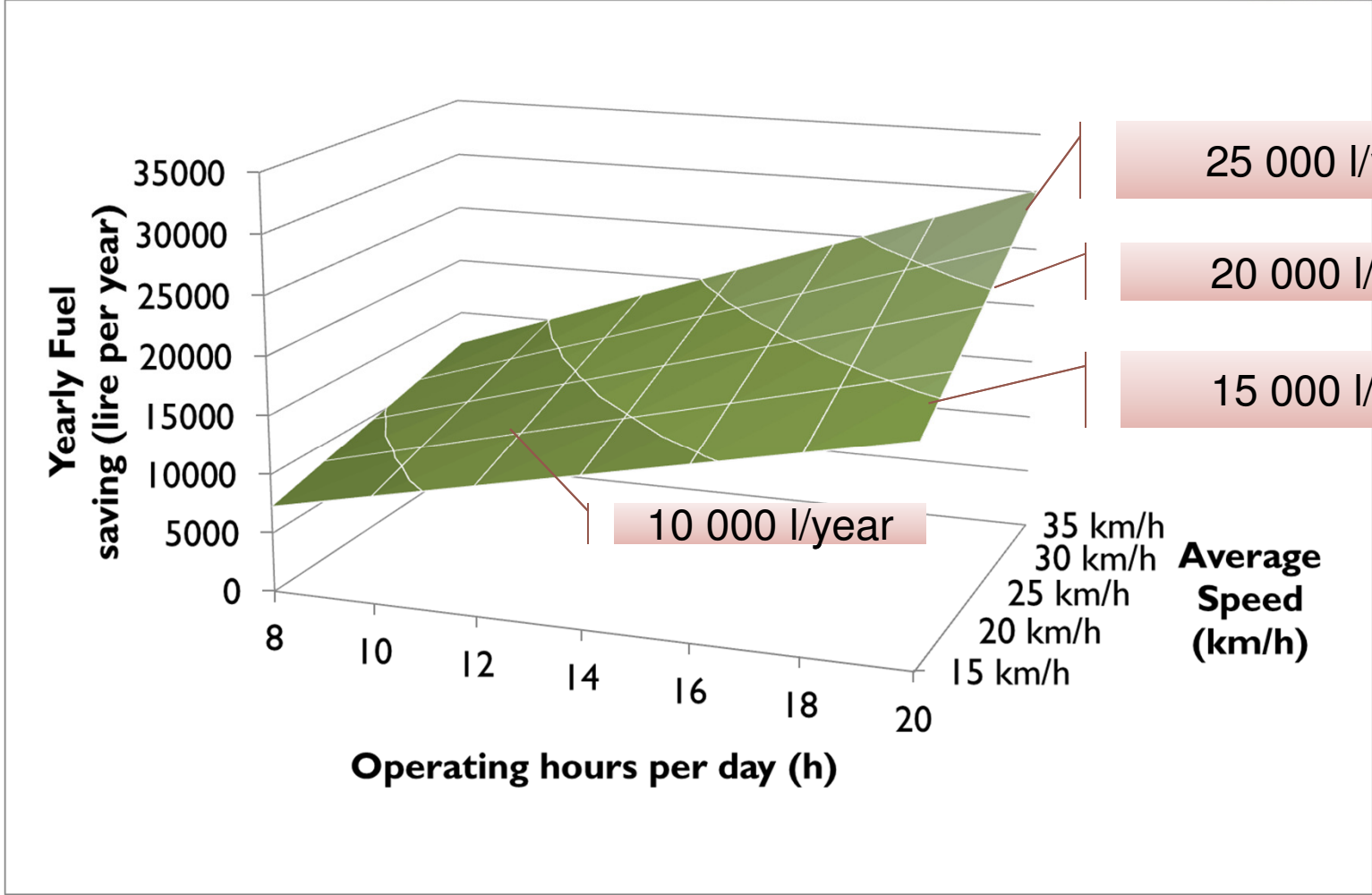


# Volvo 7900 Hybrid

Volvo hybrid vehicle – Layout

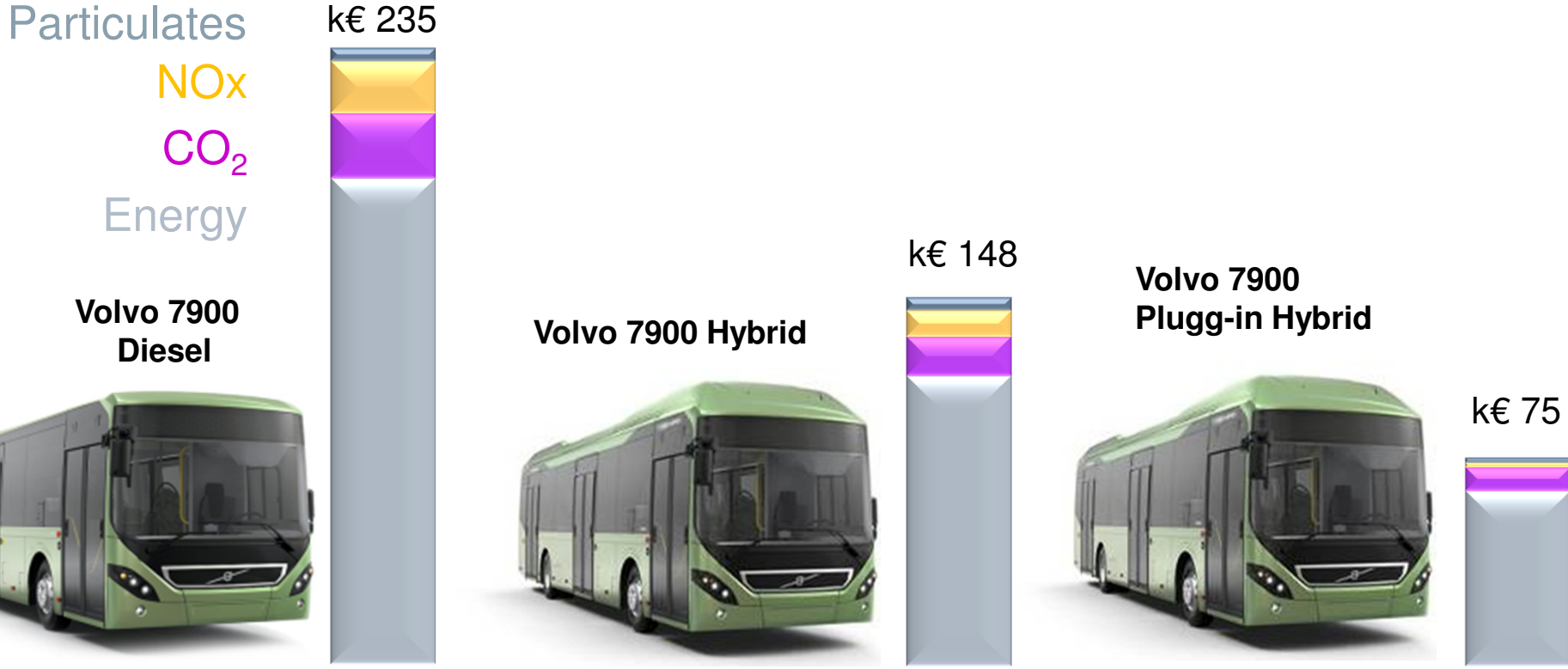


# 7900 Hybrid Yearly Fuel Saving



# Environmental Load in Use Phase

<http://europa.eu/rapid/pressReleasesAction.do?reference=MEMO/07/594>





# Volvo Hybrid Technology - the myth maker



Myth Not long ago the established truth about hybrid buses was:	Recent facts
Hybrid buses may show good results in the laboratory, but in real traffic the saving is much less.	Statistics from more than 200 Volvo hybrid buses in operation shows savings of in average 32% fuel relative a new diesel bus.
Hybrid buses have low availability.	The availability is higher than for diesel buses. In London for example 98% is reported.
Hybrid buses needs special drivers and education.	Driver education is always positive for safety and fuel consumption. However, hybrid buses show high savings with all drivers.
The hybrid technology is not mature.	Out of the first ten hybrid customers eight have already come back for additional orders. -Once hybrids, always hybrids.
Hybrid buses are only suitable for slow and dense city traffic.	Volvo hybrid technology have high fuel savings in all types of operation from slow urban to regional traffic.

