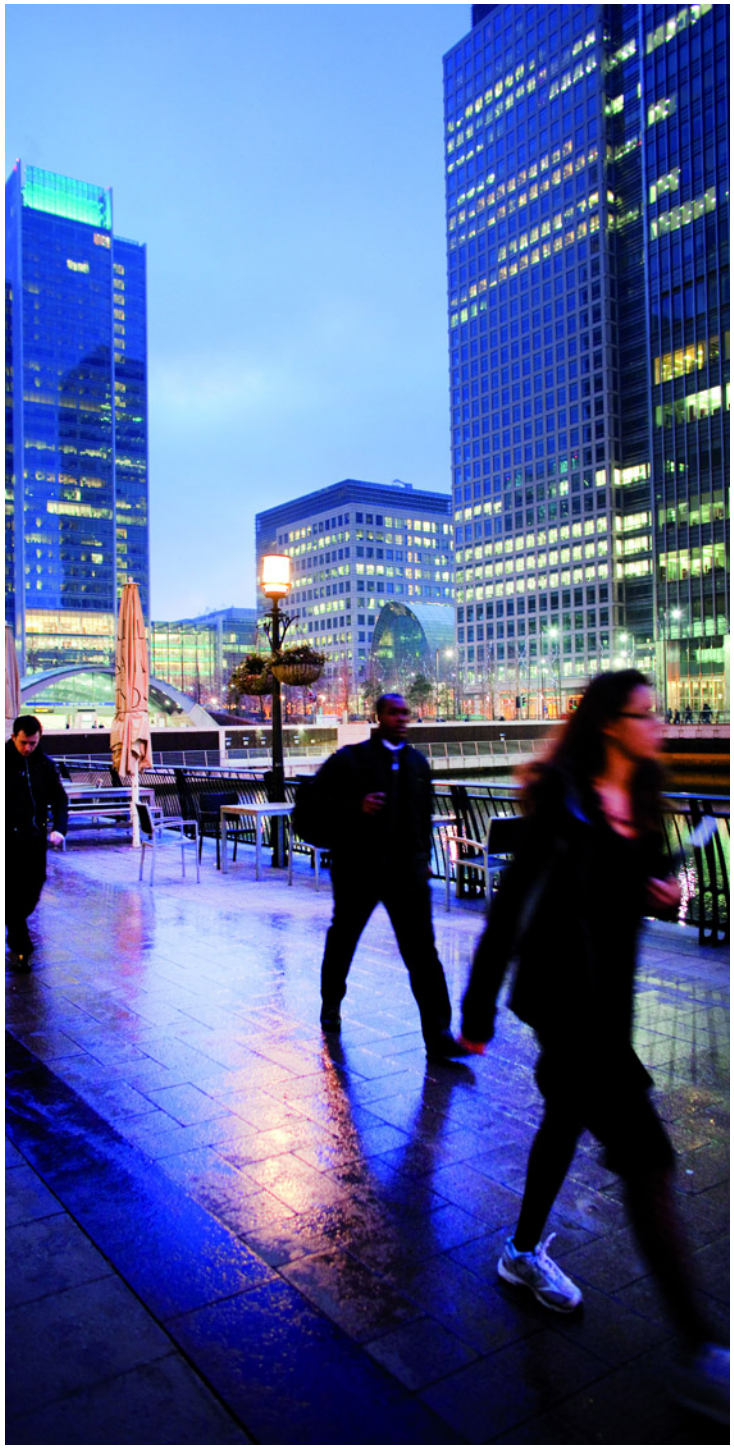
Forecasting White Certificate flows with System Dynamics



