



# OPTIMIZATION OF ABATEMENT TECHNOLOGY CHOICES UNDER CAFE STANDARDS AND DIFFUSION SPEED LIMITS

Juan VERA and Céline GUIVARCH

International Research Center on Environment and Development, Paris - France



## Motivation

An industry constrained by low emission policies has to adapt its product strategy in order to prepare for future regulations with a varying stringency level.

CAFEx regulation in the automotive sector is challenging manufacturers and suppliers because standard technology improvements are not enough to comply with future targets. Therefore, alternative fuel vehicles have emerged as an abatement solution to replace conventional vehicles.

## Research Questions

- What is the short term target needed to achieve high ambitious goals in the longer term?
- What is the impact of short term abatement strategy on longer term abatement potential?

## Model

### Public Policies "Feebates"

- Fees for fossil fuel technologies
- Rebates for low carbon technologies



### Technology Costs

- 5 Powertrains: Gasoline, Diesel, HEV, PHEV, EV
- 2 Transmissions: Manual and Automatic

### Abatement Potential

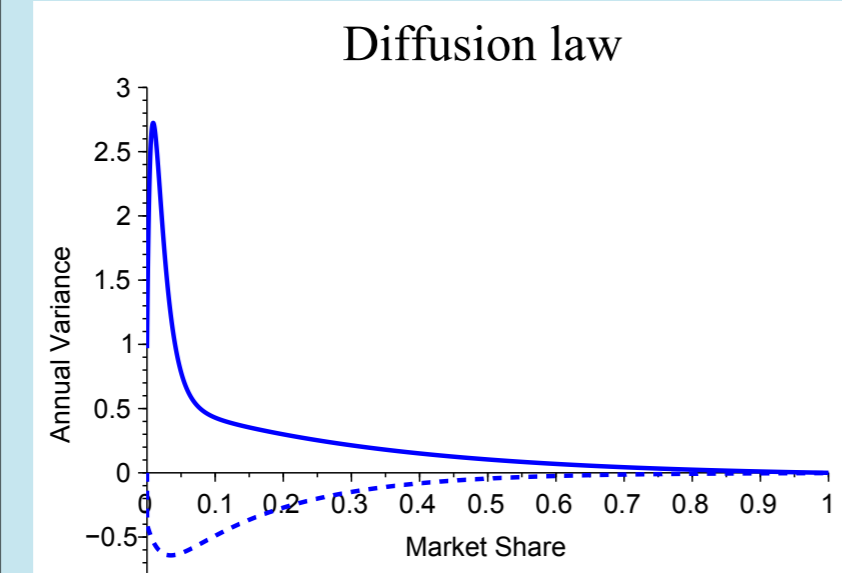
- CO2 emission level on NEDC cycle

### Optimization Model

Cost Minimization of Investments

#### Constraints:

- CAFE short 2020 and longer 2025 term targets
- Annual Volume Sales
- Speed of diffusion limited by the diffusion law as a function of market share



