



Internship proposal on R&D subsidies for the energy transition: Analysis of contractual schemes

R&D plays an important role in the energy transition. Typically these activities take place in a context of market failures (spillovers, learning-by-doing, imperfect capital markets, coordination issues...) which justifies the intervention of the State. This is even more so for the energy transition since for various reasons it remains politically difficult to implement a carbon price.

The objective of this internship is to analyze contractual arrangements used to promote specific activities intended to substitute dirty technologies by green technologies at the early deployment phases. During these stages various uncertainties prevail: the proof of concept of the green technology need to be verified, the involvement of several industrial partners providing different components may be needed, the speed and size of the deployment may be difficult to forecast. Zero emission vehicles (battery electric and fuel cell vehicles, hybrids...) provide an illustration of such a case.

Formally these activities require large upfront investments and generate future private and social benefits. The subsidies may contribute to financing the investment cost and encourage successful deployments eventually with repayments in case of large commercial success.

A first economic model of such contractual arrangements has been developed. The following topics should be explored further:

- Extension of the model to cover a larger spectrum of outcomes for the project (the current model only considers a binary outcome, either failure or success while what constitutes a "success" in practice can be debatable)
- The time span of the project should be enlarged from two to more periods and the benefit of a contractual scheme that would take advantage of the progressive information disclosure obtained along the deployment of the project
- The analysis of how the risk is allocated among the parties (the agency which provides the subsidies, the private investors, the industry operators of the project and its beneficiaries)
- The complementarity between different components of the project and the relative benefit of subsidizing the various components (i.e. for green vehicles infrastructure and manufacturing of cars)

The exploration of these topics would be closely associated with in depth analysis of case studies provided both by ADEME in relation with the Program Investments for the Future (Programme d'Investissements d'Avenir) et Air Liquide in relation with the deployment of the Fuel Cell Electric Vehicles in different countries (Japan, Germany, France...).

Useful links

Introduction to ADEME

<http://www.ademe.fr/connaitre/presentation-lademe>

Case studies on the deployment of BEV and FCEV

- The deployment of BEV and FCEV in 2015, Oct. 2015, Julien Brunet, Alena Kotelnikova, and Jean-Pierre Ponsard <https://hal-polytechnique.archives-ouvertes.fr/hal-01212353>
- Policies and deployment for Fuel Cell Electric Vehicles an assessment of the Normandy project, Julien Brunet and Jean-Pierre Ponsard *International Journal of Hydrogen Energy* (2016), <http://dx.doi.org/10.1016/j.ijhydene.2016.11.202>

Formalization of contractual arrangements

- Pour un financement conditionnel des projets risqués bas carbone Sept. 2016, Guy Meunier and Jean-Pierre Ponsard <https://hal-polytechnique.archives-ouvertes.fr/hal-01366181>

Requirements and further information

Good knowledge of microeconomics, more specifically of contract theory

Some familiarity with the economics of climate change and the economics of energy

Analytical and modeling capability (no need for econometrics)

The internship will take place under the joint supervision of Guy Meunier and Jean-Pierre Ponsard (Eco Department)

The internship is sponsored by the chair for Energy and Prosperity.

Students interested should send their CV and motivation letter to jean-pierre.ponsard@polytechnique.edu