ECEEE Industrial Efficiency 2016, Berlin

Policies and Programmes

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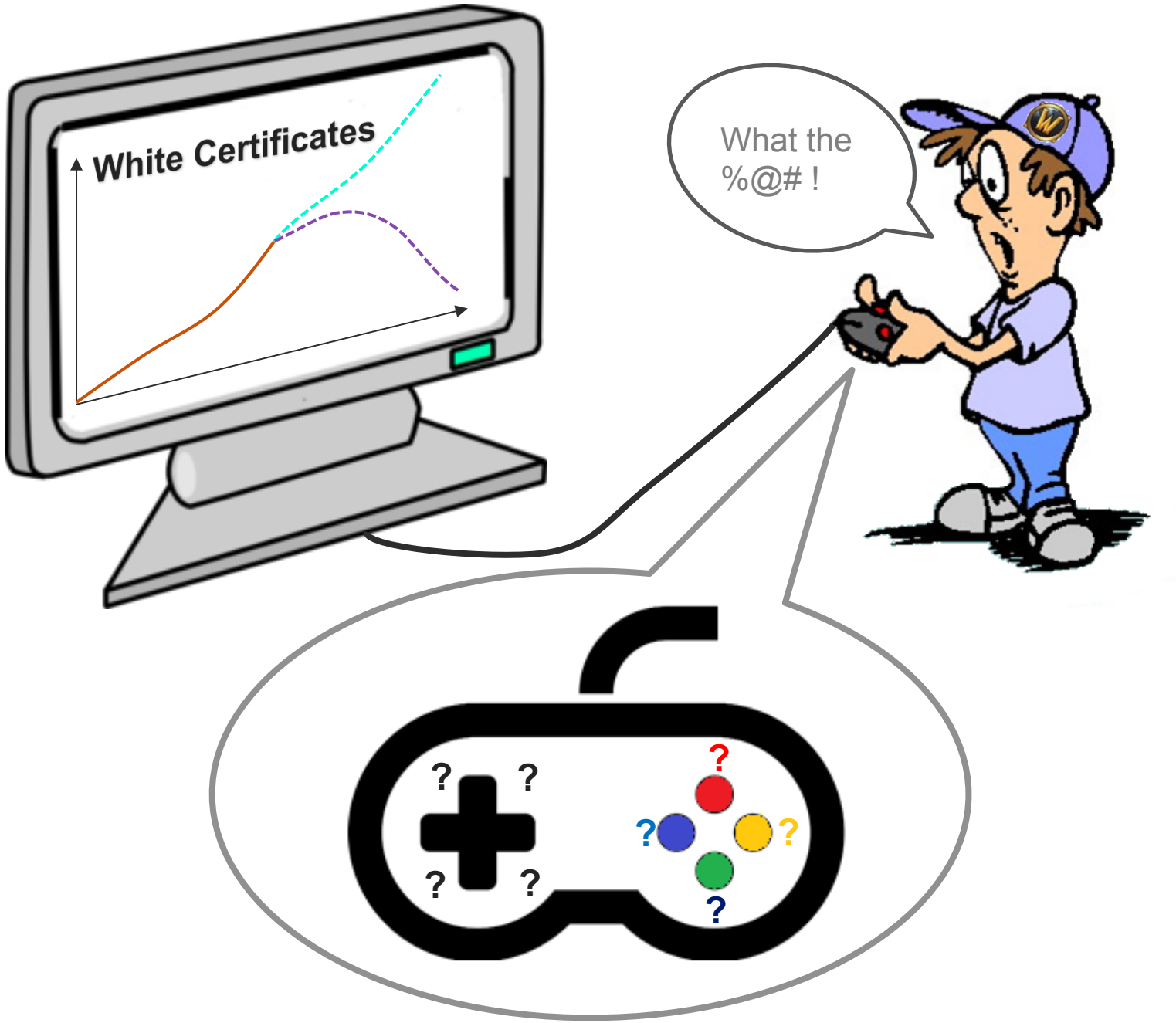
EDF Research and Development

September 2016


White Certificates
What the %@# !

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INTRODUCTION

➢ **Context:**

- France indicated that 90 % of the 1,5% annual saving required by the Energy Efficiency Directive[1] will be achieved by the White Certificate.
- White Certificates have been used for 10 years ➔ Energy savings for 2015 are about twice as high as Paris' annual energy consumption (43 TWh 2009[2]).
- The mechanism will be extended from 2018 to 2020 (fourth period).

➢ **Area of the focus is Industry and Services**

➢ **Objective:**

To provide guidance for government authorities and obligees for the next period

To build a tool to identify and quantify the potential impact of some changes in the evolution of the scheme.

