HOW TO DEFINE THE BEST CONFIGURATION FOR A NEW/RENEWED LINE (ENERGY IN TCO)?

A CROSS-COMPANY COLLABORATIVE WORK

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HOW TO DEFINE THE BEST CONFIGURATION FOR A NEW/RENEWED LINE (ENERGY IN TCO)?

Current situation

EXTERNAL PRESSURE TO IMPROVE ENVIRONMENTAL SOLUTION DEPLOYMENT

French Prime minister mission in **June 2018** to evaluate technologies available to **lower railway emissions**

End of thermic cars in 2040

Pressure on air quality in 15 cities in France

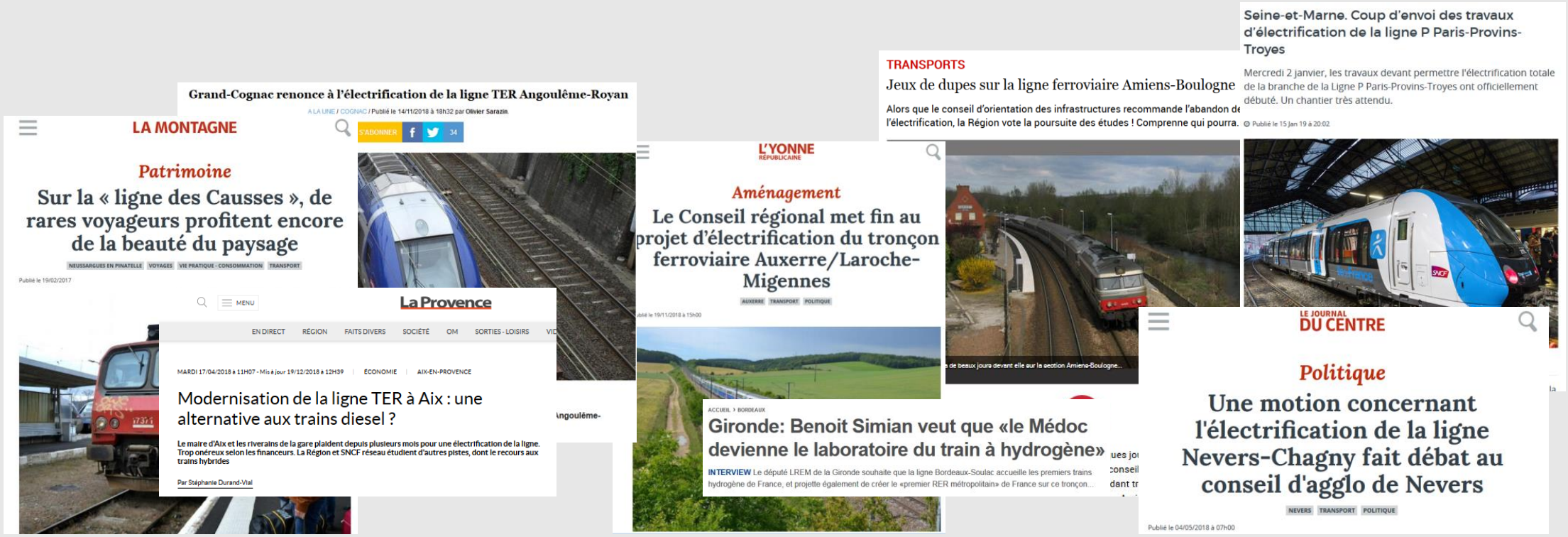
LOM Law & PPE to define **energy balance between massive consumers**

Industrial release (hydrogen train, Innotrans announcement.)

HOW TO DEFINE THE BEST CONFIGURATION FOR A NEW/RENEWED LINE (ENERGY IN TCO)?

