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RE-CONCEPTUALISING
RENEWABLE ENERGY LAW:

A COMPARATIVE STUDY OF THE
NATIONAL LAWS USED TO
ACCELERATE THE DEPLOYMENT
OF RENEWABLE ENERGY

Penelope Jane Crossley

A thesis submitted in fulfilment of the requirements of the
degree of Doctor of Philosophy

Faculty of Law
The University of Sydney

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See below.

Statement of contributions to jointly authored works contained in the thesis:

Crossley, Penelope J, Miles Curley and John Pickett, 'Legislación sobre energías renovables en el Reino Unido' in Fernando Becker et al (eds), *Tratado De Energias Renovables: Volumen II. Aspectos jurídicos* (Thomson Aranzadi/Iberdrola, 2010).

Note: the author's moral rights have been asserted over this work, which was written in the course of her employment at Linklaters LLP, London.

Penelope J. Crossley 90% contribution – wrote the book chapter

Miles Curley 5% contribution – supervised translation of the book chapter

John Pickett 5% contribution – editorial advice

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ABSTRACT

This thesis is the first scholarly research on the national renewable energy laws of all 95 countries that had such laws in force at 1 January 2014. The hypothesis tested in this research is that as different techniques for generating renewable energy become commercialised and the manufacturing of renewable technologies becomes more concentrated in particular countries, national renewable energy laws will also come under pressure to converge or harmonise to facilitate information sharing and trade.

This analysis is undertaken in three parts and employs a comparative mixed methodological approach. Part One of this thesis seeks to discover whether a common understanding of the concept of 'renewable energy' has developed in the laws of countries seeking to accelerate its deployment. In order to do this, the subject matter of national renewable energy laws is examined to assess the form and approach to content of the legislative definitions of renewable energy, and the nature and levels of support for the various energy sources and renewable energy technologies identified within the legislative definitions. Part Two of this thesis considers the rationales of countries engaging in regulatory intervention to support the accelerated deployment of renewable energy. It examines the justifications derived from economic theory for regulatory intervention into the renewable energy sector and then compares this to the legislative objectives contained in the national renewable energy laws of countries that have legislated in this area. Part Three of this thesis examines the range of regulatory support mechanisms used by countries when they intervene in the markets to support the accelerated deployment of renewable energy, before considering whether these regulatory support mechanisms are likely to converge or diverge over time.

The results of this thesis highlight that, contrary to the initial hypothesis, while there is strong conceptual consensus within the legislative definitions of renewable energy, significant normative and substantive differences still exist across the national laws promoting the accelerated deployment of renewable energy.

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LIST OF CASES

- Ålands Vindkraft AB v Energimyndigheten* (C573-12) [2014] ECR 2037
- Attorney-General v Sillem* (1864) 159 ER 178
- Bruck v Gamesa Wind US LLC*, No 06-0129 (271 JD Tex, 2006)
- Brutus v Cozens* [1973] AC 854
- Burch v Nedpower Mount Storm LLC*, 647 SE 2d 879 (WV, 2007)
- Carr v Western Australia* (2007) 232 CLR 138
- Deputy Commissioner of Taxation v Clark* (2003) 57 NSWLR 113
- Forsyth v Deputy Commissioner of Taxation* (2007) 231 CLR 531
- Gibb v Federal Commissioner of Taxation* (1966) 118 CLR 628
- Gidaro v Secretary, Department of Social Security* (1998) 83 FCR 139
- Institute of Patent Agents v Lockwood* [1894] AC 347
- IW v City of Perth* (1997) 191 CLR 1
- Kelly v The Queen* (2004) 218 CLR 216
- Lamont v Kennan* [2003] WASCA 82
- Minister for Urban Affairs and Planning v Rosemount Estates Pty Ltd* [1996] NSWCA 91 (14 August 1996)
- O'Dell v FPL Energy LLC*, No 06-502 (235 JD Tex, 2006)
- Porter v Gentry County Commission*, No 08-6029-CV-SJ-FJG (DC Mo, 2008)
- PreussenElektra AG v Schleswag AG* (C-379/98) [2001] EUECJ 160
- Project Blue Sky Inc v Australian Broadcasting Authority* (1998) 194 CLR 355
- R v Gee* (2003) 212 CLR 230
- Rankin v FPL Energy LLC*, 266 SW 3d 506 (Tex Ct App, 2008)
- Rassier v Houim*, 488 NW 2d 635 (ND, 1992)
- Re Haven Gold Mining Co* (1882) 20 Ch D 151
- Repatriation Commission v Vietnam Veterans' Association of Australia NSW Branch Inc* (2000) 154 FLR 345
- Rose v Chaikin*, 187 NJ Super 210 (Ch Div, 1982)
- Saulnier v Royal Bank of Canada WBLI Inc* [2008] 3 SCR 166

LIST OF NATIONAL RENEWABLE ENERGY LEGISLATION

Albania

Për Burimet E Energjisë Së Rinovueshme [Law on Renewable Energy Sources] (Albania) No 138/2013 [Linguistico Translations translation from Albanian]