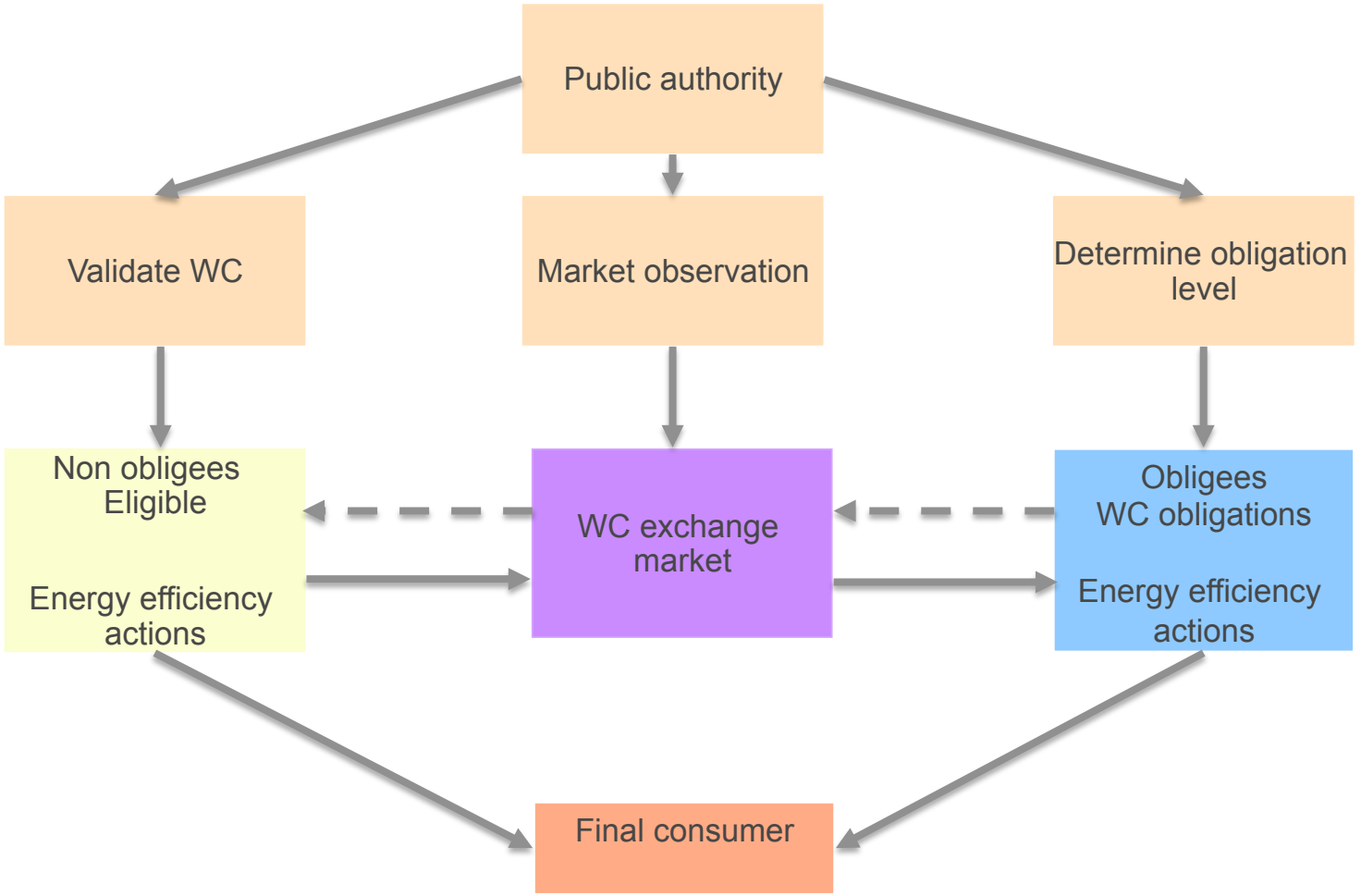
➢ **Method:**

Modelisation with System Dynamics

(1) Art.7 Directive 2012/27/UE
(2) Reference Mairie de Paris « Bilan énergétique de Paris 2009 »