Current situation

IN FRANCE THERE ARE A LOT OF ELECTRIFICATION OR RENEWED PROJECTS ! BUT ONLY SOME MATERIALIZE…



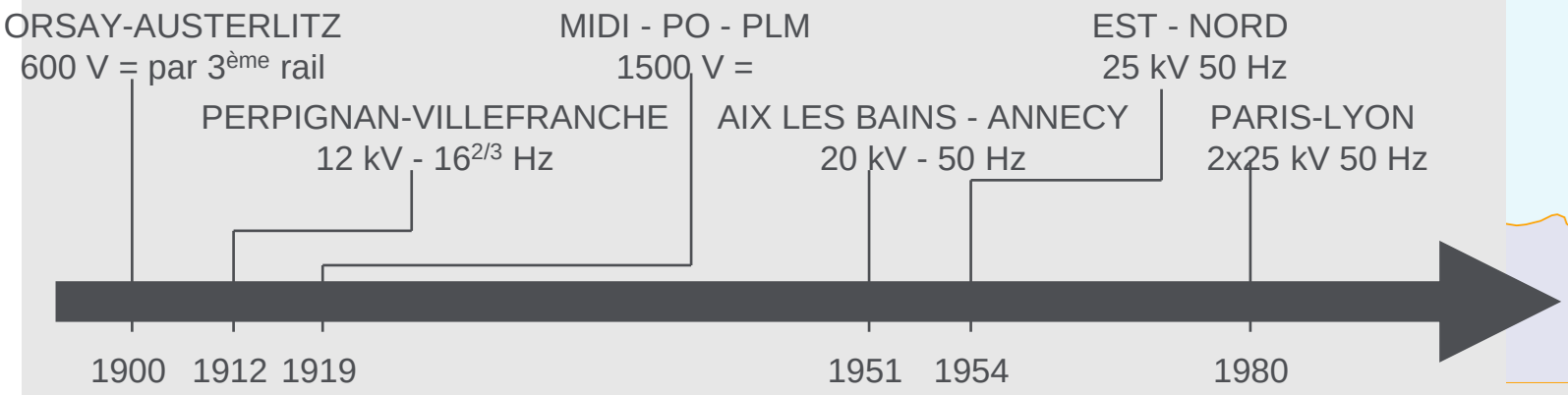
HOW TO DEFINE THE BEST CONFIGURATION FOR A NEW/RENEWED LINE (ENERGY IN TCO)?

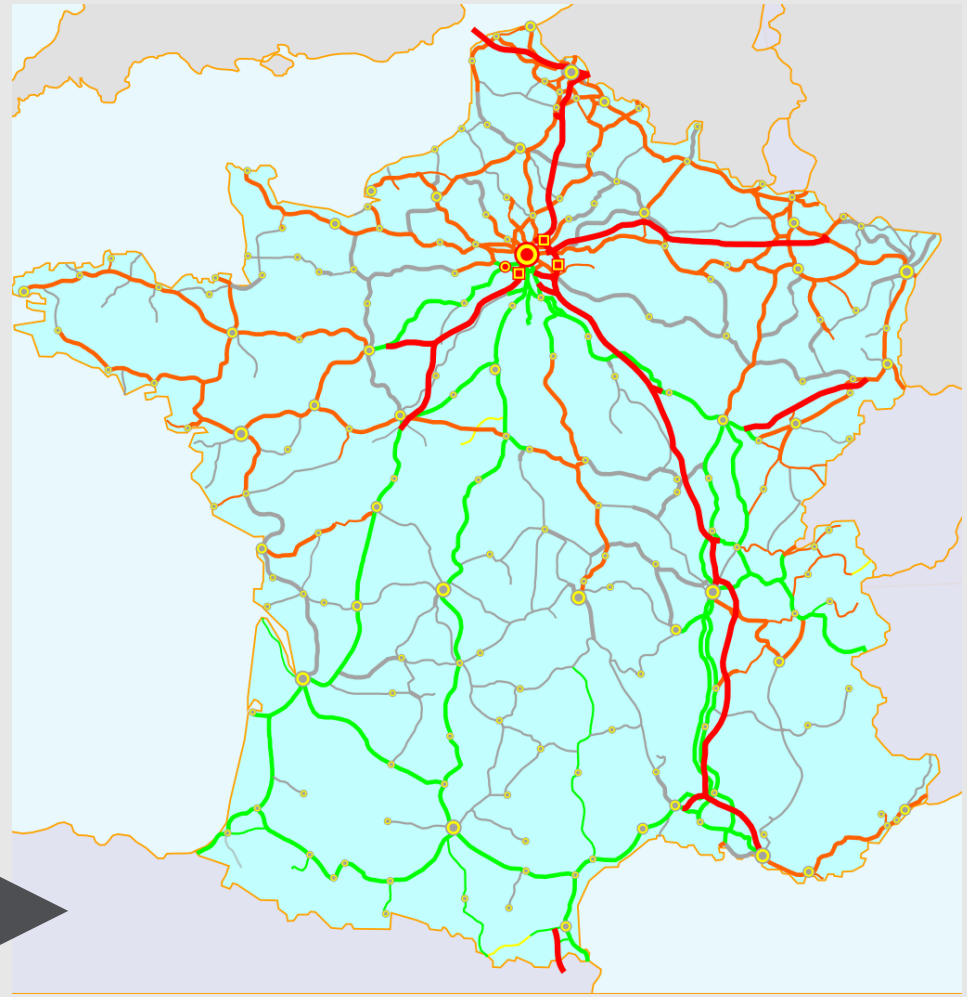
Current situation – infrastructure point of view