Algeria

Loi n° 04-09 du 27 Jomada Ethania 1425 correspondant au 14 août 2004 relative à la promotion des énergies renouvelables dans le cadre du développement durable [Law No 04-09 of 27 Jumada Ethania 1425 corresponding to 14 August 2004 on the promotion of renewable energies in the framework of sustainable development] (Algeria) [Stephanie Watson translation from French]

Andorra

LLEI 93/2010, DEL 16 DE DESEMBRE, DE MESURES DE PROMOCIÓ DE L'ACTIVITAT ECONÒMICA I SOCIAL, I DE RACIONALITZACIÓ I D'OPTIMITZACIÓ DELS RECURSOS DE L'ADMINISTRACIÓ [Law 93/2010 of 16 December on the Promotion of Economic Activity and Social and Rationalisation and Optimisation of Resources Administration] (Andorra) [Linguistico Translations translation from Catalan]

Argentina

ENERGIA ELECTRICA Ley 26.190. Regimen de Fomento Nacional para el uso de fuentes renovables de energía destinada a la producción de energía eléctrica [Electricity Law 26.190: National Development Regimen for using renewable energy for electricity production' (Argentina) 27 December 2006 [Linguistico Translations translation from Spanish]

Armenia

The Law of the Republic of Armenia on Energy Saving and Renewable Energy (Armenia) 9 November 2004 [National Assembly of the Republic of Armenia translation from Armenian]

Australia

Renewable Energy (Electricity) Act 2000 (Cth)

Austria

75. Bundesgesetz über die Förderung der Elektrizitätserzeugung aus erneuerbaren Energieträgern (Ökostromgesetz) 2012 [75 Federal Act on the promotion of electricity generation from renewable energy sources (Green Electricity Act) 2012] (Austria) [Mitchell Cleaver translation from German]

Bangladesh

Sustainable and Renewable Energy Development Authority Act (Bangladesh) Act 48 of Law No 01 [Linguistico Translations translation from Bengali]

Belarus

«ЗАКОН РЕСПУБЛИКИ БЕЛАРУСЬ, 27 декабря 2010 г. № 204-З, О возобновляемых источниках энергии» [Law of the Republic of Belarus, 27 December 2010 No 204-W, Use of Renewable Energy] (Belarus) [Levi Romanov translation from Russian]

Belgium

Arrêté royal relatif à l'établissement de mécanismes visant la promotion de l'électricité produite à partir des sources d'énergie renouvelables [Royal Decree on the establishment of mechanisms for the promotion of electricity produced from renewable energy sources] (Belgium) 16 July 2002 [Tallulah Bur translation from French]

Brazil

Law No 10,438 (Brazil) 26 April 2002 [Linguistico Translations translation from Portuguese]

Bulgaria

«Закон за енергията от възобновяеми източници» [Energy from Renewable Sources Act] (Republic of Bulgaria) 3 May 2011, State Gazette 35, 2011 [Bulgarian Government translation from Bulgarian]

Chile

LEY NÚM. 20.257 INTRODUCE MODIFICACIONES A LA LEY GENERAL DE SERVICIOS ELÉCTRICOS RESPECTO DE LA GENERACIÓN DE ENERGÍA ELÉCTRICA CON FUENTES DE ENERGÍAS RENOVABLES NO CONVENCIONALES [The Law No 20,257 better known as Non-Conventional Renewable Energy Law] (Chile) 1 April 2008 [Linguistico Translations translation from Spanish]

China

«中华人民共和国可再生能源法» [Renewable Energy Law of the People's Republic of China] (People's Republic of China) National People's Congress, 28 February 2005 [Ministry of Commerce of the People's Republic of China translation from Mandarin]

Colombia

LEY 697 DE 2001 (Octubre 3) Diario Oficial No. 44.573, de 05 de octubre de 2001 mediante la cual se fomenta el uso racional y eficiente de la energía, se promueve la utilización de energías alternativas y se dictan otras disposiciones [Law 697 on the promotion of the efficient and rational use of energy and alternative energies] (Colombia) 5 October 2001, Official Gazette No 44,573 [Linguistico Translations translation from Spanish]

Croatia

Zakon o energiji 2012 [Energy Act 2012] (Croatia) [Croatian Government translation from Croatian]

Cyprus

About The Promotion and Encouragement of the Use of Renewable Energy Act of 2013 (Croatia) 112(1)/2013

Czech Republic

Zákon č. 165/2012 Sb. podporovaných zdrojích energie [Act on promoted energy sources] (Czech Republic) Act No 165/2012 [Linguistico Translations translation from Czech]

Denmark

Lov om fremme af vedvarende energi [Promotion of Renewable Energy Act] (Denmark) Act No 1392 of 2008 [Global Denmark Translations on behalf of the Danish Government translation from Danish]

Dominican Republic

Ley No. 5707 sobre Incentivo al Desarrollo de Fuentes Renovables de Energía y de sus Regímenes Especiales [Renewable Energies Incentive Law 57-07] (Dominican Republic) 2007 [Linguistico Translations translation from Spanish]