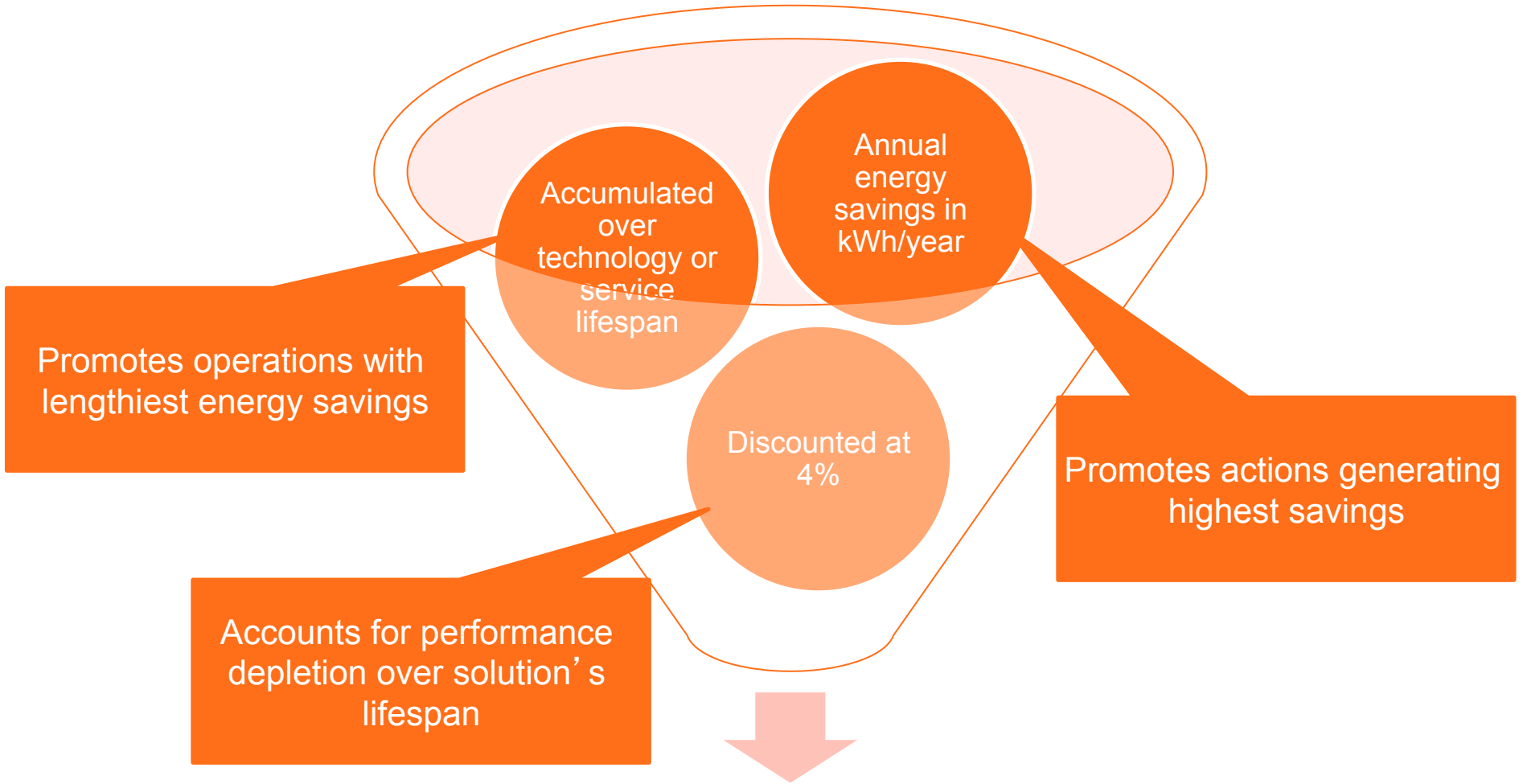
1. The French White Certificate scheme

THE FRENCH WHITE CERTIFICATE SCHEME [1]



