



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

A CROSS-COMPANY COLLABORATIVE WORK

**FEBRUARY 11TH**

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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...

**Grand-Cognac renonce à l'électrification de la ligne TER Angoulême-Royan**

A LA LIGNE / COGNAC | Publié le 14/11/2018 à 18h32 par Olivier Sarazin.

**LA MONTAGNE**

**Patrimoine**

**Sur la « ligne des Causses », de rares voyageurs profitent encore de la beauté du paysage**

NEUSSARGUES EN PINATELLE VOYAGES VIE PRATIQUE - CONSOMMATION TRANSPORT

Publié le 19/02/2017

**La Provence**

**Modernisation de la ligne TER à Aix : une alternative aux trains diesel ?**

MARDI 17/04/2018 à 11H07 - Mis à jour 19/12/2018 à 12H39 | ÉCONOMIE | AIX-EN-PROVENCE

Le maire d'Aix et les riverains de la gare plaident depuis plusieurs mois pour une électrification de la ligne. Trop onéreux selon les financeurs. La Région et SNCF réseau étudient d'autres pistes, dont le recours aux trains hybrides

Par Stéphanie Durand-Vial

**L'YONNE RÉPUBLICAINE**

**Aménagement**

**Le Conseil régional met fin au projet d'électrification du tronçon ferroviaire Auxerre/Laroche-Migennes**

AUXERRE TRANSPORT POLITIQUE

Publié le 19/11/2018 à 15h00

**Gironde: Benoit Simian veut que «le Médoc devienne le laboratoire du train à hydrogène»**

INTERVIEW Le député LREM de la Gironde souhaite que la ligne Bordeaux-Soulac accueille les premiers trains hydrogène de France, et projette également de créer le «premier RER métropolitain» de France sur ce tronçon...

**Seine-et-Marne. Coup d'envoi des travaux d'électrification de la ligne P Paris-Provins-Troyes**

Mercredi 2 janvier, les travaux devant permettre l'électrification totale de la branche de la Ligne P Paris-Provins-Troyes ont officiellement débuté. Un chantier très attendu.