Ecuador

República del Ecuador Constitución de 2008 [Republic of Ecuador Constitution of 2008] (Ecuador) [Political database of the Americas, Georgetown University translation from Spanish]

El Salvador

Ley De Incentivos Fiscales Para El Fomento De Las Energías Renovables En La Generación De Electricidad [Fiscal Incentives Law for the Promotion of Renewable Energy] (El Salvador) 2007 [Linguistico Translations translation from Spanish]

Estonia

Elektrituruseadus RT I 2003, 25, 153 [Electricity Market Act 2003] (Estonia) [Estonian Government translation from Estonian]

Finland

Laki uusiutuvilla energialähteillä tuotetun sähkön tuotantotuesta [Act on Production Subsidy for Electricity Produced from Renewable Energy Sources] (Finland) Act No 1396/2010 [Finlex (Ministry of Justice, Government of Finland) translation from Finnish]

France

Code de l'énergie Version consolidée au 4 janvier 2014 [Energy Code Version consolidated January 1, 2014] (France) [Legifrance (Government of France) translation form French]

The Gambia

The Renewable Energy Act 2013 (The Gambia)

Germany

Gesetz für den Vorrang Erneuerbarer Energien [Act on granting priority to renewable energy sources] (Germany) 25 February 2000, BGBl, 2009 [German Government translation from German]

Ghana

Renewable Energy Act (Ghana) Act 832 of 2011

Greece

Law 3468/2006 Generation of Electricity using Renewable Energy Sources and High-Efficiency Cogeneration of Electricity and Heat and Miscellaneous Provisions (Greece)

Law 3851/2010 Accelerating the development of Renewable Energy Sources to deal with climate change and other regulations addressing issues under the authority of the Ministry of Environment, Energy and Climate Change (Greece)

Law No.4062/2012 Project HELIOS and Promotion of the Use of Energy from Renewable Sources (Transposition of Directive 2009/28/EC) (Greece)
[Directorate General for Energy, Renewable Energy Sources and Energy Saving Directorate, Hellenic Republic Ministry of Development translations from Greek]

Guatemala

DECRETO NÚMERO 52-2003 LEY DE INCENTIVOS PARA EL DESARROLLO DE PROYECTOS DE ENERGIA RENOVABLE 2003 [Renewable Energy Project Incentives Act 2003] (Guatemala) [Linguistico Translations translation from Spanish]

Honduras

Ley de Promocion a la Generacion de Energia Electrica con Recursos Renovables 2007 [Law for the Promotion of Electricity Generation with Renewable Resources 2007] (Honduras) 70/2007 [Linguistico Translations translation from Spanish]

Hungary

2007. évi LXXXVI. törvény a villamos energiáról [Act No. LXXXVI of 2007 on Electric Energy] (Hungary) [Linguistico Translations translation from Hungarian]

Iceland

Act on the guarantee of origin of electricity produced from renewable energy sources (Iceland) No 30/2008 [Government of Iceland translation from Icelandic]

India

The Electricity Act 2003 (India) No 36 of 2003

Indonesia

UNDANG-UNDANG REPUBLIK INDONESIA NOMOR 30 TAHUN 2007 TENTANG ENERGI [Law of the Republic of Indonesia Number 30 of 2007 About Energy] (Republic of Indonesia) [Ellen Marie O'Brien translation from Indonesian]

Ireland

Electricity Regulation Act 1999 (Ireland) No 23 of 1999

Italy

Legislative Decree 2011 No 28 Implementation of the Directive 2009/28/EC on the promotion of the use of energy from renewable sources (Italy) 11G0067 [Linguistico Translations translation from Italian]

Japan

«石油代替エネルギーの開発及び導入の促進に関する法律, 昭和五十五年法律第七十一号» [Act on the Promotion of Development and Introduction of Non-Fossil Energy 1980] (Japan) [Melanie Trezise, Australian Network for Japanese Law, translation from Japanese]

Jordan

The Renewable Energy and Energy Efficiency Law 2010 (Kingdom of Jordan) [Kingdom of Jordan translation from Arabic]

Kazakhstan

«О поддержке использования возобновляемых источников энергии Закон Республики Казахстан от 4 июля 2009 года № 165-IV» [Law of the Republic of Kazakhstan No 165-IV About the Support of the Use of Renewable Energy of 4 July 2009] (Kazakhstan) [Government of the Republic of Kazakstan translation from Kazakh]

Kenya

The Energy Act 2006 (Kenya)

Korea, South

«개발의 승진 주문, 사용 및 확산 새로운 신 재생 에너지의» [Act on the Promotion of the Development, Use and Diffusion of New and Renewable Energy] (Republic of Korea), 31 December 2004 [Korean Legislative Research Institute translation from Korean]

Kosovo

Law on Energy 2004 (Kosovo) 03/L184

Kyrgyzstan

«ЗАКОН КЫРГЫЗСКОЙ РЕСПУБЛИКИ "О ВОЗОБНОВЛЯЕМЫХ ИСТОЧНИКАХ ЭНЕРГИИ» [Law of Kyrgyz Republic 'On Renewable Energy'] (Kyrgyzstan) 2008 No 283 [Levi Romanov translation from Russian]