Length of electrified lines : 14500 km (45 % of the RFN)

- 5900 km in 1500 V DC
- 8500 km in 25 kV - 50 Hz (2 x 25 kV comprised)

88 % of the traffic is carried out on electrified lines





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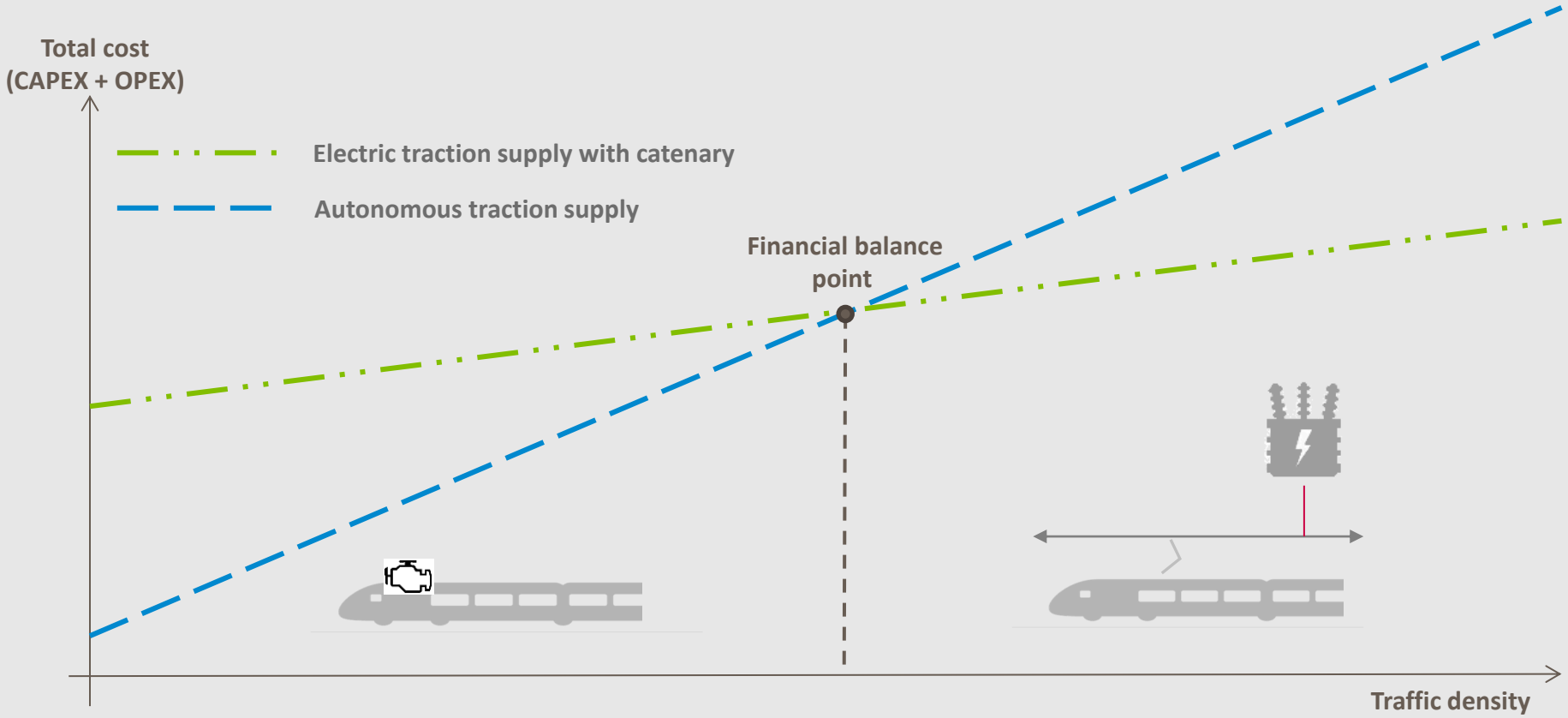
Current situation – infrastructure point of view