Publié le 15 Jan 19 à 20:02

**LE JOURNAL DU CENTRE**

**Politique**

**Une motion concernant l'électrification de la ligne Nevers-Chagny fait débat au conseil d'agglo de Nevers**

NEVERS TRANSPORT POLITIQUE

Publié le 04/05/2018 à 07h00

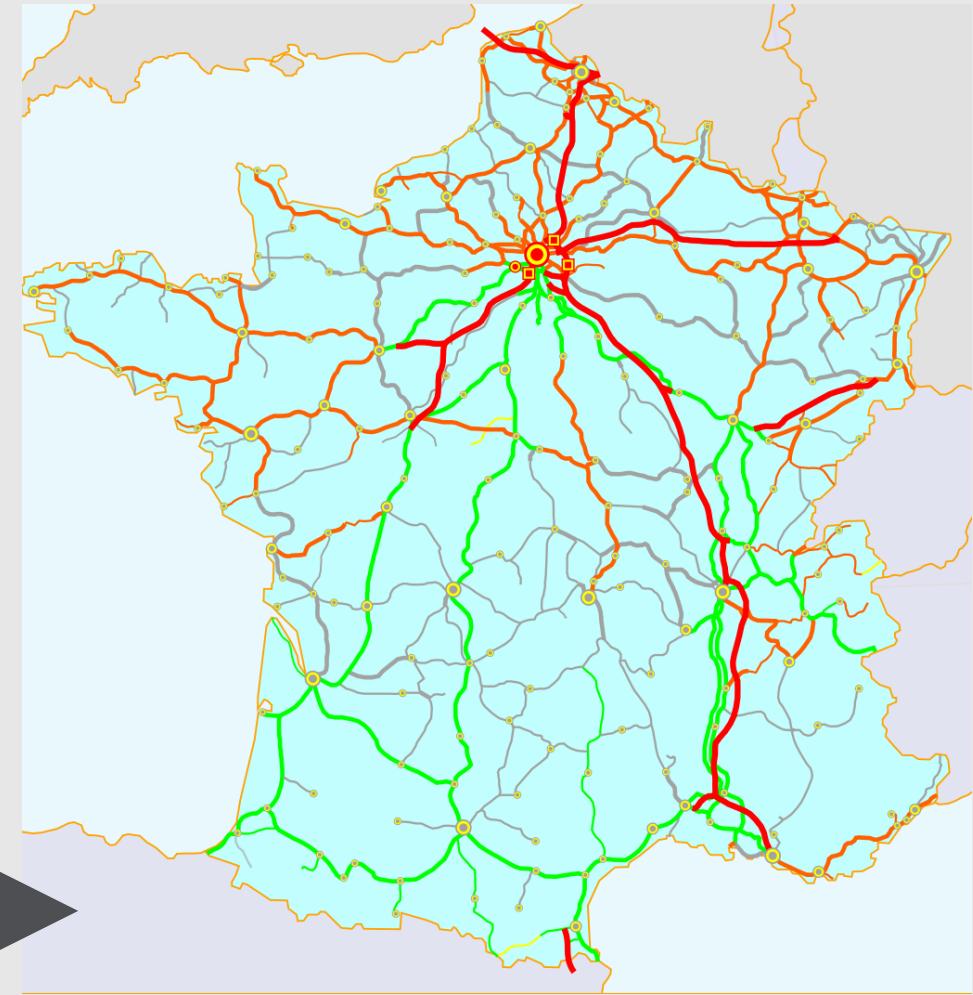
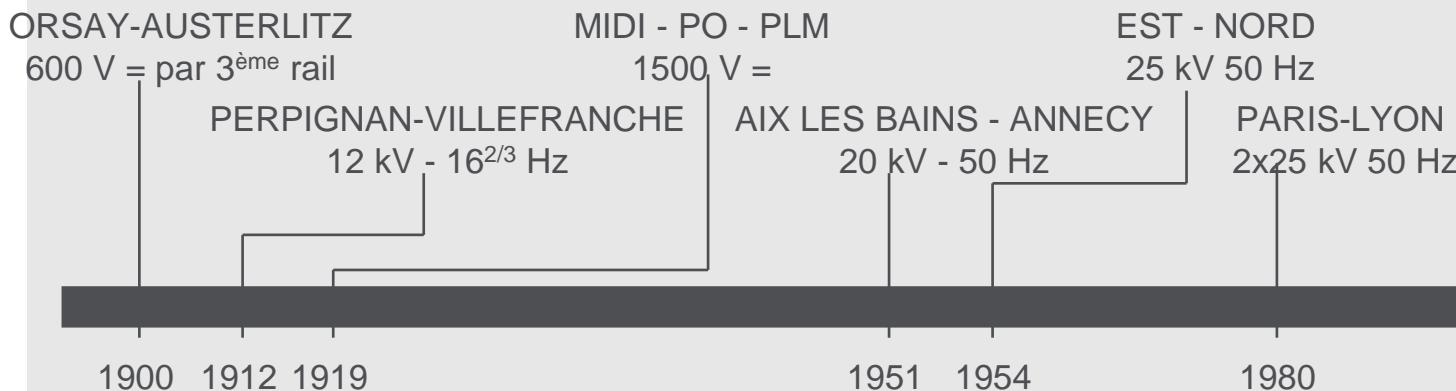
# HOW TO DEFINE THE BEST CONFIGURATION FOR A NEW/RENEWED LINE (ENERGY IN TCO)?