Latvia

Elektroenerģijas tirgus likums 2005 [Electricity Market Law 2005] (Latvia) 82 115/0825/201105 [Latvian Government translation from Latvian]

Liechtenstein

Gesetz vom 24. April 2008 über die Förderung der Energieeffizienz und der erneuerbaren Energien (Energieeffizienzgesetz; EEG) [Energy Efficiency Act (24 April 2008) Law on the requirement of energy efficiency and renewable energy (EEG)] (Liechtenstein) [Laura Peck translation from German]

Lithuania

Atsinaujinančių išteklių energetikos įstatymas [Law on Energy from Renewable Sources] (Lithuania) 2011 [Linguistico Translations translation from Lithuanian]

Luxembourg

Loi du 18 février 2010 relative à un régime d'aides à la protection de l'environnement et à l'utilisation rationnelle des ressources naturelles [Act of 18 February 2010 establishing a support system for environmental protection and rational use of natural resources] (Luxembourg) [Tallulah Bur translation from French]

Macedonia

Energy Law 2006 ('New Energy Law') (Macedonia) [Government of the Republic of Macedonia translation from Macedonian]

Malawi

Energy Regulation Act 20 of 2004 (Malawi) GN 37/2007

Malaysia

Renewable Energy Act 2011 (Malaysia) Act 725

Malta

Feed-In Tariffs Scheme (Electricity Generated from Solar Photovoltaic Installations) 2013 (Malta) SL 423 46

Mexico

LEY PARA EL APROVECHAMIENTO DE ENERGÍAS RENOVABLES Y EL FINANCIAMIENTO DE LA TRANSICIÓN ENERGÉTICA 2008 [Law on the Development of Renewable Energy and Energy Transition Funding 2008] (Mexico) [Linguistico Translations translation from Spanish]

Moldova

Renewable Energy Law (Republic of Moldova) 2007 No 16-XVI

Mongolia

«Монголын эрчим хүч 2012» [Law of Mongolia on Renewable Energy 2012] (Mongolia) [Ministry of Mineral Resources and Energy, Mongolia translation from Mongolia]

Montenegro

Energy Law 2010 (Montenegro) [Montenegro Investment Promotion Agency translation from Montenegrin]

Morocco

Loi n 13-09 relative aux énergies renouvelables [Renewable Energy Law] (Kingdom of Morocco) 2010 [Tallulah Bur translation from French]

Netherlands

Electricity Act 1998 (Netherlands) [Government of the Netherlands translation from Dutch]

New Zealand

Energy Efficiency and Conservation Act 2000 (New Zealand) Public Act No 14 2000

Nicaragua

LEY PARA LA PROMOCIÓN DE GENERACIÓN ELÉCTRICA CON FUENTES RENOVABLES [Law for the Promotion of Renewable Energy Generation] (Nicaragua) Act No 532, 2005 [Nicaraguan Government translation from Spanish]

Norway

Lov om elsertifikater 2011 [Electricity Certificates Act 2011] (Norway) [Linguistico Translations translation from Norwegian]

Palau

Net Metering Act 2009 (Palau) RRPL No 8-39

Panama

ASAMBLEA LEGISLATIVA LEY N26 POR LA CUAL SE DICTA EL MARCO REGULADORIO E INSTITUCIONAL PARA LA PRESTACION DEL SERVICIO PUBLICO DE ELECTRICIDAD [Legislature Law N26 Which is Issued by the Regulatory and Institutional Framework for the Benefit of the Public Service of Electricity] (Panama) 1997 [Linguistico Translations translation from Spanish]

Paraguay

Poder Legislativo Ley No 3009 De La Producción Y Transporte Independiente De Energía Eléctrica (PTIEE) [Law No 3009 On The Production And Transport Independent Electricity (PTIEE)] (Paraguay) [Linguistico Translations translation from Spanish]

Peru

Decreto Legislativo De Promoción De La Inversión Para La Generación De Electricidad Con El Isuo De Energías Renovables [Legislative Decree of Investment Promotion for Electricity Generation With The Use Of Renewable Energy (Peru) No 1002/2008 [Linguistico Translations translation from Spanish]

Philippines

Renewable Energy Act of 2008 (Republic of the Philippines)

Poland

Prawo energetyczne 1997 [Energy Law 1997] (Poland) 10 April 1997 [Poland Office of Sejm translation from Polish]

Portugal

Ministry of Industry and Energy Decree Law No 189/88 (Portugal) [Linguistico Translations translation from Portuguese]

Romania

Legea 220/2008 pentru stabilirea sistemului de promovare a producerii energiei din surse regenerabile de energie, republicata 2010 [Law 220/2008 on establishing the promotion system of energy production from renewable energy sources] (Romania) [Linguistico Translations translation from Romanian]