ECONOMIC MODEL OF ELECTRIFICATION

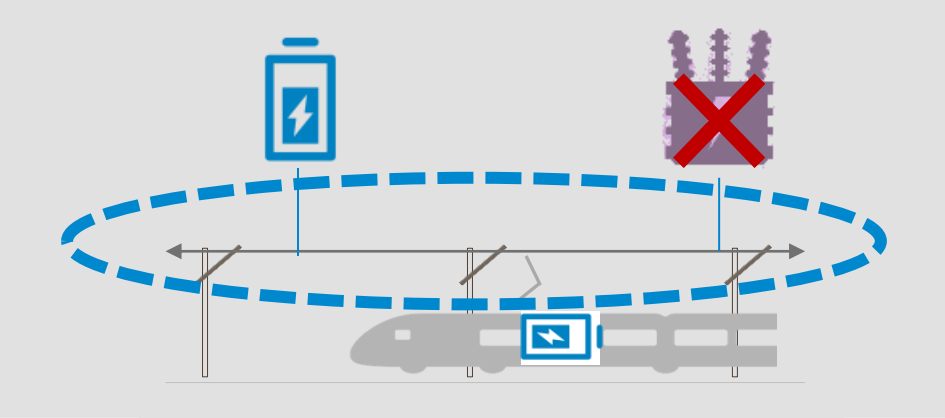


HOW TO DEFINE THE BEST CONFIGURATION FOR A NEW/RENEWED LINE (ENERGY IN TCO)?

Current situation – Rolling Stock

NEW ALTERNATIVE SOLUTIONS

- **0% ELECTRIFIED LINES WITH :**
  - **Hybrid** *(ex : Hydrogen / Diesel + Battery)*
  - **Biofuel**
- **FRACTIONATED ELECTRIFIED LINES WITH :**
  - **Bi-mode** *(Diesel + catenary)*
  - **Tri-mode** *(ex : Diesel / Hydrogen + Battery / Supercapacitor + Catenary)*
- **100% ELECTRIFIED LINES OPTIMIZED WITH :**
  - **EMU**
  - **EMU battery** *(Battery + Catenary)*