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**

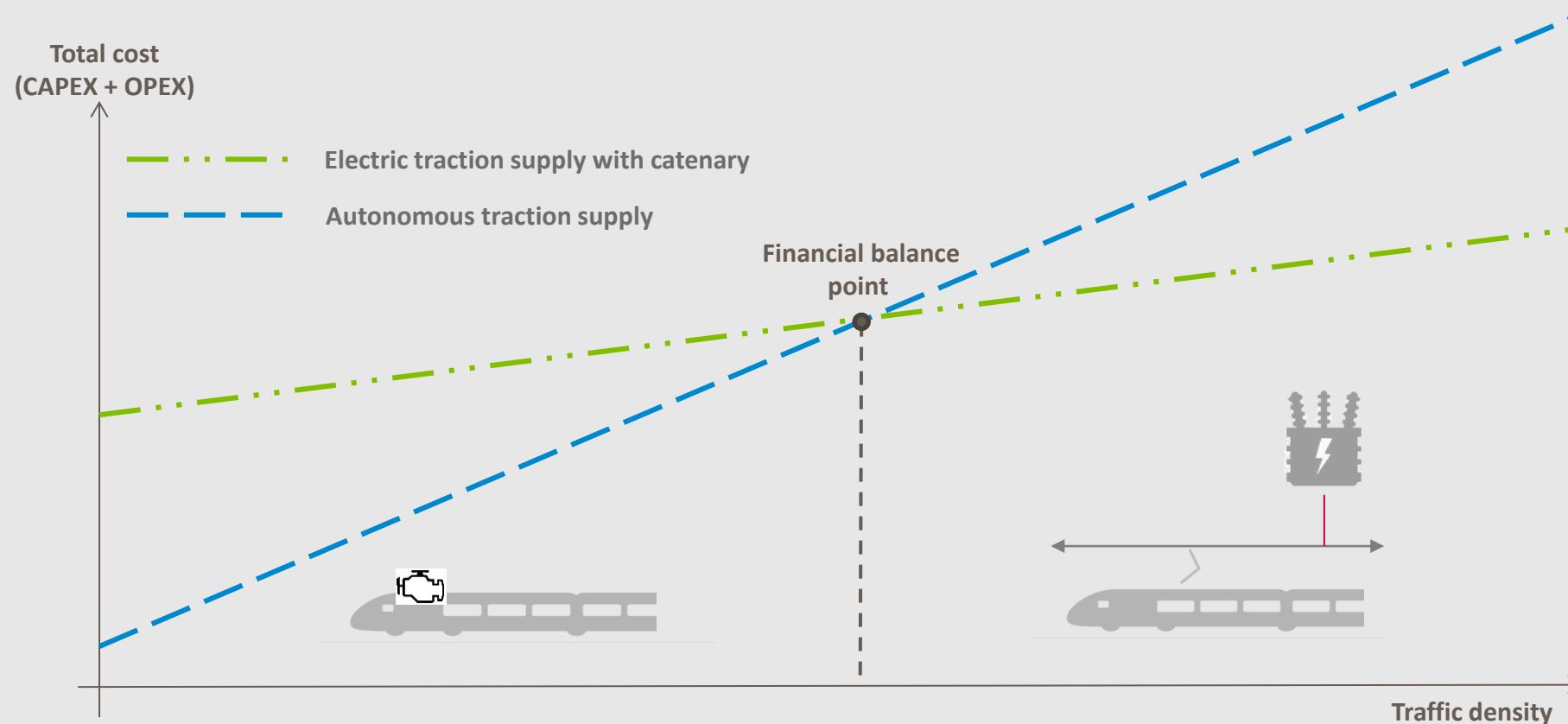


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Current situation – infrastructure point of view