Russia

«ФЕДЕРАЛЬНЫЙ ЗАКОН N 35-ФЗ ОБ ЭЛЕКТРОЭНЕРГЕТИКЕ» [Russian Federation Federal Law on the Electric Power Industry] (Russian Federation) 26 March 2003, No 35-FZ [RAO Russian Power and Electrification Company translation from Russian]

San Marino

LEGGE 7 MAGGIO 2008 N.72 PROMOZIONE ED INCENTIVAZIONE DELL'EFFICIENZA ENERGETICA DEGLI EDIFICI E DELL'IMPIEGO DI ENERGIE RINNOVABILI IN AMBITO CIVILE E INDUSTRIALE [Law No 72 on the Promotion and Incentives for Energy Efficiency in Buildings and the Use of Renewable Energy in the Civil and Industrial Fields] (San Marino) 7 May 2008 [Linguistico Translations translation from Italian]

Senegal

Loi n° 2010-21 du 20 Décembre 2010 relative à l'orientation sur le droit de l'énergie renouvelable [Act No 2010-21 of 20 December 2010 concerning guidance on renewable energy law] (Senegal) [Ashley Richards translation from French]

Serbia

Закон о енергетици [Energy Law] (Serbia) No 57/11 [Energy Agency, Republic of Serbia translation from Serbian]

Seychelles

Energy Act 2012 (Seychelles) Act 11 of 2012

Slovakia

Zákon 309/2009 Z.z. o podpore obnoviteľných zdrojov energie [Act 309 of 19 June 2009 on the promotion of renewable energy sources and high-efficiency cogeneration and on amendments to certain acts] (Slovakia) [Slovakian Government translation from Slovakian]

Slovenia

Energetski zakon - neuradno prečiščeno besedilo 2010 [Energy Act 2010] (Slovenia) [Linguistico Translations translation from Slovenian]

South Africa

National Energy Act 2008 (South Africa)

Spain

Law 24/2013, of 26 December, the Electricity Sector (Spain) [Spanish Government translation from Spanish]

Sri Lanka

Sustainable Energy Authority Act 2007 (Sri Lanka) No 35 of 2007

Sweden

Lag om elcertifikat [Electricity Certificates Act] (Sweden) No 2011:1200 [Swedish Government translation from Swedish]

Switzerland

730.0 Energy Act (EnG) 1998 (Switzerland)

Syria

Law 32 on the policy for the electricity sector in Syria 2010 (Syria) [Linguistico Translations translation from Arabic]

Taiwan

Renewable Energy Development Act 2009 (Taiwan)

Tajikistan

The Law of the Republic of Tajikistan on the use of Renewable Energy Sources (Tajikistan) 12 January 2010, No 587 [UNDP in Tajikistan translation from Russian]

Thailand

Energy Industry Act, B E 2550 (Kingdom of Thailand) 10 December 2007 [Thai Law Forum translation from Thai]

Tonga

Renewable Energy Act 2008 (Tonga) No 10 of 2008

Tunisia

Loi n° 2004-72 du 2 août 2004, relative à la maîtrise de l'énergie [Law No 2004-72 dated 2 August 2004 relating to the energy management] (Tunisia) [Ashley Richards translation from French]

Turkey

Yenilenebilir Enerji Kaynaklarının Elektrik Enerjisi Üretimi Amaçlı Kullanımına İlişkin Kanun Kanun Numarası [Law Regarding The Use Of Renewable Energy Resources For Electricity Production] (Turkey) 2005 No 5346 [Linguistico Translations translation from Turkish]

Ukraine

Law on Alternative Energy Sources (Ukraine) 20 February 2003, no 555-IV [Linguistico Translations translation from Ukrainian]

United Kingdom

Electricity Act 1989 (UK)

Energy Act 2008 (UK)

The Promotion of the Use of Energy from Renewable Sources Regulations 2011 (UK)

United States

Energy Policy Act of 2005 42 USC § 15801

Uruguay

Se declaran promovidas las actividades tendientes a la generación de energía eléctrica 2009 [Declaration promoting activities aimed at generating electricity 2009] (Uruguay) Decree No 354/009 [Linguistico Translations translation from Spanish]

Uzbekistan

Law on the Rational Use of Energy 1997 (Uzbekistan) [Uzbekistan Energy Centre translation from Uzbek]

Vietnam

Electricity Law 2004 (Vietnam) 28/2004/QH11 [Ministry of Justice, Socialist Republic of Vietnam translation from Vietnamese]

Yemen

«ءاءبرهءكل ان أشب م 2009 ؤنسل (1) مقرر نوناق» [Electricity Law 2009] (Yemen) [Linguistico Translations translation from Arabic]

LIST OF OTHER LEGISLATION

Acts Interpretation Act 1901 (Cth)

Carbon Tax Act 2008 (British Columbia)

Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the Promotion of the Use of Energy from Renewable Sources and Amending and Subsequently Repealing Directives 2001/77/EC and 2003/30/EC [1993] OJ L 140/16

Electricity Supply Act 1995 (NSW)

Electricity Supply Amendment (Solar Bonus Scheme) Act 2009 (NSW)

Environmental Pollution Fee 1999 (Ukraine)

