

## Why industrial energy efficiency innovation policies fail to deliver the sustainability goals they promised?

(Sustainable Energy Transition Strategies: an applied economic modelling based case study)

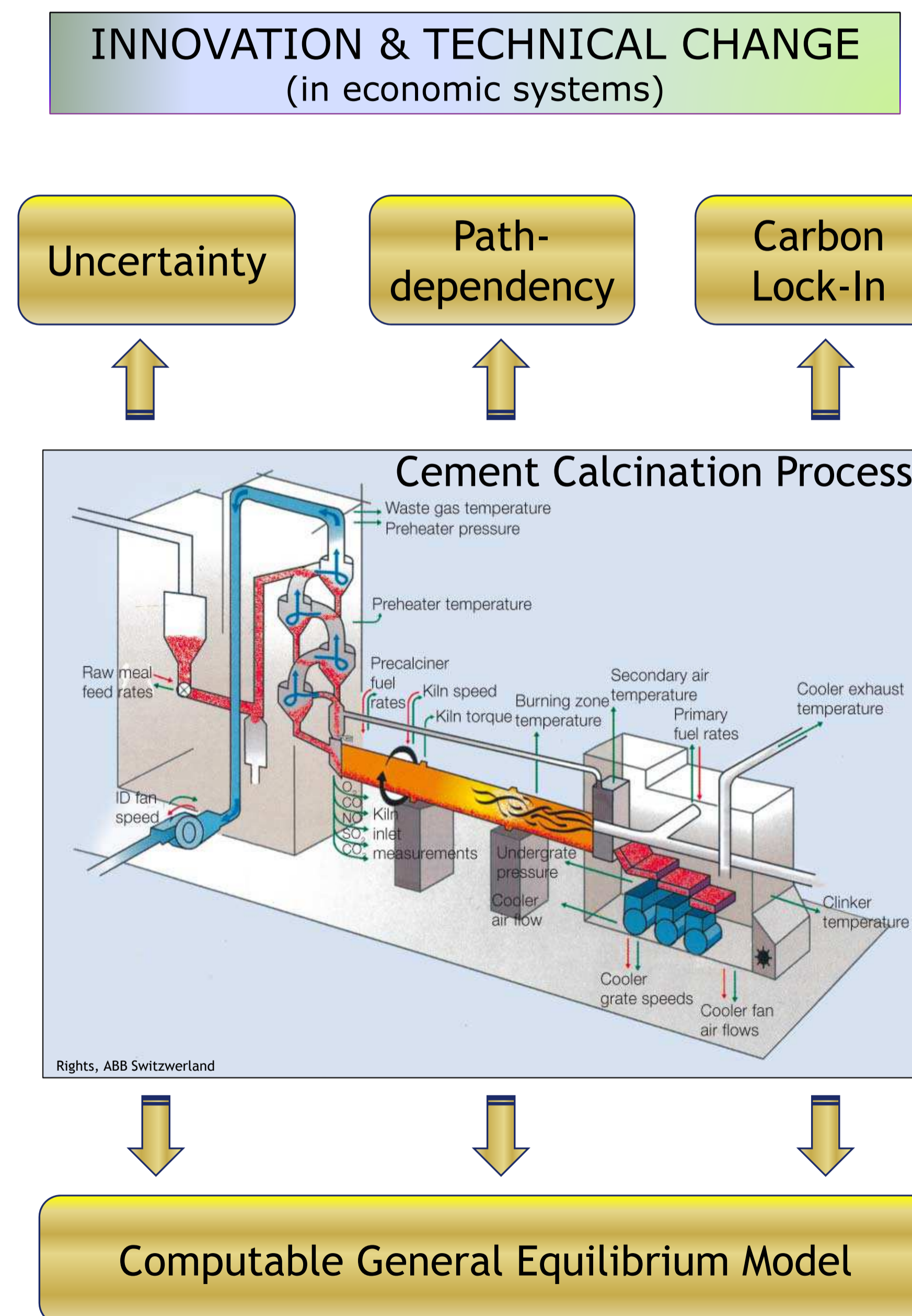
### Background

Global sustainability strategies usually rely on technology innovation for single economic sectors or particular technological advancements. Energy-efficiency technologies are one of the main innovation spaces that are regarded as suitable for policy initiatives of induced technological change. Little is known about how energy-intensity improvement potentials will affect overall sustainability indicators economy-wide.