(1) Reference ADEME

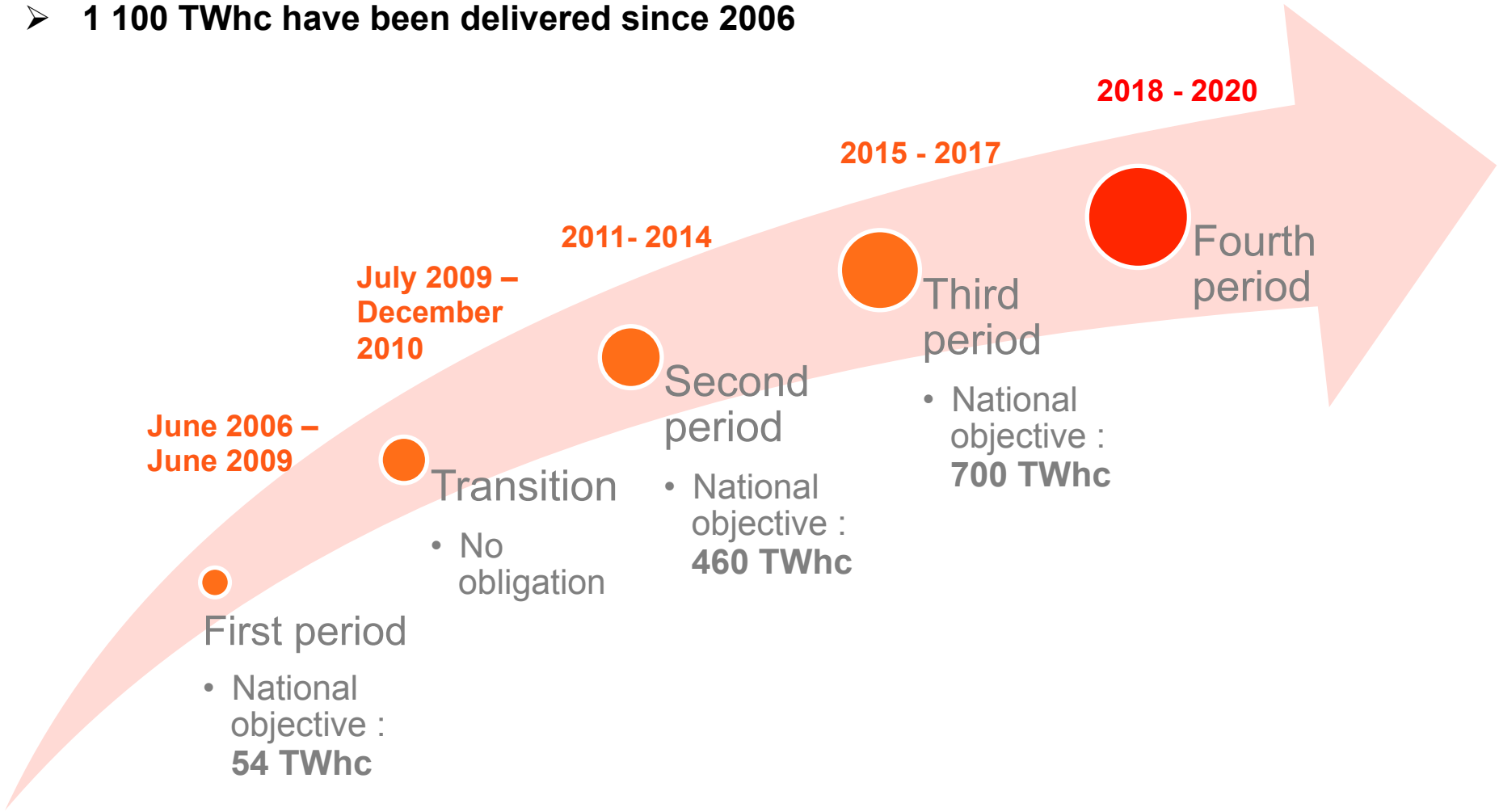
ENERGY SAVINGS ACCOUNTING



kWh « cumac »

WHITE CERTIFICATES OBLIGATION LEVEL

➢ **1 100 TWhc have been delivered since 2006**



2. Modelisation of White Certificate flows

2.1. Data used for the study
2.2. Principle of the model

MODELIZATION OF THE WHITE CERTIFICATE FLOWS
Data used for the study

➢ **3 kinds of input data for our model:**

1 The History of White Certificate flows

Available for each energy-efficiency action, between 2006 and 2015

2 Energy saving potentials

Calculated for each energy-efficiency action

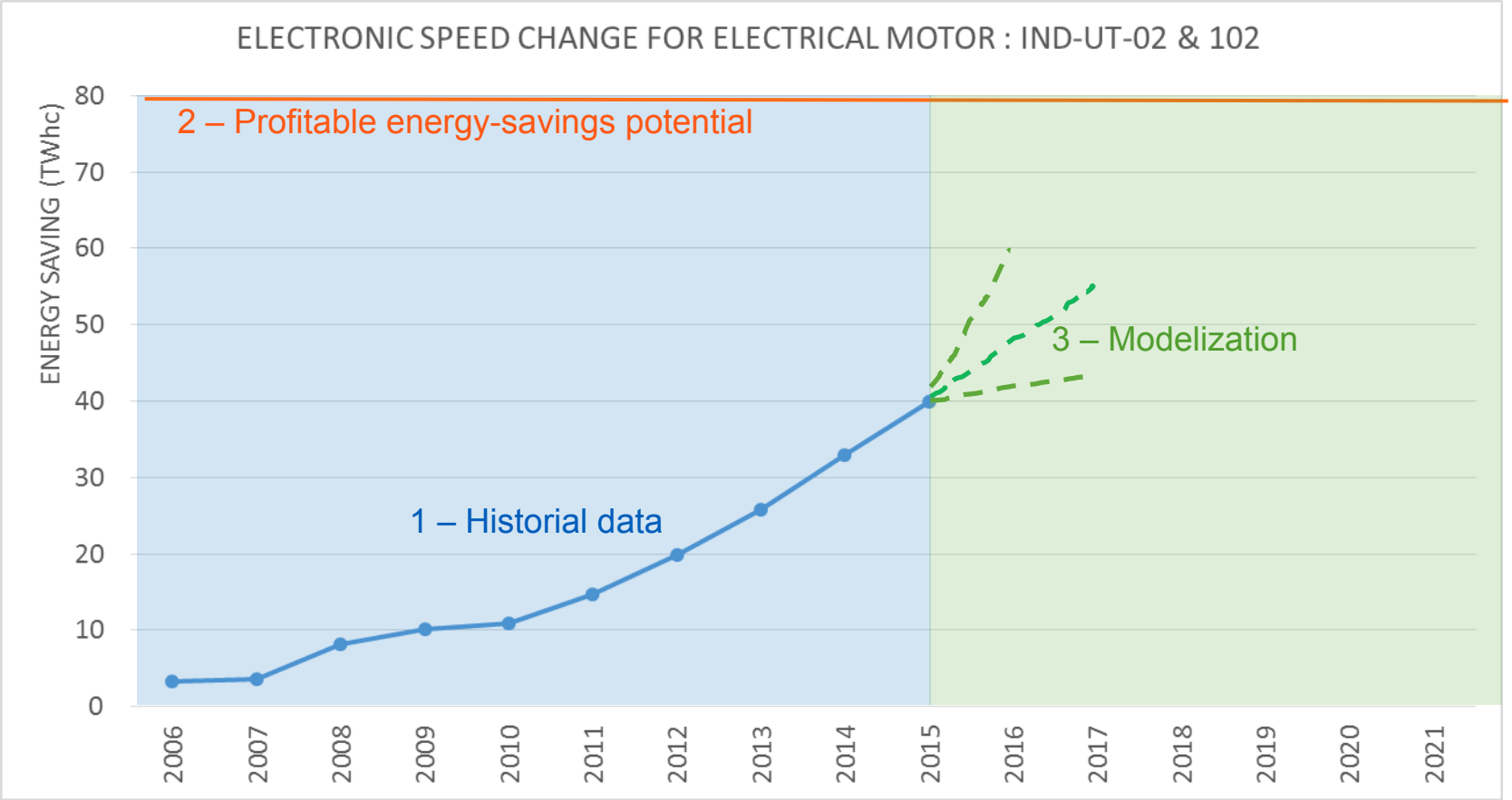
3 Qualitative information

Obtained thanks to interviews of the scheme's main participants

MODELIZATION OF WHITE CERTIFICATE FLOWS
Principle of modelization

➢ **Idea of our model:**

For each action, we try to estimate the best possible way between the end of the observed data and the maximum accessible energy-savings potential. A system dynamics software is used (Vensim)