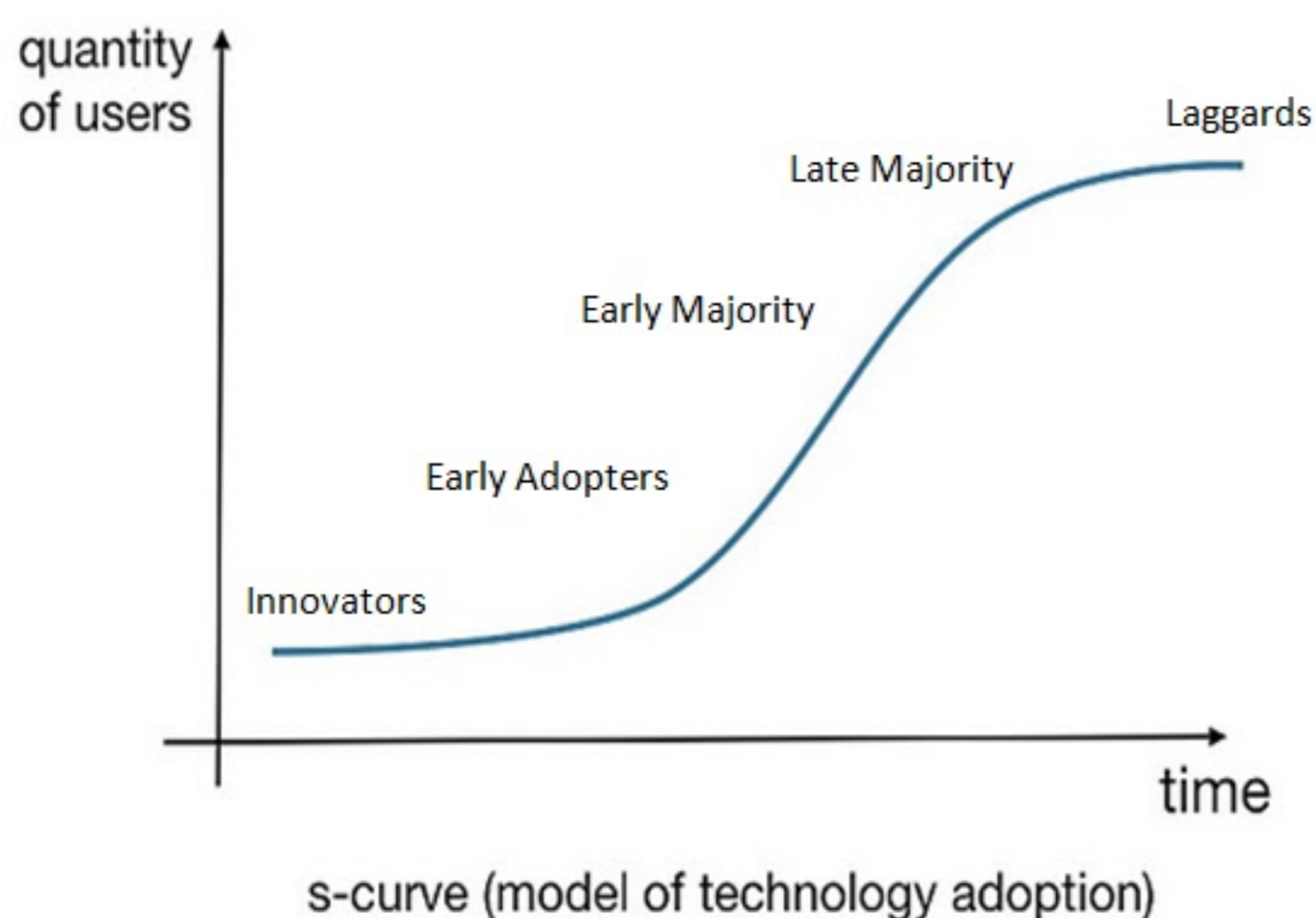
### Technology Mix

- Volume Sales
- Total abatement cost
- Total abatement potential

## Focus

- Speed of diffusion: limiting product growth and decay with past cases and current technology trends