# Challenges in technologies



## Electric path

- Energy storage (power, energy, weight, lifespan, price)
- Electric motors (rare elements, switch reluctance, weight, integration, superconductors)
- Power electronics (SiC)
- Cradle to Cradle
- General electrification
  - Suspension
  - Steering and brake servo
  - Climate control

## ”Outside the box”

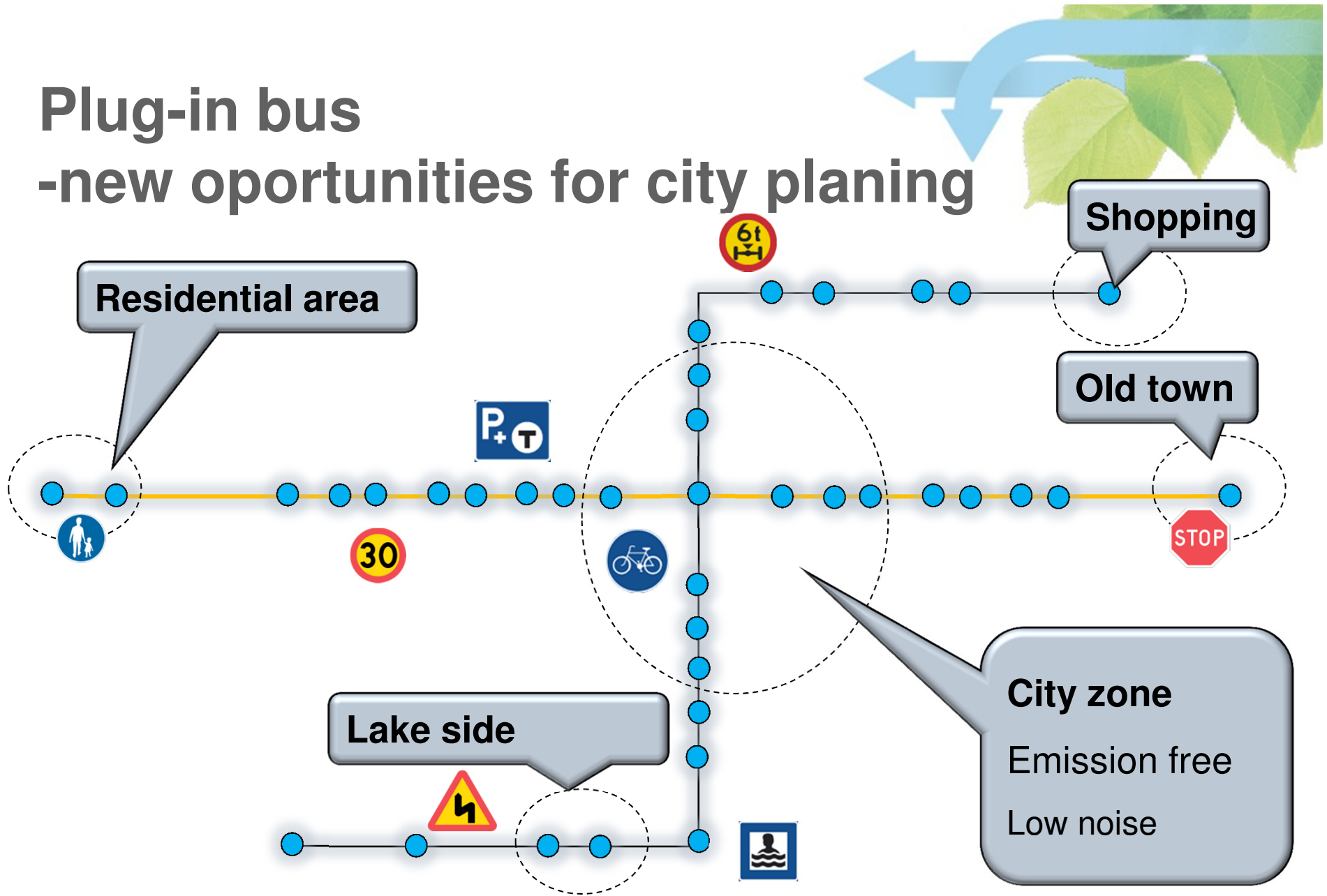
- High efficiency energy converter
  - Combined cycle SOF
- Solar power
  - Production technologies
  - Carbon fixation
- Friendly fusion
  - Ikegami reaction

# Volvo 7900 Plug-in Hybrid

- Field test spring 2013
- Serial Production near term
- 10+ km electric range
- 5-10 min charging time
- Plug-in from various infrastructure
- Energy use 40% of diesel
- CO2 emissions 75-85 % lower
- Very low external noise levels
- Very low internal noise- and vibration levels



# Plug-in bus -new opportunities for city planning



# Electric buses



Volvo joint venture Sunwin: 500 electric buses sold with different technologies

# The path towards Green Efficiency