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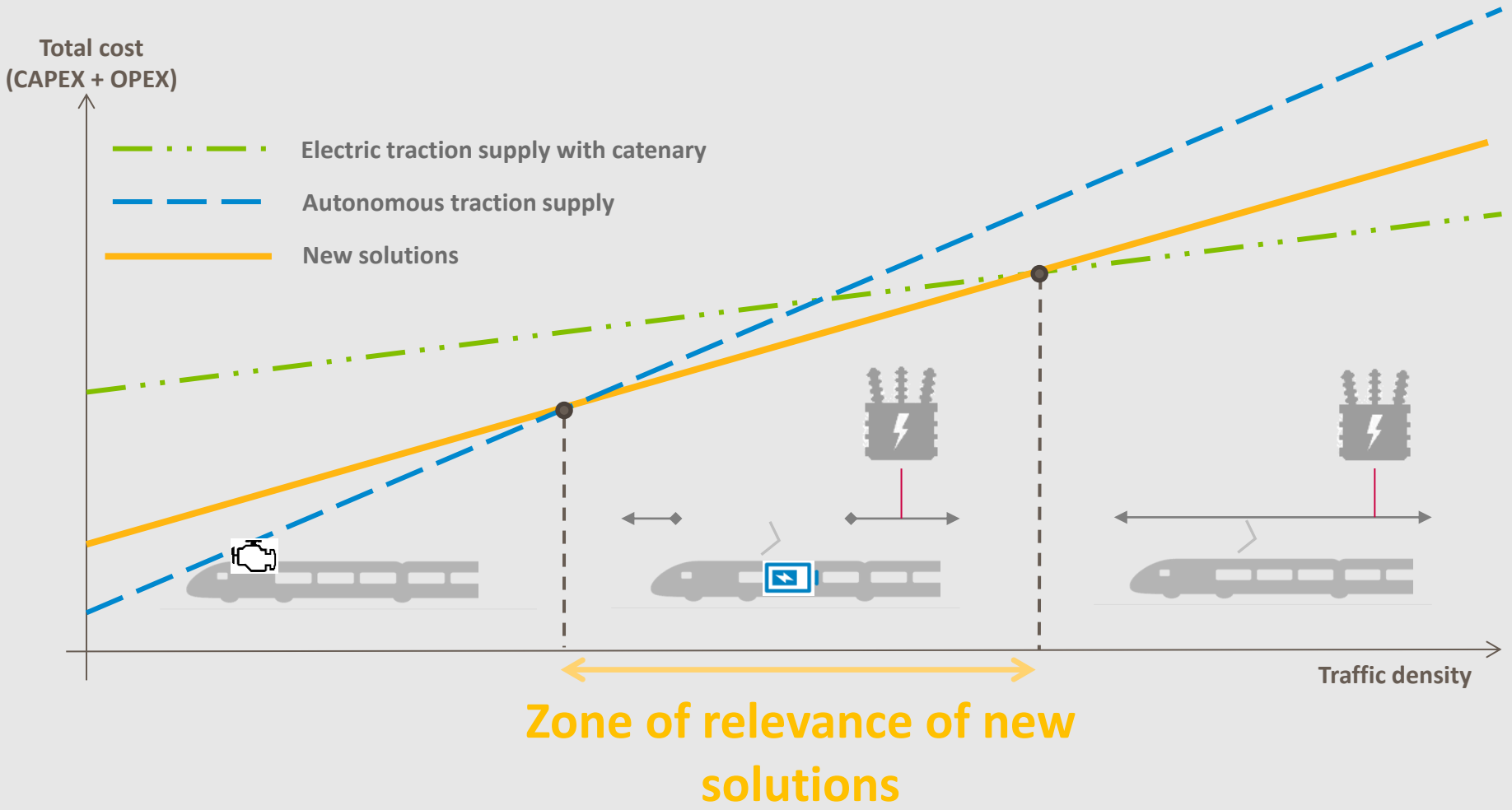
Optimized solution system Approach

NEW **SYSTEM** SOLUTIONS IN THE ECONOMIC MODEL



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Optimized solution system Approach

ELECTRIFICATION DECISION PROCESS OVERVIEW

Mobility needs expressed by Regional authorities

Operator

Role :

1. Define an mobility offer in order to meet regional expectations

Network

Role :

1. Study line structure & parameters
2. Build an electrification scenario

Rolling Stock

Role :

Chose within a list of rolling stock type taking into account the network answer and the operator constraint

The historical ways :

A phasing & binary process which mostly lead to overate infrastructure capacity & RS performance