### Diffusion of new product principle



## Results

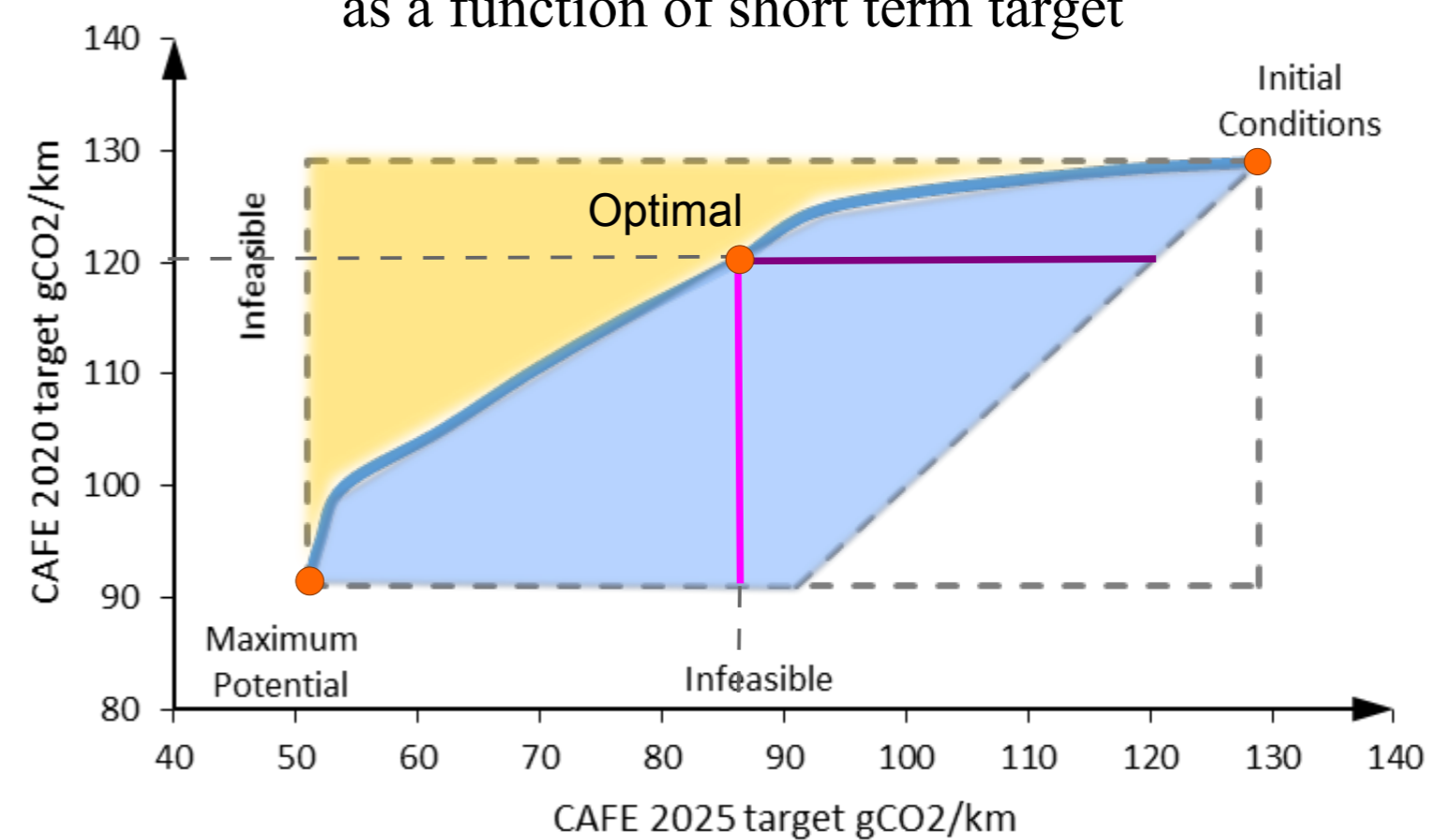
### 1) Longer Term Binding Region

When thinking about the long run, longer term ambitions need to be prepared in advance. The longer term binding region in yellow represents the infeasible short term target region. For a given longer term target, short term target must be below the blue optimal line.

### 2) Short Term Binding Region

When short term objective is binding, (the blue region in Fig. 1) the goal fixed in the short term is too ambitious, there is a lower optimal short term target that exists.