## ECONOMIC MODEL OF ELECTRIFICATION

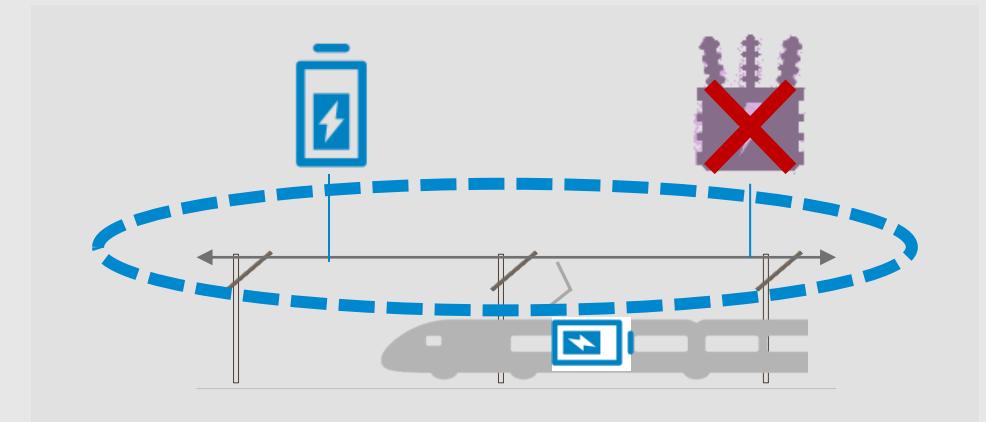


# HOW TO DEFINE THE BEST CONFIGURATION FOR A NEW/RENEWED LINE (ENERGY IN TCO)?

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)