MODELIZATION OF WHITE CERTIFICATE FLOWS
Principle of modelization

➢ **Theoretical background:**

Bass Diffusion model[1] is commonly used on economic and marketing research to explain the diffusion of new products or technologies. It describes the dynamics of adoption connected at the same time to the initiation and diffusion of information.

→ We adjusted this model for our topic.

➢ **Drivers taken into account in our model:**

1. Advertisement impact
2. Information diffusion
3. Structure offer
4. Financial incentive

(1) Bass, Frank M. 1963) « A Dynamic model of Market Share and Sales behavior »

MODELIZATION OF WHITE CERTIFICATE FLOWS
Principle of modelization

4. Financial incentive

Added as an acceleration phenomenon of the White Certificate flows.

This consists of a price drop for an EE action.

$$(\text{Advertissement impact} + \text{Information diffusion} \times \text{Structure offer}) \times \text{Financial incentives} = \text{Adoption rate}$$

MODELIZATION OF WHITE CERTIFICATE FLOWS
Principle of modelization

$$Adoption\ rate = (advertissement\ impact + word\ of mouth\ impact \times structure\ offer) \times financial\ incentives$$

$$Adoption\ rate = \left[PB.e.r + \frac{c.i.PB.B}{N} . \left(\frac{1}{1 + e^{(-v.(B-s)}} \right) \right] . (1 - IC)^{\varepsilon}$$

N: number of past and potential beneficiaries
c: frequency of contact between them
i: proportion of these contacts which are transformed into White Certificates.
B: buyers having conducted a WC action

ε: price-elasticity of the request
IC: financial incentive

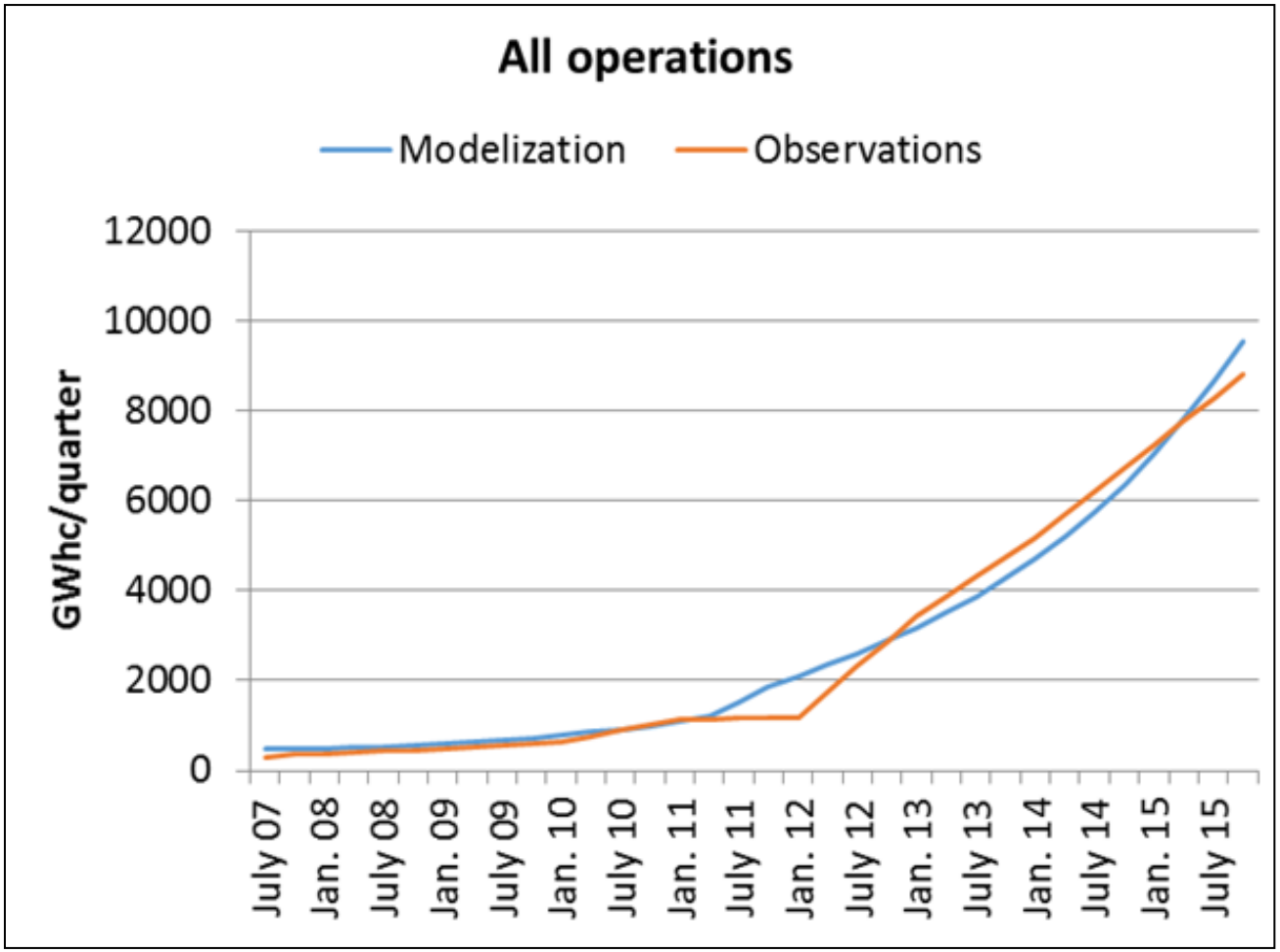
PB : number of potential buyers
e: efficiency of advertisement
r: financial and human resources