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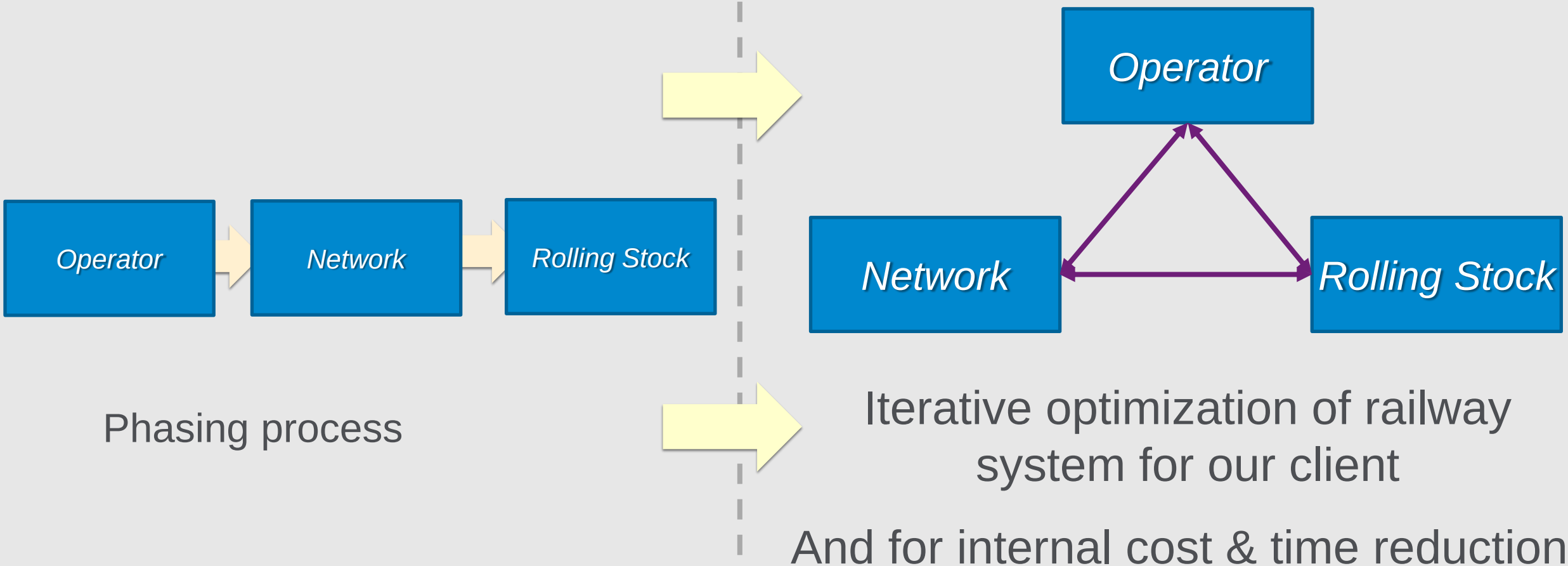
Optimized solution system Approach

NEW DECISION PROCESS



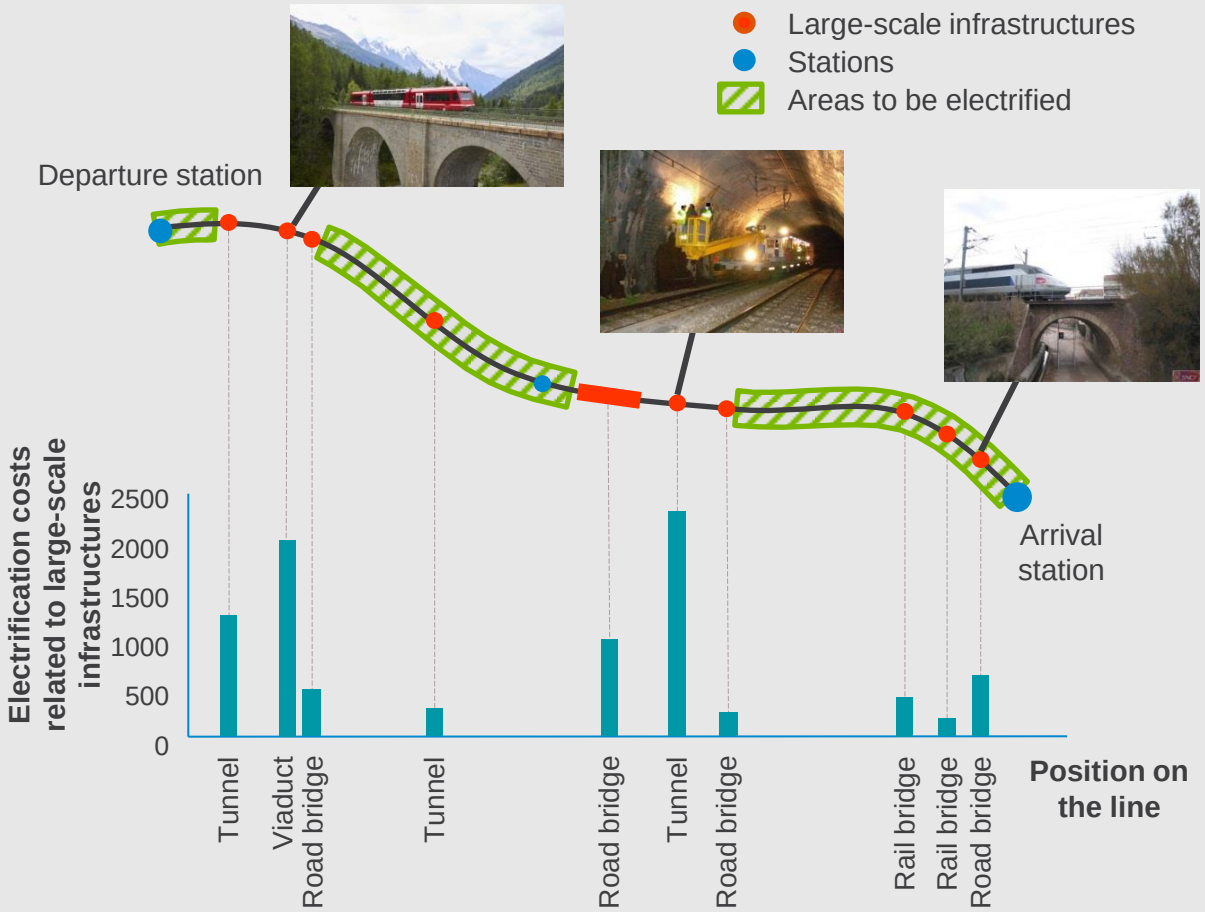
HOW TO DEFINE THE BEST CONFIGURATION FOR A NEW/RENEWED LINE (ENERGY IN TCO)?

