Funding Ontario's Renewable Energy Deployment: the Design of Innovative and Alternative Financing Models

Tom Du
July 30, 2012

York University
Toronto, Canada

Student's Signature	**Supervisor's signature**
Tom Du	**Dr. José Etcheverry**

I. Acknowledgements

I would not be on this fulfilling path without my mother, sister, and especially my father, who sparked a sense of environmental responsibility early on our fishing trips.

I would like to thank my supervisor, *Dr. José Etcheverry*, for inspiring me on a professional and personal level to continually strive for positive change. José's boundless passion and professional dedication are qualities that I aspire to embody. My FES experience has been enriched by the opportunities graciously provided by José, and I would like to express my deepest appreciation for all his help.

Thank you to my advisor, *Dr. Ellie Perkins*, for her astute advice and positive encouragement throughout the program. I am also thankful to my field supervisors, *Stefan Gsänger* and *Preben Maegaard,* for introducing me to so many diverse perspectives in Germany and Denmark, respectively. Finally, I would like to thank my peers and friends:

- *Phil* for his moral guidance, intellectually stimulating questions, and openness to my random thought experiments
- *Sarah* for the amusingly insightful energy conversations and, specifically, for being there for me since joining the RE sector
- My peers at the *DSF, FC, OSEA, SEI, TREC*, and *WWEA* for their help during consulting projects, research, fieldwork, and conferences
- My FES friends – especially *Antony, Bahareh, Dawn, Hazel, Jess, Ron, Steph*, and *Tanya* – for the profound debates and for enduring my endless energy talk
- *Andrea, Louisa, Nancy*, and *Syed* for their loving support over the years – and for always challenging me to grow as a person

II. Abstract

The primary aim of this research is to analyse and synthesise findings related to i) the prevailing renewable energy (RE) context in Ontario as well as global RE financing trends; ii) financing model design criteria and trade-offs; iii) key supporting policies for RE deployment; iv) alternative RE financing models; and v) an integrated financing model in Ontario, Canada. This research begins by reviewing the financing gap for RE deployment and proposing a design 'toolbox' for RE financing models. Subsequent chapters analyse key RE policies and alternative financing models before recommending an integrated financing model consisting of project finance, green bonds, community bonds, and crowdfunding. As the mechanism that combines cash flow needs with funding sources, financing models are one of the most crucial elements in RE project development. Therefore, the overarching vision here is to develop financing models that provide accessible and low-cost funding to projects, as well as competitive, risk-adjusted returns to investors. In doing so, it is hoped that investors, community members, and project developers may easily engage with new RE projects – thereby launching a large-scale (and timely) transition to a more sustainable energy system.

III. Foreword

The research and work conducted throughout my Master in Environmental Studies (MES) program have centered on several main themes: sustainable energy policy, business sustainability, behavioural economics, and financial modelling. The Area of Concentration for my program – "Sustainable Energy Systems Development" – integrates the supply and demand-side energy requirements into a cohesive long-term, comprehensive strategy. This concentration consists of 3 components: i) understanding the sustainability of energy systems; ii) analysing energy policy; and iii) developing alternative business and financing models. As such, most of my coursework, research, extra-curricular projects, and fieldwork have focused on analysing the technical, policy, and financing solutions required for the design of a (more) sustainable energy system in Ontario, Canada.

Given the critical need to shift to energy systems that respect ecological realities while promoting economic development, it is disappointing to witness the lethargic response of global economies and societies. One of the key barriers for rapid and widespread RE deployment remains the lack of accessible financing options. As such, my aim throughout the past two years has been to explore the intersection of RE and corporate finance, and to highlight solutions-based alternatives to overcome the RE financing gap. I hope some of the results found herein prove valuable to policy-makers, project developers, and finance professionals – especially as global economies create more economically rewarding, ecologically respectful, and structurally resilient energy systems.

IV. Table of Contents

Table of Contents

V. Acronyms

CB – Community Bond
CC – Climate Change
CCGT – Combined Cycle Gas Turbine
CCS – Carbon Capture and Sequestration
CF – Capacity Factor
CREB – Clean Renewable Energy Bond
DE – Decentralised Energy
DSCR – Debt Service Coverage Ratio
EROI - Energy Return on Energy Invested
ET-RAM – Emerging Technology Reverse Auction Mechanism
FIT – Feed-in Tariff
GEA – Green Energy and Green Economy Act
GB – Green Bond
GHG – Greenhouse Gas
GW – Gigawatt
IEA – International Energy Agency
IRENA – International Renewable Energy Agency
kW – Kilowatt
kWh – Kilowatt-hour
LDC – Local Distribution Company
LTEP – Long Term Energy Plan
MW – Megawatt
MWh – Megawatt-hour
OBF – On-Bill Financing
OPA – Ontario Power Authority
PACE – Property Assessed Clean Energy
PV – Photovoltaic
RE – Renewable Energy
REC – Renewable Energy Certificate
RED – Renewable Energy Deployment
REF – Renewable Energy Finance
ROE – Return on Equity
ROI – Return on Investment
RPS – Renewable Portfolio Standards
SBC – System Benefit Charges
T&D – Transmission & Distribution
TW – Terawatt

VI. List of Figures

VII. List of Tables