

# From fossil fuels to renewables: The role of electricity storage\*

Itziar Lazkano<sup>†</sup>      Linda Nøstbakken<sup>‡</sup>      Martino Pelli<sup>§</sup>

April 30, 2015

Preliminary and incomplete;  
Please do not cite or circulate without permission.

## Abstract

We analyze the determinants of innovation in electricity storage, and study the role of storage in increasing the share of renewable energy. Since renewable energy sources such as wind and solar are intermittent, significant use of renewables in the energy mix requires better storage solutions to balance the grid. We propose a theoretical model of the electricity sector where innovative firms develop energy storage innovations that affect not only the relative competitiveness between clean and dirty electricity sources, but also the ease at which they can be substituted. Our theoretical model predicts that energy storage limits innovation when clean and dirty sources are complements in energy production while it promotes innovation with substitutability. We empirically test the relationship between clean and dirty sources and the role of storage at directing innovation using a global firm-level dataset of electricity patents. Our results show that electricity storage plays an important role for both the speed and direction of technological innovation in electricity generation (clean vs dirty), and should be considered separately from clean technologies to gain a complete understanding of the incentive structure.

**Keywords:** Innovation; Directed technical change; Storage technology; Electricity

---

\*We are grateful to seminar and conference participants at the University of Alberta, the University of Kiel, the University of Wisconsin Madison, the University of Wisconsin Milwaukee, the University of Sherbrooke, the Montreal Natural Resources and Environmental Economics Workshop, WCERE 2014, and CESifo Area Conference on Energy and Climate Economics 2014 for helpful comments.

<sup>†</sup>Department of Economics, University of Wisconsin-Milwaukee. P.O. Box 413, Bolton Hall, Room 840, Milwaukee, 53201, WI, USA. Email: lazcano@uwm.edu.

<sup>‡</sup>Department of Economics, Norwegian School of Economics, Department of Economics, Helleveien 40, 5045 Bergen, Norway. Email: linda.nostbakken@nhh.no.

<sup>§</sup>Department of Economics, Université de Sherbrooke, Sherbrooke, Quebec, Canada. Email: martino.pelli@usherbrooke.ca