International Renewable Energy Agency, Statute of the International Renewable Energy Agency (Adopted at the Conference on the Establishment of the International Renewable Energy Agency, Bonn, 26 January 2009, entered into force 8 July 2010)

Renewable Energy Development Act 2009 (Utah)

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LIST OF ACRONYMS AND ABBREVIATIONS

AC	alternating current
\$AU	Australian dollar
CDM	Clean Development Mechanism
CHP	combined heat and power
CO ₂	carbon dioxide
CO _{2e}	carbon dioxide equivalent
COGEN	cogeneration
dB	decibel
DC	direct current
EC	European Commission
EIA	Energy Information Administration (US)
ES	energy storage
ETS	emissions trading scheme
EU	European Union
FIP	feed-in premium
FIT	feed-in tariff
GATT	General Agreement on Tariffs and Trade
G20	Group of Twenty
GDP	Gross Domestic Product
GHG	greenhouse gas
GW	gigawatt (1 GW = 1000 MW)
GWh	gigawatt-hour
GO	guarantee of origin
H ₂ O	water

IEA	International Energy Agency
IISD	International Institute for Sustainable Development
IPCC	Intergovernmental Panel on Climate Change
IPP	independent power producer
IPR	intellectual property right
IRENA	International Renewable Energy Agency
ITC	investment tax credit
kW	kilowatt (1 kW = 1000 watts)
kWh	kilowatt-hour
LNG	liquefied natural gas
LRET	large-scale renewable energy target
MW	megawatt (1MW = 1000 kW)
MWh	megawatt-hour
NDRC	National Development and Reform Commission (China)
NFFO	Non-Fossil Fuel Obligation
NGO	non-governmental organisation
NREL	National Renewable Energy Laboratory (US)
NSW	New South Wales, Australia
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of Petroleum Exporting Countries
OTEC	ocean thermal energy conversion (also called 'maremotermica')
PM	particulate matter
PPA	power purchase agreement
PTC	production tax credit
PV	photovoltaic
R&D	research and development
REEEP	Renewable Energy and Energy Efficiency Partnership

RES	renewable energy sources
RES-E	electricity derived from renewable energy sources
RET	Renewable Energy Target
RO	Renewables Obligation
ROC	Renewable Obligation Certificate
RPS	Renewable Portfolio Standards
SCM	Agreement on Subsidies and Countervailing Measures
SEDA	Sustainable Energy Development Authority of NSW (now defunct)
SOE	state-owned enterprises
SRET	small-scale renewable energy target
TFEU	Treaty on the Functioning of the European Union
TGC	tradeable green certificates
TPES	total primary energy supply
TW	terawatt (1 TW = 1000 GW)
UAE	United Arab Emirates
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
US	United States of America
\$US	United States dollar
VAT	value added tax
W	Watt
WHO	World Health Organization
WTO	World Trade Organization

UNITS OF MEASUREMENT

Throughout this thesis, reference is made to both units of power and units of energy. A brief explanation of the difference between these two common units of measurement is provided below.

UNITS OF POWER

The watt (W) is a unit of power, which represents the *rate* at which energy is produced or consumed at a specific point in time. For example, light bulbs are designated into categories by watts. A 100W light bulb will require a greater flow of energy to power the globe than a 60W light bulb.

UNITS OF ENERGY

The watt-hour (Wh) is a unit of energy, which represents the *amount* of energy used or generated to carry out 'work' within a specified time period, in this case an hour. For example, a kilowatt-hour (kWh) is the amount of energy used in one hour at a rate of 1,000 watts.

STANDARD PREFIXES FOR UNITS OF POWER AND UNITS OF ENERGY

The following prefixes are used in relation to both watts and watt-hours:

Kilo (k) = 1,000 = 10^3

Mega (M) = 1,000,000 = 10^6

Giga (G) = 1,000,000,000 = 10^9

Tera (T) = 1,000,000,000,000 = 10^{12}

Peta (P) = 1,000,000,000,000,000 = 10^{15}

CHAPTER 1: INTRODUCTION

Since 2004, the renewable energy sector has experienced an unprecedented boom, with global renewable energy investment increasing over sixfold to \$US 249.4 billion per annum in 2014.¹ In 2014, renewable energy comprised 26.4 per cent of global power capacity from all sources and delivered 22.1 per cent of global electricity supply.² Further, net investment in new renewable energy generation capacity now exceeds that for new fossil fuel capacity.³ This growth reflects the role that governments believe renewable energy will play in ensuring national energy security, combating climate change and sustainably meeting rising energy demands.

Despite this rapid growth, significantly more investment is needed if projections from the International Energy Agency (IEA) of a tripling of renewable generation by 2040 are to be met.⁴ Indeed, the IEA has predicted that ‘cumulative investment of \$US 7.8 trillion is needed for renewable energy supply in the period to 2040, around 95 per cent of which should be spent on power generation technologies.’⁵ Further, global investment in the renewable energy sector is now declining; with investment in 2013 some 23 per cent lower than the global peak in investment in 2011.⁶ This decline is attributable to the expiry of the green infrastructure stimulus packages following the end of the Global Financial Crisis,⁷ increased uncertainty about national renewable energy laws and policy following the early closure or retroactive declines in support schemes

¹ REN21 Secretariat, ‘Renewables 2014 Global Status Report’ (Report, Renewable Energy Policy Network the 21st Century, 2014) 15.