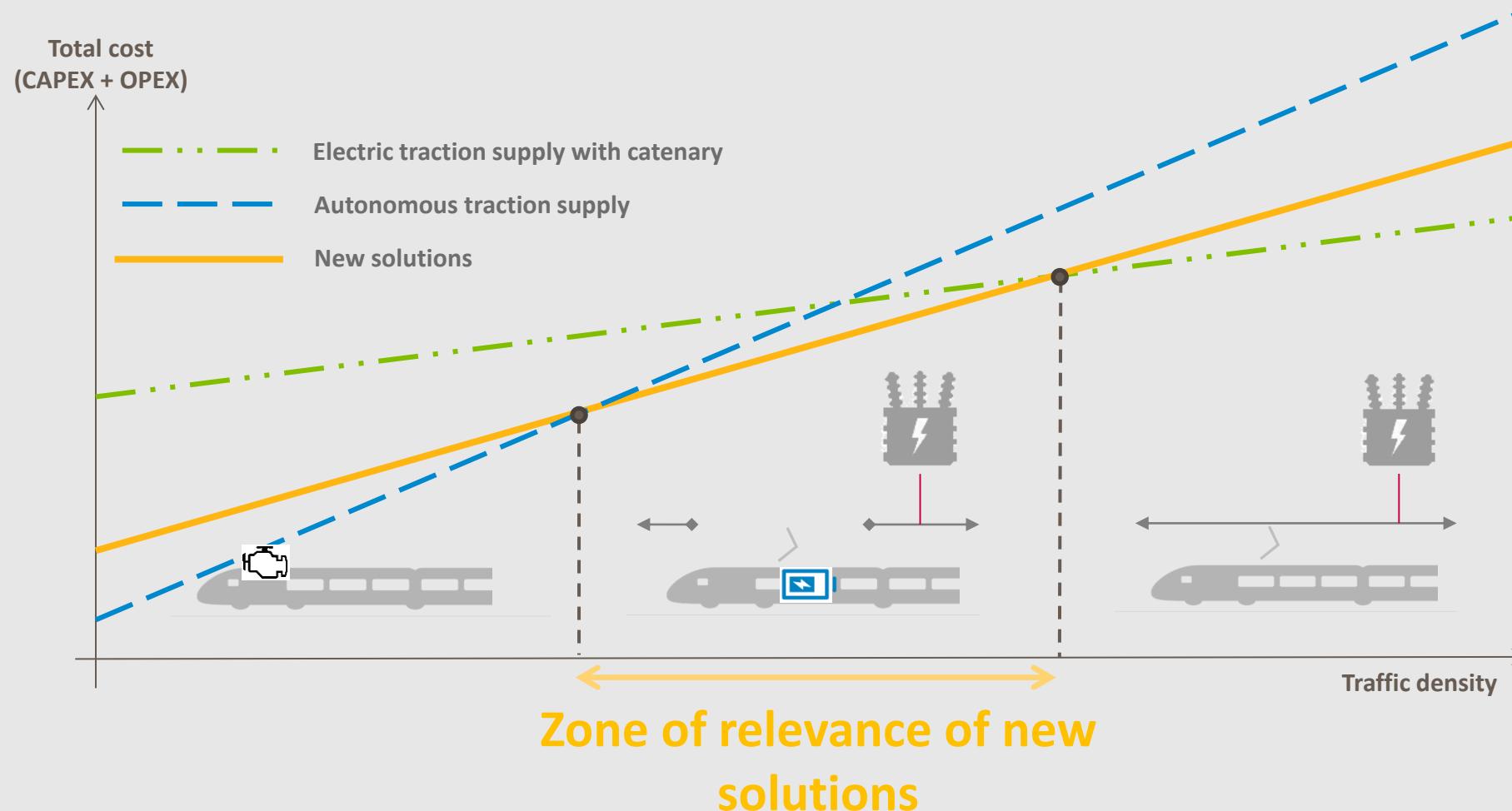


# HOW TO DEFINE THE BEST CONFIGURATION FOR A NEW/RENEWED LINE (ENERGY IN TCO)?



Optimized solution system Approach

## NEW SYSTEM SOLUTIONS IN THE ECONOMIC MODEL



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