### Research Objectives

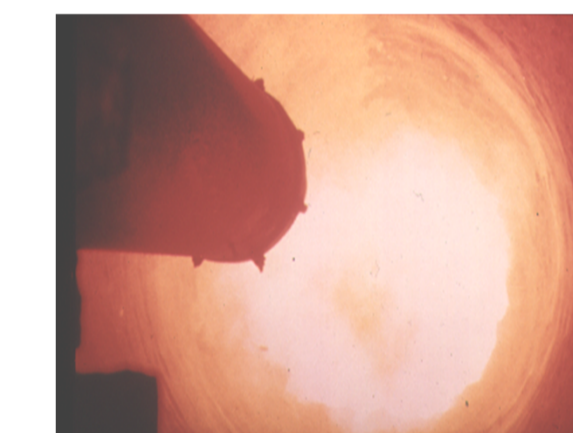
Energy-economy models provide an adequate quantitative analytical framework to evaluate different policy measures for long-term technology replacement under an integrated economic-technological optimality approach. However, at the centre of energy systems transitional analysis lies pervasive uncertainties related to technological change that arise from innovation. Using an energy-economy model this project examines if better understanding of economy-wide spillovers from structured programmes of technology innovation at the industry level is achieved. The research aim sets to analyse practical implications of technological restructuring coming from process innovation in the cement sector. The study is conducted through the implementation of a complementarity modelling method which links Top-Down and Bottom-Up techniques. An applied general equilibrium (a CGE model) exercise had been selected as the method of analysis. It uses technology specificity through bespoke technical coefficients embedded in customised production functions that represent endogenous technical change.

### Methodology



### Results

If industrial innovation processes are considered to be an endogenous policy measure instead of coming from external factors, diverse spillovers exist that were either not assessed or not perceivable in the first instance.



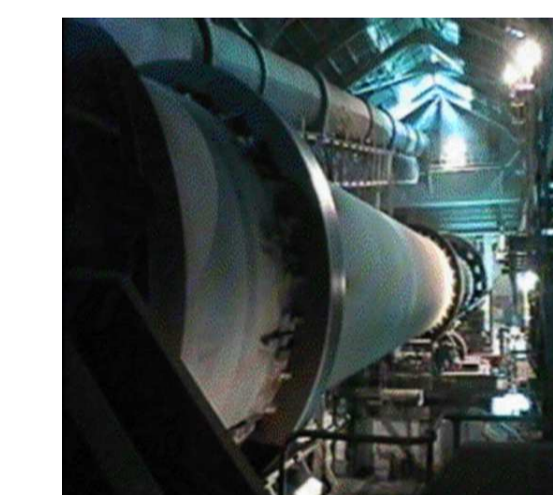
Exemplified for the Mexican economy results showed that overall costs related to the use of capital are kept unchanged on services and administrative activities. Meanwhile, agriculture and industrial costs report an increase.

### Conclusions

Sustainability achievements of technical change initiatives are clearly an ancillary part of the process of policy implementation for capital formation that depend on the overall economic system components interaction.

Following an initiative of induced technological change, systemic interactions produce intertwined effects that report different effects on sustainability and productivity all-around the Economy.

We have found that there is a positive spillover arising from the process of technical change in the cement sector which is pronounced in the production level of the service sector in contrast to manufacture.



### Further Work

Sensitivity analysis needs to be applied in a dynamic exercise. This analysis needs to focus on a mix of variables that affect the pace of endogenous technical change. The main variables to consider are:

- ✓ Long term effects from investment on Research & Development - returns to innovation that leaks to other firms in the sector
- ✓ Intra-temporal spillovers from innovation capacities for the incumbent firms participating in the sector
- ✓ The results coming from the generation of an improved knowledge base over time for the innovative firm itself

### References

- 1) Smulders, S., & Nooij, M. (2003). The impact of energy conservation on technology and economic growth. *Resource and Energy Economics*, 25(1), 59-79.
- 2) Schumacher, K., & Sands, R. D. (2007). Where are the industrial technologies in energy-economy models? An innovative CGE approach for steel production in Germany. *Energy Economics*, 29(4), 799-825.