Figure 1: CAFE long term resilience as a function of short term target



### 3) Resilience intervals

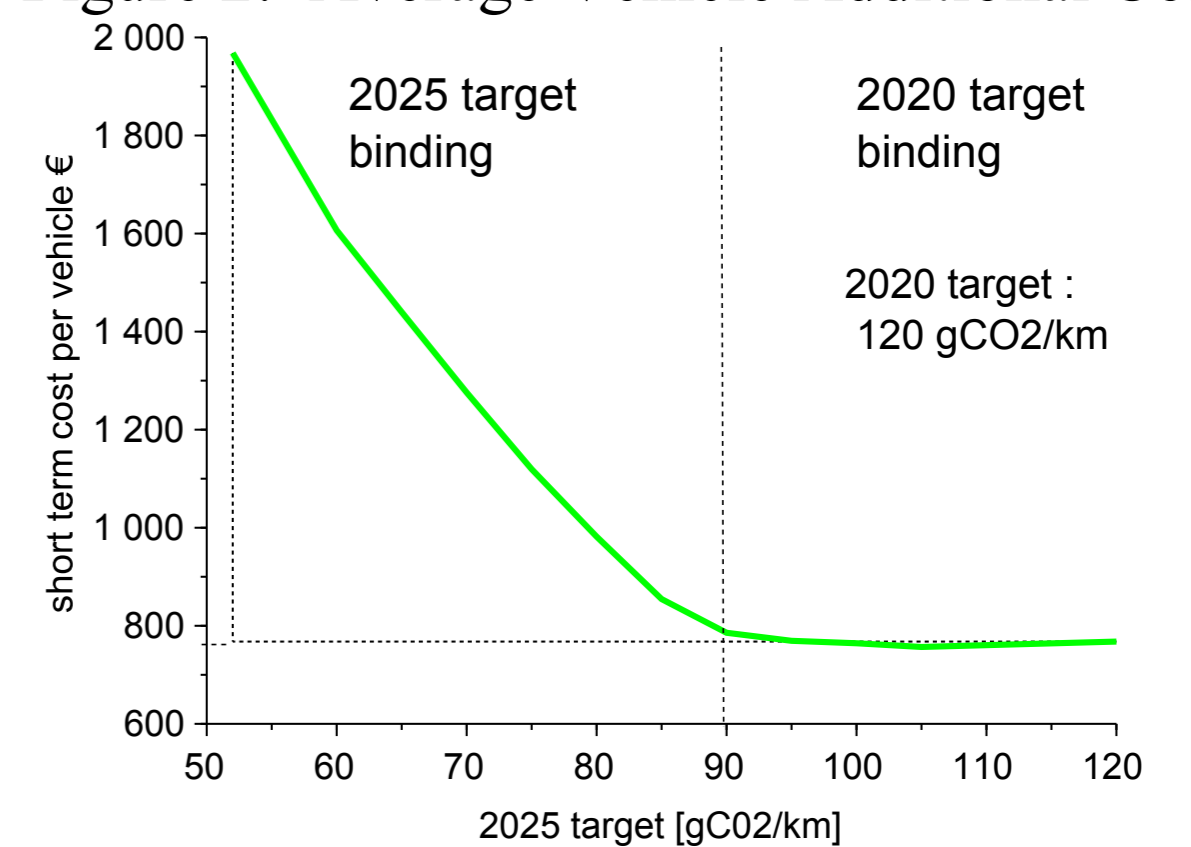
If the short term target is fixed, the range of longer term targets that are achievable is given by the purple line. Resilience in this case is the capacity of a short term target to remain unchanged when varying a longer term target. For more ambitious target in the far future, the resilience of a given short term target decreases.

Likewise for a given longer term target, multiple short term targets are possible: the interval of possibilities is represented in the pink line in Fig. 1

### 4) Impact on cost:

When the short term goal is binding the average vehicle additional cost remains unchanged, then after a threshold, the short term cost increases with a more ambitious longer term target.

Figure 2: Average Vehicle Additional Cost



## Further Work

- Adapt the speed of diffusion constraint for each product specifications and consumer behaviour.
- Include other type of low emission policies in the model.
- Compare Total Cost Ownership model of options instead of Purchase Price.

### Scope of PhD Research