Study on a French use Case

PRINCIPLE

- Create electrification scenarios
- Calculate operation cost of different Rolling Stocks solutions
  - Biofuel
  - Hybrid
  - Bi-modes
  - Tri-modes

FIND THE BETTER ECONOMICAL SOLUTION



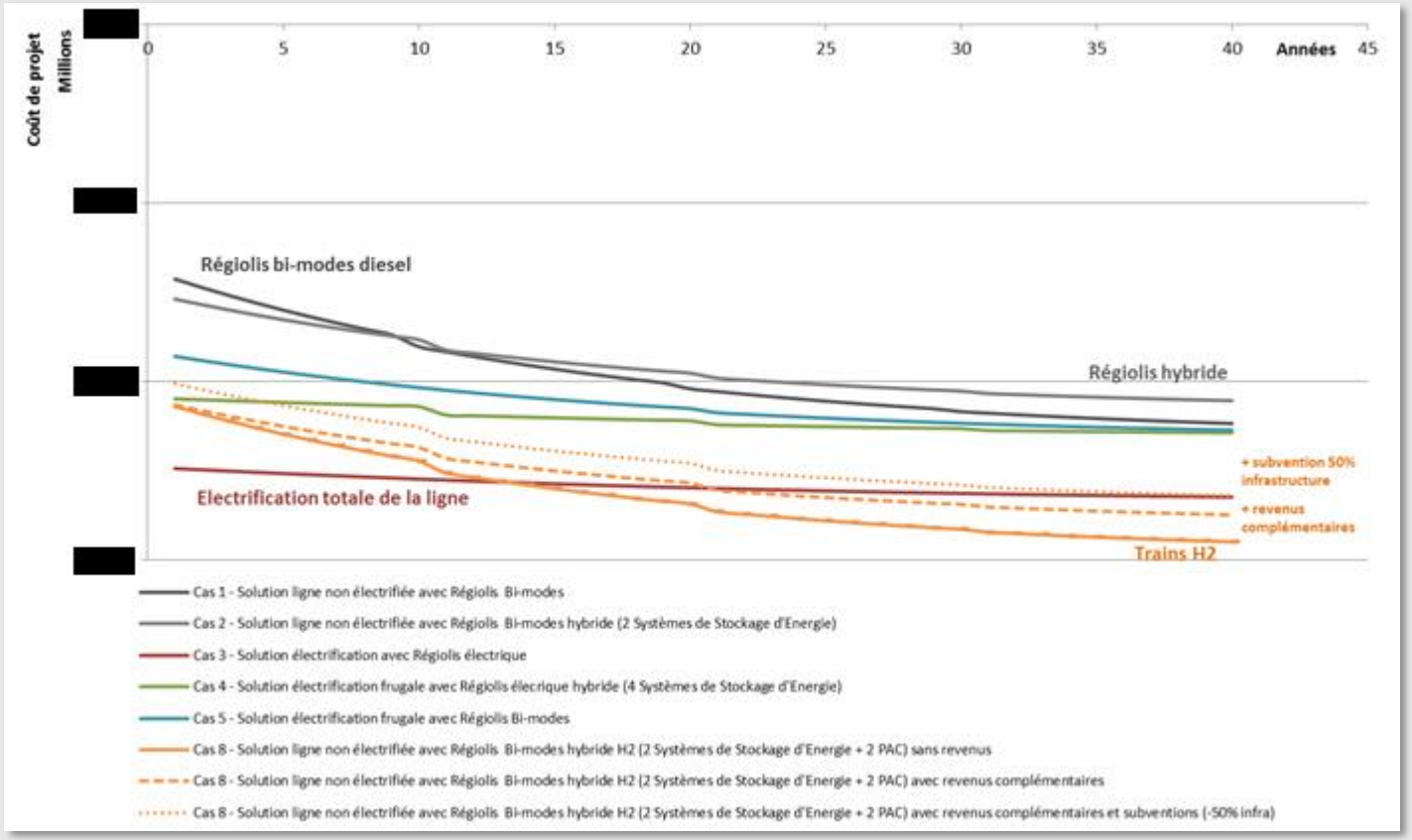
HOW TO DEFINE THE BEST CONFIGURATION FOR A NEW/RENEWED LINE (ENERGY IN TCO)?