s: offer threshold
v: offer implementation speed

3. Model results

3.1. Calibration with historical data
3.2. Forecasts
3.3. Perspectives

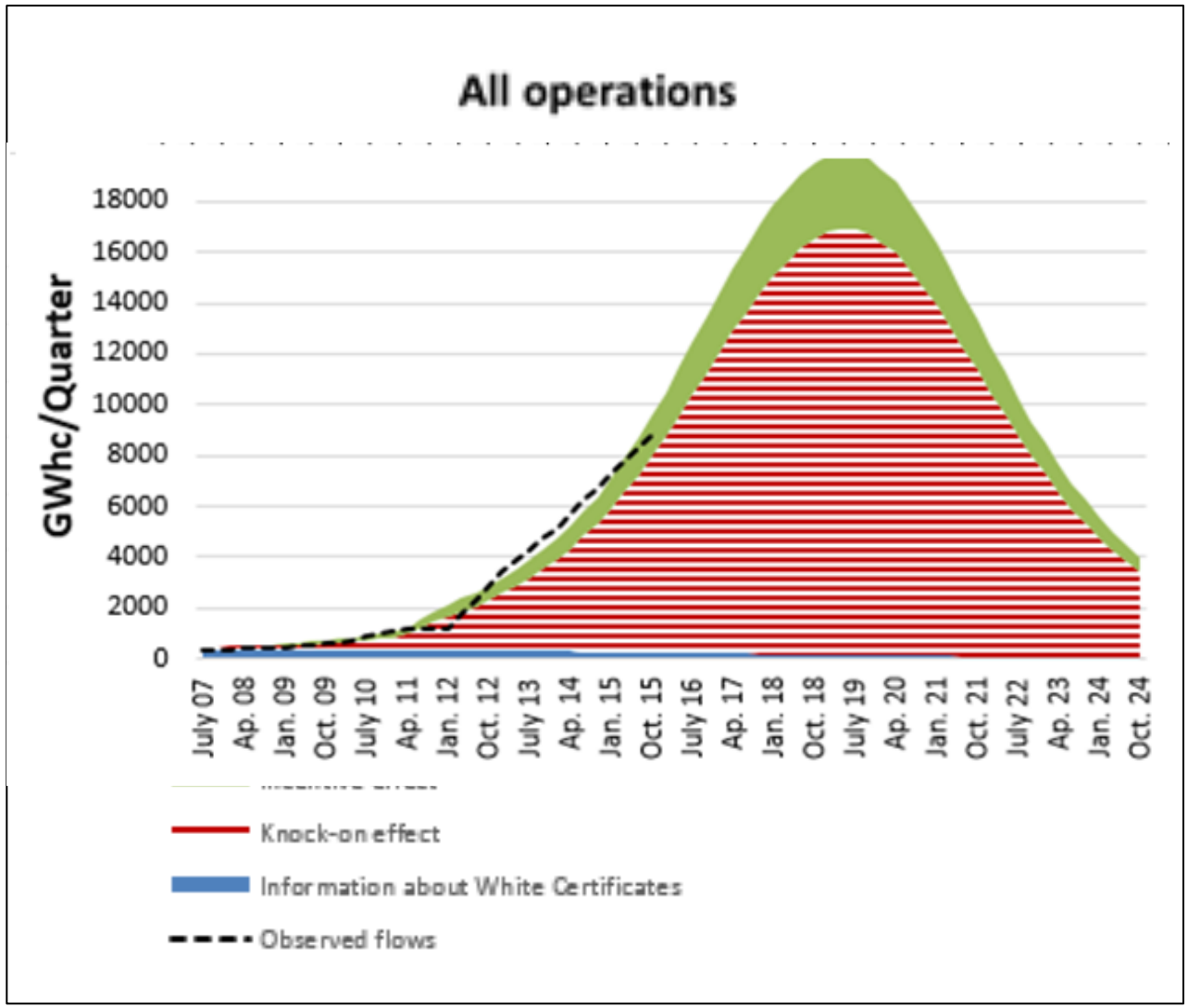
MODEL RESULTS
Calibration with historical data



Calibration worked out for each energy-efficient action.