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

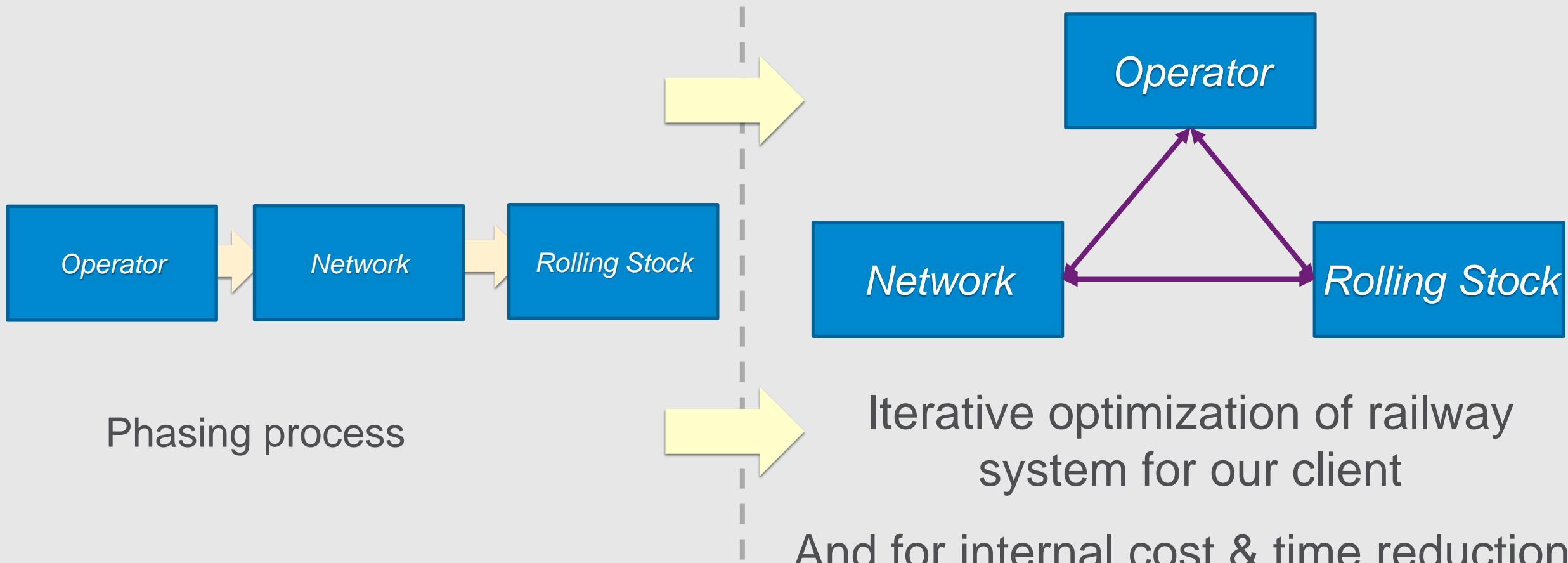
**The historical ways :**  
**A phasing & binary process which mostly lead to overate infrastructure capacity & RS performance**