² Ibid 25.

³ Ibid 25, 103.

⁴ International Energy Agency, ‘Renewable energy outlook’ in International Energy Agency (ed), *World Energy Outlook (2014)* 239, 243.

⁵ Ibid 239.

⁶ REN21 Secretariat, ‘Renewables 2014 Global Status Report’, above n 1, 17, 67.

⁷ Frankfurt School, UNEP Centre, *Global Trends in Renewable Investment 2014* (2014) <<http://www.fs-unep-centre.org>> 21.

in some countries⁸ and sharp reductions in the costs of renewable energy technologies.⁹ The recent decrease in the costs of fossil fuels following large discoveries of shale gas and oil in the United States is also likely to negatively impact the future development of the renewable energy sector in the short to medium term.¹⁰

The renewable energy sector is also affected by the presence of at least three market failures within the energy sector: (i) the presence of unpriced negative and positive externalities in the energy sector; (ii) spillovers and learning effects; and (iii) information asymmetries. These market failures, which afflict countries all over the world, are further combined with a range of market barriers that vary by country. Arguably, the most significant market barrier is the ongoing subsidies provided to fossil fuel and nuclear generation, with direct subsidies provided to fossil fuels (i.e. excluding nuclear generation) reaching \$US 480bn in 2013 alone (or 0.7% of global gross domestic product (GDP)).¹¹ These factors mean that without government intervention into the sector, renewable energy cannot effectively compete with fossil fuel generation and would not have a sufficient market, price or profitability potential to warrant improving existing technologies, reducing their costs and the development of new technologies.¹²

⁸ Thomas Gerke, *Italy imposes retroactive changes to feed-in tariff for solar PV* (15 August 2014) RE New Economy <<http://reneweconomy.com.au/2014/italy-imposes-retroactive-changes-feed-tariff-pv-38857>>; Nilima Choudhury, *Spain announces retroactive FiT cuts* (19 February 2013) PV Tech <http://www.pv-tech.org/news/spain_announces_retroactive_fit_cuts>; James Martin, *Western Australia announces retroactive feed-in tariff cuts* (9 August 2013) Solar Choice <<http://www.solarchoice.net.au/blog/news/western-australia-announces-retroactive-feed-in-tariff-cuts-090813/>>; REN21 Secretariat, 'Renewables 2014 Global Status Report', above n 1, 14.

⁹ International Energy Agency, 'Renewable energy outlook', above n 4, 271; Frankfurt School, UNEP Centre, above n 7, 36; REN21 Secretariat, 'Renewables 2014 Global Status Report', above n 1, 17, 67.

¹⁰ European Renewable Energy Council, 'Shale Gas and its impact on Renewable Energy Sources' in EREC (ed), *EREC Factsheet* (2013).

¹¹ International Monetary Fund, 'Subsidy Reform: Lessons and Implications' (Executive Summary, IMF, 28 January 2013) <<http://www.imf.org/external/np/pp/eng/2013/012813.pdf>>.

¹² See e.g. Government of the United Kingdom, *The UK Renewable Energy Strategy* (2008) 18; Commonwealth Department of Climate Change, 'Adapting to Climate Change in Australia – An Australian Government Position Paper' (Position Paper, Department of Climate Change, 2009) 7-8; RE LAW Assist, 'Renewable Energy Law in China' (Issues Paper, Australia-China Bilateral Partnership on Climate Change, 2007) 9.

As a result, a majority of the countries in the world now engage in some form of government intervention into the renewable energy sector, with the numbers consistently growing year on year. By early 2014, 144 countries had renewable energy targets (RETs),¹³ 138 countries had support policies directed at renewable energy,¹⁴ and 95 countries had national renewable energy laws in force.¹⁵ In addition, many countries have developed other flexible policy mechanisms to encourage the development and commercialisation of new renewable generation. These mechanisms include research and development (R&D) support, reforms to planning laws and improving key market infrastructure such as the reinforcement of the electricity transmission and distribution networks so that they can cope with increased loads and intermittency of supply.

1.1 THE PROBLEM AND SIGNIFICANCE OF THE RESEARCH

Given the considerable growth of the renewable energy sector and the frequency with which governments intervene to support its ongoing development, it is surprising that there has not been a comprehensive scholarly analysis of the national renewable energy law for every country that has such a law. This means that fundamental issues such as how renewable energy is defined in law, what countries are trying to achieve through their national renewable energy laws and how they combine regulatory support mechanisms to achieve this, have often been neglected in research.

Much of the prior research into the renewable energy sector has been focused on the relative efficiency and efficacy of the different regulatory models that have been available.¹⁶ These studies have analysed whether feed-in tariffs, quota

¹³ REN21 Secretariat, 'Renewables 2014 Global Status Report', above n 1, 14.

