



**EUROPEAN BUS SYSTEM
of the FUTURE 2**

Demo Lyon

European Mobility Exhibition – 14/06/5016

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@ebsf_2project

Energy management and Ecodriving

Consumption : importance of savings:

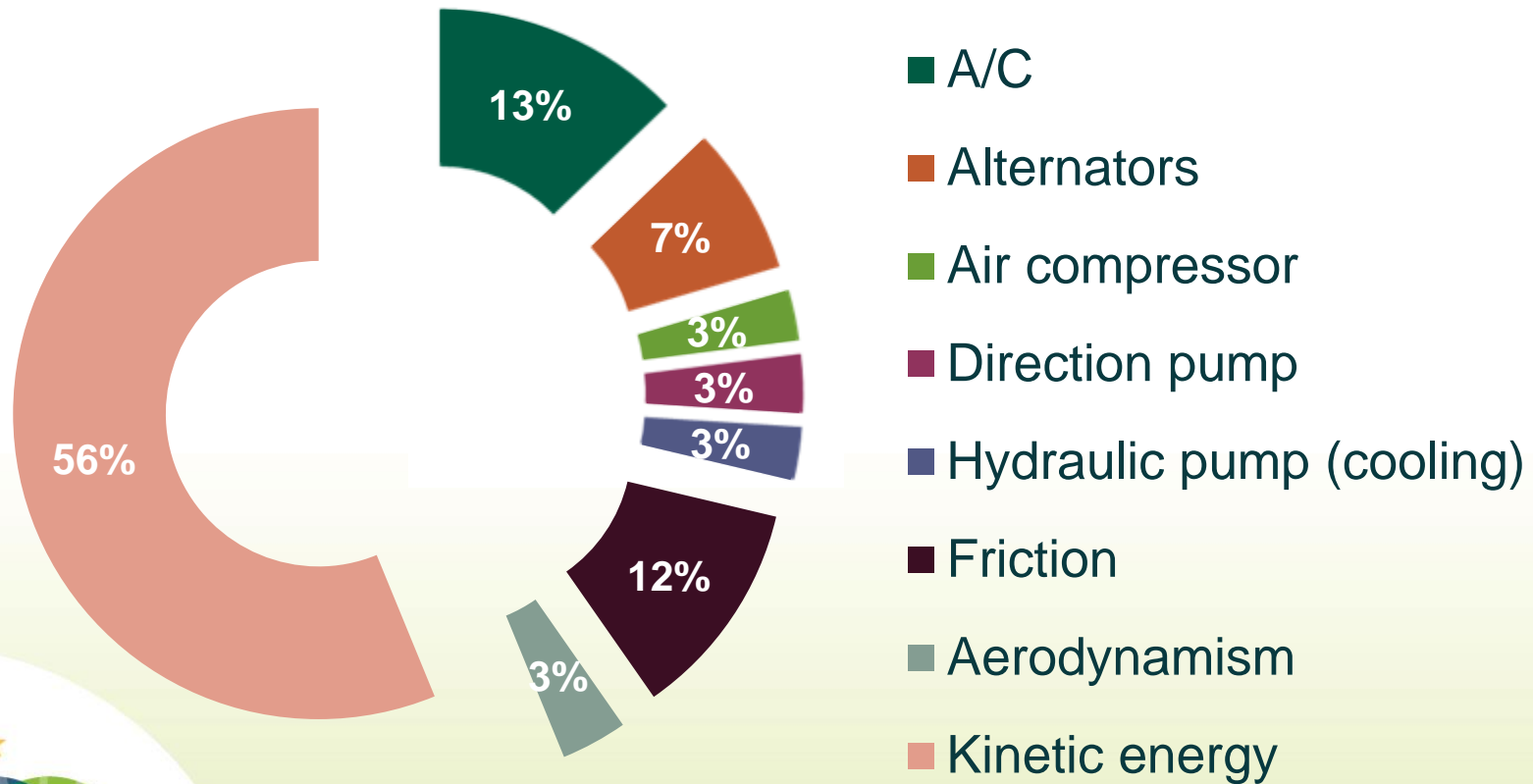
1 bus = **20 000 litres** fuel / year
(approx.)



