RAILWAY SYSTEM CONTRIBUTION TO NATIONAL ELECTRICITY SUSTAINABILITY
INTRODUCTION

ENERGY IS THE MAIN FUEL FOR REDUCING TIME/DISTANCE

17 TWh energy consumption
for SNCF Group in 2015

10% of industrial electricity market
for SNCF railway activities in 2015

Energy policy

- Improve the economic efficiency
- Engage for energy transition
- Innovate and seize business opportunities
- Make people move
- Make SNCF Group an influential stakeholder
INTRODUCTION
RAILWAY, AN ELECTRIC ENERGY CONSUMER?

- Railway data
  - 8 TWh
  - 84%
  - 11%
  - 3%
  - 2%

- Working day consumption profile
  - 2,000 MW
  - 1,700 MW

= an instant power consumer
INTRODUCTION

THE ELECTRIC FLEXIBILITY ENHANCEMENT

GRID
INTRODUCTION
A SIMPLE CONSUMER?

FLEXIBILITY
SMARTGRID
ELECTRIC NETWORK NOWADAYS AND FUTURE

Bi-directional energy flows
Decentralized production

Energy Storage Systems
Electric grid management center
Local control and management
Intelligent consumers

Source: Business English Magazine (businessenglish.pl) / GROUPE ONEPOINT
RAILWAY SMARTGRID
DIFFERENT CONSUMERS WITH DIFFERENT BEHAVIOURS

New electrotechnics and IT technologies

Control
SMARTGRID FOR RAILWAY
FIVE NEEDS AND TWO DEGREES OF FREEDOM

- Railway reliability: predictive maint., stand alone behaviour
- New load integration without reinforcement
- Modulate consumption
- Integrate renewable energy sources easily
- Use energetic buffers
- Energetic efficiency: losses reduction
- New business
AGREGATION PRINCIPLE
A TOOL TO DEFINE THE BENEFITS OF SNCF AS AN AGGREGATOR

1. Electricity price forecasting
2. Send a signal to consumers to know their flexibilities
3. The different resources calculate their flexibilities versus activation cost and send it back
4. The aggregator tool chooses the flexibilities to activate and sell a block to the electricity market

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ENERGY STORAGE SYSTEMS FLEXIBILITY

VALORISATION OF EXISTING ASSETS
ENERGY STORAGE SYSTEMS FLEXIBILITY
A LARGE POTENTIAL

280 generators
Old generators: not reliable and pollutant
ENERGY STORAGE SYSTEMS FLEXIBILITY
SEARCHING FOR ALTERNATIVE FUELS

Source: RTE, January 19-20 2017

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ENERGY STORAGE SYSTEMS FLEXIBILITY
ENERGY TRANSITION LEADING TO NEW LIFE FOR AGING ASSETS

Power grid

geqCO2/kWh

1 3 5 7 9 11 13 15 17 19 21 23

730

<700

4 to 12 years ROI

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Energy self-sufficiency

Life cycle analysis positive compared to fossil fuels

Complex topic and general public controversies
ENERGY STORAGE SYSTEMS FLEXIBILITY
A MULTI-SERVICE STORAGE SYSTEM TO MAKE THEM MORE PROFITABLE
RAILWAY STATION FLEXIBILITY TO SMARTER STATIONS AND BUILDINGS

» The demand response is a **Temporary reduction of consumption** to respond external demand (RTE).
» Temperature of travelers’ waiting area,
» Variation of the lighting of platforms,
» Etc.

» How to proceed?
» Add local energy management and controllable component (consumers)
» Add energy sources
  • Integration of **renewable energies**;
  • Integration of **Energy Storage Systems**;
    • Stationary ESS like batteries,
    • Electric vehicles (V2G).
RAILWAY STATION FLEXIBILITY
TO SMATER STATIONS AND BUILDINGS

2 real tests:
- Besancon TGV – building automation and acceptability studies
- Aix-en-provence TGV – microgrid development
Parameters

- LN1 Paris Lyon
- 15 HST Duplex on morning rush hour with 10min delay
ROLLING STOCK FLEXIBILITY

ROLLING STOCK INVOLVEMENT

\[ v_{\text{veh}} \text{ [km/h]} \]

Balancing period 60min

- Normal journey
- Journey with balancing mechanism participation
- Journey with balancing mechanism participation with help of opti-conduite

Time [min]

Delay

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ROLLING STOCK FLEXIBILITY
ROLLING STOCK INVOLVEMENT

One train study

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CONCLUSION AND DISCUSSIONS
CONCLUSION & DISCUSSIONS

CONCLUSION

► Societal responsibility meet economic aspects:
  ► A new degree of freedom to reduce carbon footprint and energetic consumption all over SNCF group

► New technologies for new businesses: benefits up to M€/an

► Increase the profitability of ESS that can be valuable for railway services (signalling emergency services, catenary voltage control, etc.) and may accelerate investments in storage systems
CONCLUSION & DISCUSSIONS

- Railway advantage for risk mitigation in flexibility operations
- Regulation may rule out diesel generators (too cost efficient in comparison to cleaner businesses)
- Uncertainty of return over investment due to market rules evolving
- Regulators should consult to take into account railway specificities