Results of calibration are close to past dynamics.

MODEL RESULTS
Flow forecast



- **External information**:

Essential to initiate the process, doesn't have a strong effect in terms of energy saving flow

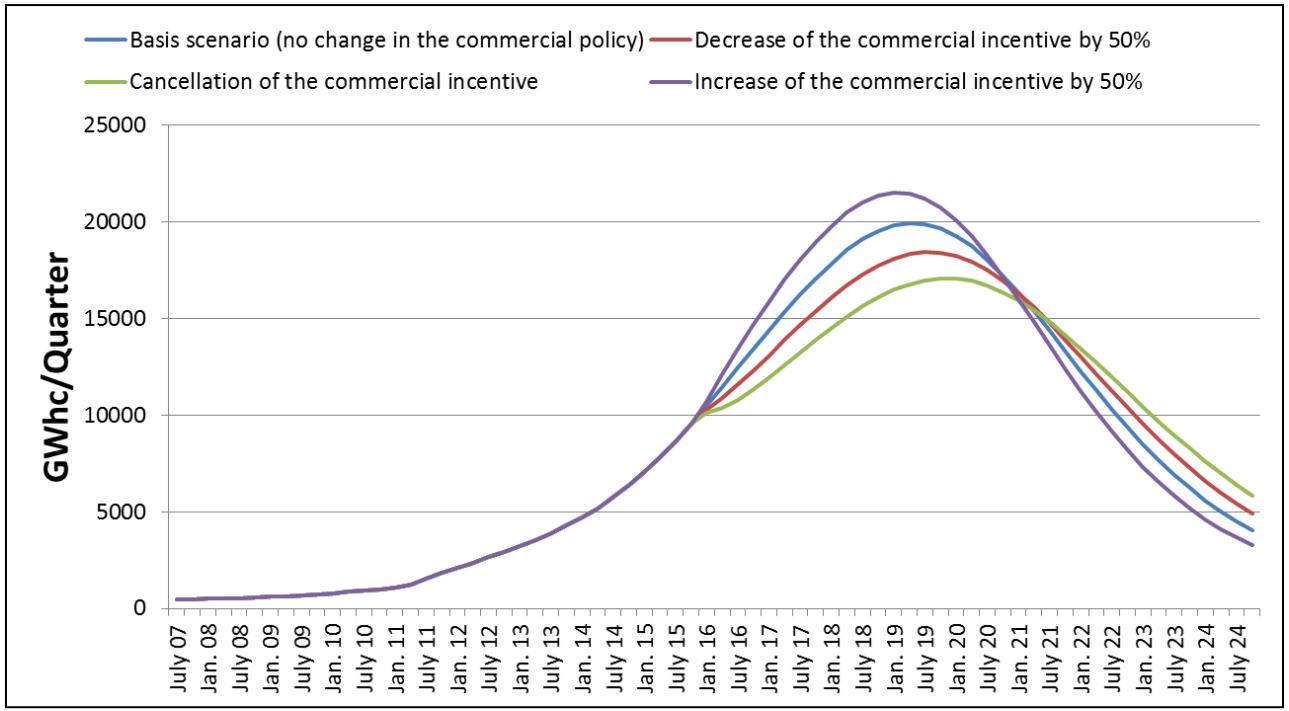
- **Knock-on effect (information diffusion)** :

rapidly becomes the most significant leveraging effect.

- **Financial incentives**:

not decisive in the development of an energy-saving operation, but act as an accelerator of the internal diffusion process

MODEL RESULTS
Perspectives



- Test of four scenarios on the commercial financial incentives.
- The commercial incentive is not the main driving parameter.
- Boosting effect in the short term but a steeper decline in the long term. This is because of the deminished stock of possible energy efficient actions.

CONCLUSION

- Simulations are helpful
  - in understanding the most efficient policy,
  - in forecasting annual energy efficiency improvements.

- The “knock on effect“ is the principal constraint in the diffusion of energy efficient actions
  ➔ **Institutional advertising and certification** can significantly boost energy savings.

- Financial incentives play only a secondary role

- Future evolutions will improve modelling of the other side effects, such as:
  - Energy costs
  - Regulatory obligations (such as the energy audit obligation)
  - Financial barriers on the implementation of energy efficiency actions

- So far the study has been conducted in conjunction with ADEME and now continuing in partnership with ADEME and PSE

THANK YOU FOR YOUR ATTENTION!