Every step of 1% consumption saving on a 1 000 bus fleet
= **200 000 litres** / year fuel saved

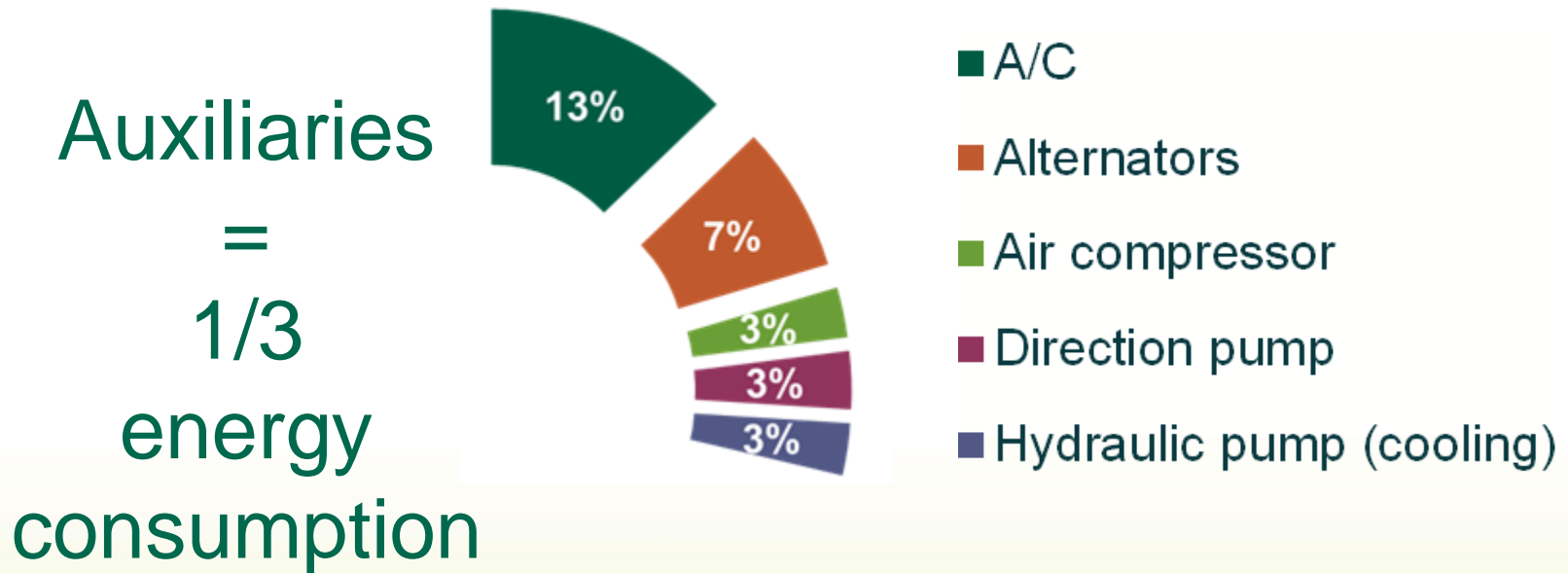
Improvement of auxiliaries management

Energy consumption :



Improvement of auxiliaries management

Energy consumption :



Improvement of auxiliaries management

Importance of improving auxiliaries energy management for the Public Transport Operator :

- Energy savings
 - Energy consumption also relies on driving conditions (heat/cold, bus line topology and infrastructure, number of passengers, technologies, accessories...)
 - With Diesel vehicles } fuel
 - With Hybrid vehicles } fuel
 - With Electric vehicles } electricity
- Batteries efficiency / lifetime
- Operability
 - New technologies and uses on-board increase the need in energy availability
 - Passenger Information
 - Passenger services (WI-FI, USB, intelligent lighting...)
 - ...



Improvement of auxiliaries management

- 0,3 to 0,45 kWh/km are consumed by accessories
 - Thermal management
 - Active: thermal 8kWh/km HVAC will consume approx. 0,25 kWh/km extra
 - HVAC devices
 - Passive, can be improved by optimising:
 - Air circulation
 - Door opening
 - Doors isolation
 - Low floor isolation
 - Other auxiliaries
 - Alternators: poor energy efficiency
- Impact on braking energy recovery on hybrid and electric vehicles