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

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)?

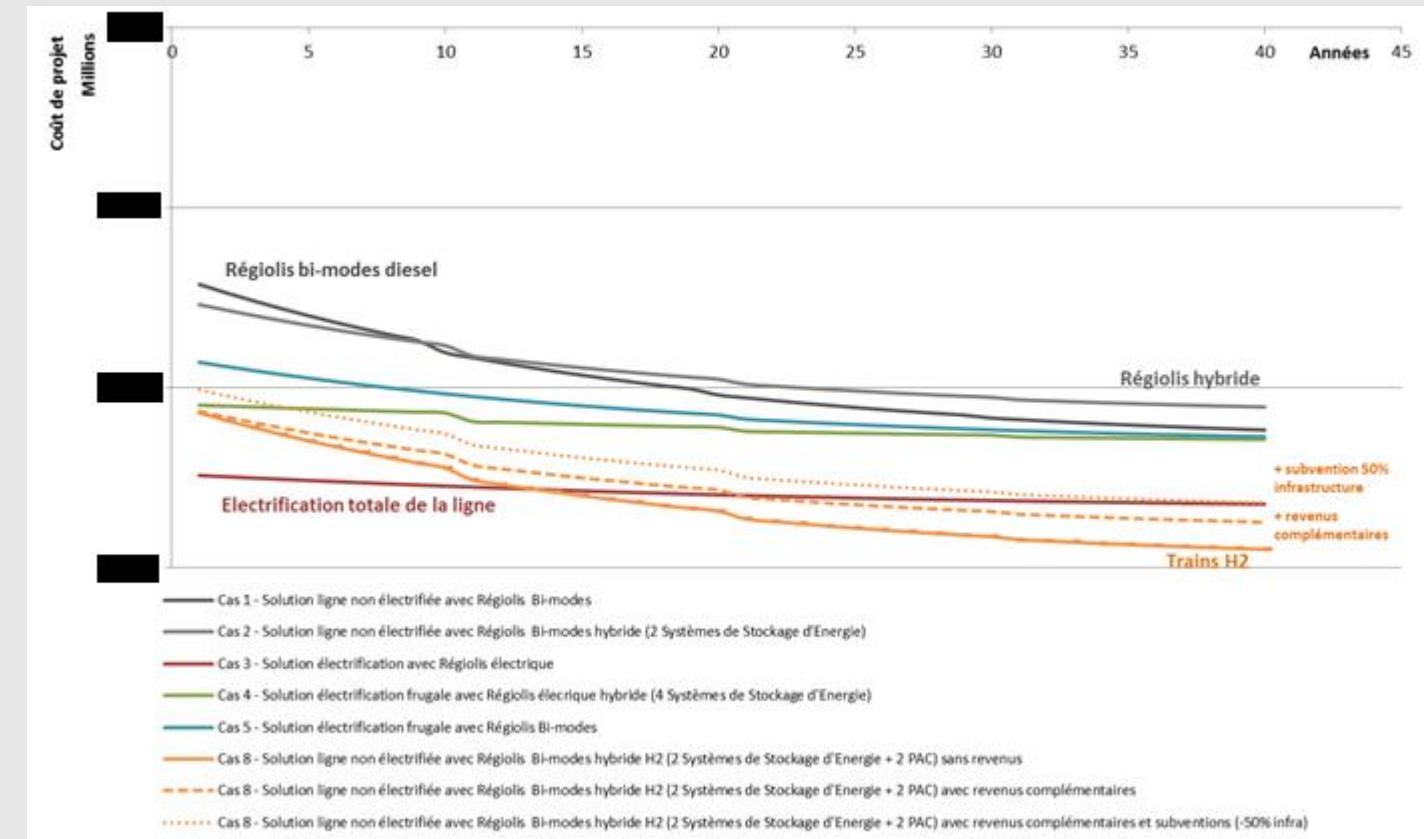


Study on a French use Case

## 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

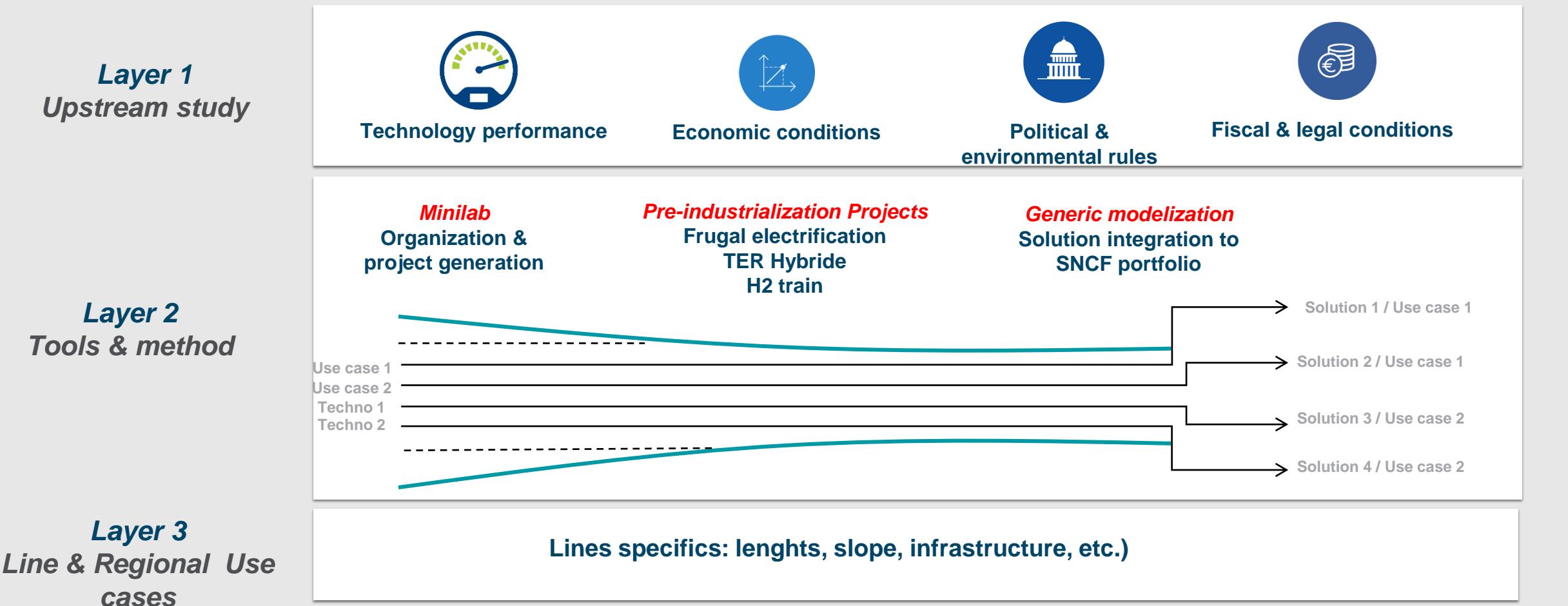


# HOW TO DEFINE THE BEST CONFIGURATION FOR A NEW/RENEWED LINE (ENERGY IN TCO)?



Collaborative work

## STRATEGY IMPLEMENTED



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