Study on a French use Case

RESULTS AND CONCLUSION

- Those study allowed us to compare solutions from an economic point of view
- **But results are too close to reach real conclusions.**

IT TAKES MORE INDICATOR TO REACH A FINAL DECISION



HOW TO DEFINE THE BEST CONFIGURATION FOR A NEW/RENEWED LINE (ENERGY IN TCO)?

Collaborative work

CROSS COMPANY SEMINARY : MINILAB “ÉLECTRIFICATION FRUGALE”

- 30-50 expert from Railway Infrastructure, Railway operator, RS, Research,… gathered to imagine the solutions starting from the problematic

- **Objective : Create working groups able to find system solutions and method to give to Regional authority answers for each lines**

HOW TO DEFINE THE BEST CONFIGURATION FOR A NEW/RENEWED LINE (ENERGY IN TCO)?

Collaborative work

STRATEGY IMPLEMENTED

Layer 1
Upstream study

Technology performance

Economic conditions

Political & environmental rules

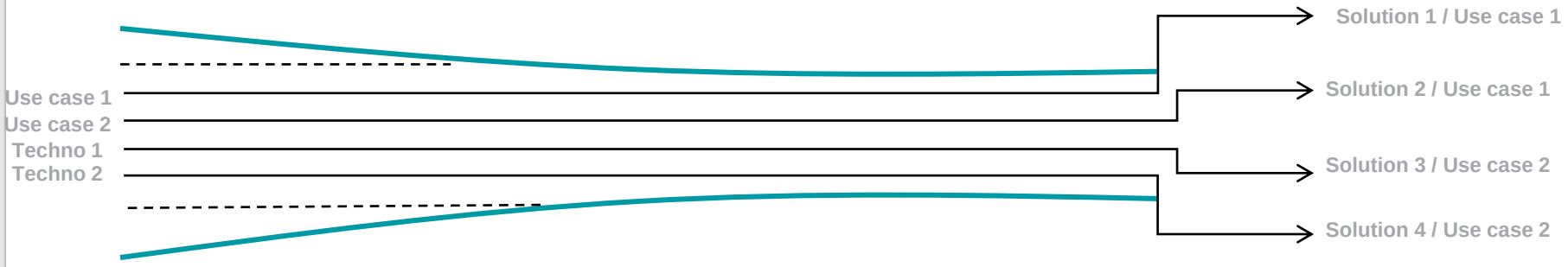
Fiscal & legal conditions

Layer 2
Tools & method

Minilab
Organization & project generation

Pre-industrialization Projects
Frugal electrification
TER Hybride
H2 train

Generic modelization
Solution integration to SNCF portfolio



Layer 3
Line & Regional Use cases

Lines specifics: lenghts, slope, infrastructure, etc.)

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