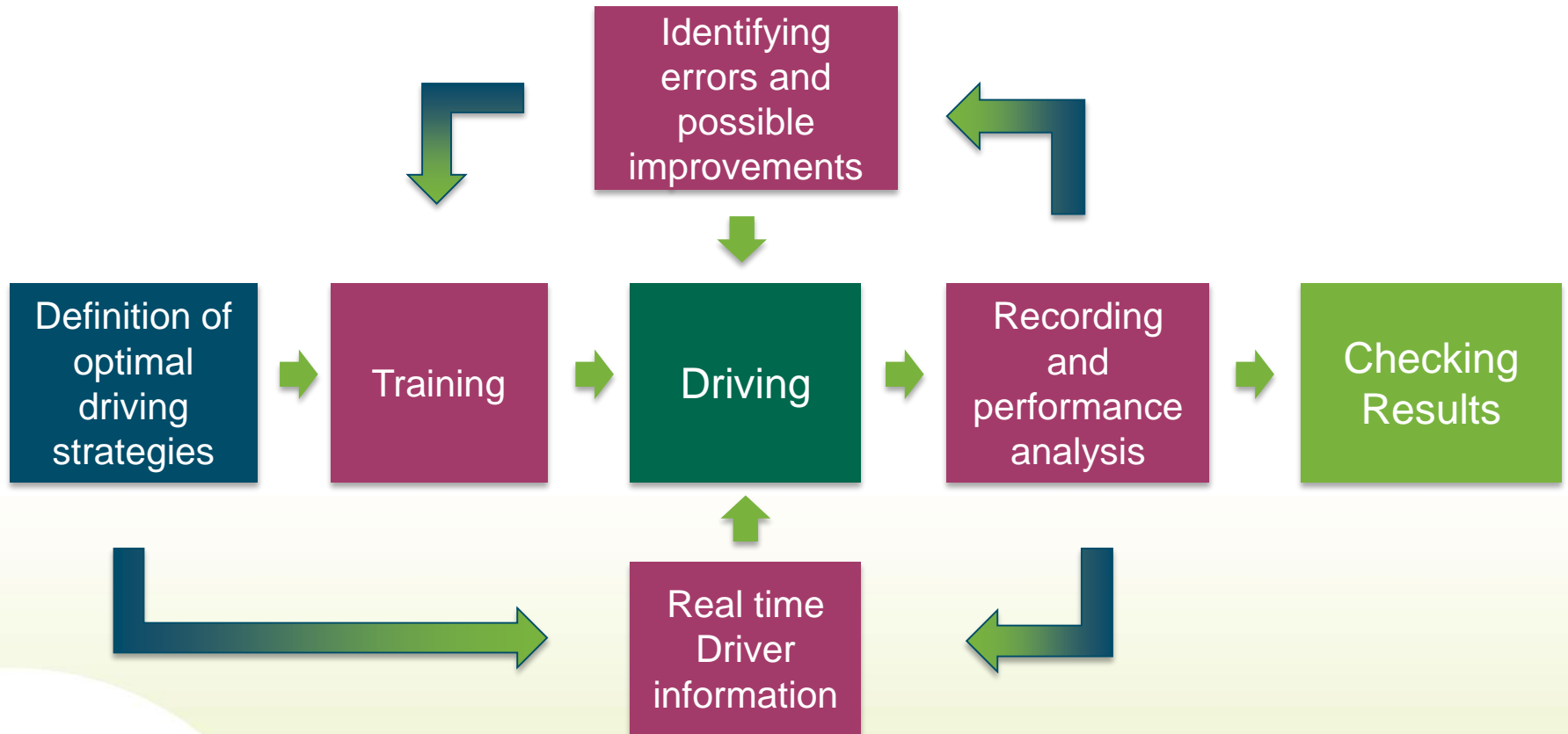
Ecodriving

Ecodriving has an impact on :

- Comfort of the passengers
 - Less acceleration/braking/deceleration/jerk
 - More **safety** for the passengers
- Environment:
 - Less pollution emissions (CO₂, No_x, particles)
 - Less noise
 - Peaceful environment
- Fuel consumption:
 - Keolis estimates that 5% on average rely on driving
- Managing the driving styles efficiently:
 - Indicators
 - Feedback
 - Training



Ecodriving



Energy saving system approach

The driving conditions of the bus at current cycle section are similar

Driving cycles and road slope are two important factors affecting fuel saving performance of hybrid and electric buses

Buses run along the same routine every day

Bus stops
Invariably at similar locations
(GPS navigation hardware)

Driving Styles Classification
Speed
Acceleration
Braking

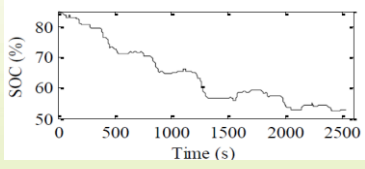
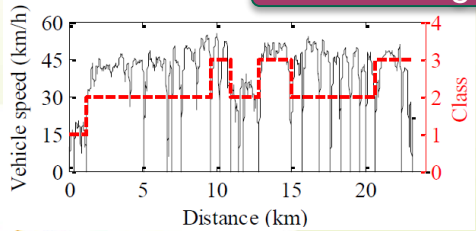
Predict the driving conditions →
Manage the power split of the bus.

Battery Management System

Auxiliary Energy Management



The energy management strategy could be further improved by analyzing onboard data collected by auxiliary equipment





Thank you for your attention

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