¹⁴ Ibid.

¹⁵ These are the 95 countries identified in Appendix 1.

¹⁶ See e.g. Michael B Gerrard (ed), *The Law of Clean Energy: Efficiency and Renewables* (American Bar Association Section of Environment, Energy, and Resources, 2012); Jonathan A Lesser and Xuejuan Su, 'Design of an economically efficient feed-in tariff structure for renewable energy

systems such as renewable portfolio standards (RPS), tax incentives, subsidies or other regulatory support mechanisms are preferable.¹⁷ Due to the focus of these studies on relative efficiency and effectiveness, much of this work has adopted a strong economic focus and/or policy orientation.¹⁸ Further, the existing multi-country comparisons in this area have tended to focus on Europe,¹⁹ North America,²⁰ Organisation for Economic Co-operation and Development (OECD)

development' (2008) 36 *Energy Policy* 981; Richard L Ottinger and Adrian J Bradbrook (eds), *UNEP Handbook for Drafting Laws on Energy Efficiency and Renewable Energy Resources* (UNEP/Earth Print Limited, 2007); Maria Ellingson et al, *Compendium of Best Practices: Sharing Local and State Successes in Energy Efficiency and Renewable Energy from the United States* (REEEP/ACORE, 2010).

¹⁷ Peng Sun and Pu-yan Nie, 'A comparative study of feed-in tariff and renewable portfolio standard policy in renewable energy industry' (2015) 74 *Renewable Energy* 255; CG Dong, 'Feed-in tariff vs. renewable portfolio standard: An empirical test of their relative effectiveness in promoting wind capacity development' (2012) 42 *Energy Policy* 476; Reinhard Haas et al, 'A historical review of promotion strategies for electricity from renewable energy sources in EU countries' (2011) 15 *Renewable and Sustainable Energy Reviews* 1003, 1026; Lucy Butler and Karsten Neuhoff, 'Comparison of Feed-in Tariff, Quota and Auction Mechanisms to Support Wind Power Development' (2008) 33 *Renewable Energy* 1854, 1858; Toby Couture and Yves Gagnon, 'An analysis of feed-in tariff remuneration models: Implications for renewable energy investment' (2010) 38 *Energy Policy* 955, 955.

¹⁸ See e.g. Lesser and Su, 'Design of an economically efficient feed-in tariff structure', above n 16; Severin Borenstein, 'The Private and Public Economies of Renewable Electricity Generation' 26 *The Journal of Economic Perspectives* 67.

¹⁹ See e.g. Dörte Fouquet, 'Policy instruments renewable energy – From a European perspective' (2013) 49 *Renewable Energy* 15; António C Marques, José A Fuinhas and J R Pires Manso, 'Motivations driving renewable energy in European countries: A panel data approach' (2010) 38 *Energy Policy* 6877; Pablo del Rio, Mario Ragwitz, Simone Steinhilber, Gustav Resch, Sebastian Busch, Corinna Klessmann, Isabelle de Lovinfosse, Jana V Nysten and Angus Johnston, 'Key policy approaches for a harmonisation of RES(-E) support in Europe – Main options and design elements' (Report, European IEE Project Beyond2020, March 2012); Kitzing, Lena, Catherine Mitchell and Poul Erik Morthorst, 'Renewable energy policies in Europe: Converging or diverging?' (2012) 51 *Energy Policy* 192; Resch, Gustav, Malte Gephart, Simone Steinhilber, Corinna Klessmann, Pablo del Rio and Mario Ragwitz, 'Coordination or Harmonisation? Feasible Pathways for a European Res Strategy Beyond 2020' (2013) 24 *Energy and Environment* 147; David Jacobs, *Renewable Energy Policy Convergence in the EU: The Evolution of Feed-in Tariffs in Germany, Spain and France* (Ashgate Publishing, 2012); Sian Crampsie, 'Renewables convergence?' (2011) 34(14) *Utility Week* 9; Tatiana Romanova, 'Legal Approximation in Energy: A New Approach for the European Union and Russia' in Caroline Zuzemko, Andrei V Belyi, Andreas Goldthau and Michael F Keating (eds), *Dynamics of Energy Governance in Europe and Russia* (Palgrave Macmillan, 2012) 23; Miquel Muñoz, Volker Oschmann and J David Tàbara, 'Harmonization of renewable electricity feed-in laws in the European Union' (2007) 35 *Energy Policy* 3104; Roger Hildingsson, Johannes Strippel and Andrew Jordan, 'Governing renewable energy in the EU: Confronting a governance dilemma' (2012) 11 *European Political Science* 18; Malgorzata Alicja Czeberkus, *Renewable Energy Sources: EU policy and law in light of integration* (LLM Thesis, University of Iceland, 2013); Per-Olof Busch and Helge Jörgens, 'Europeanization through diffusion? Renewable energy policies and alternative sources for European Convergence' in Francesc Morata and Israel Solorio Sandoval (eds), *European Energy Policy* (Edward Elgar, 2012) 66.

²⁰ Thomas P Lyon and Haitao Yin, 'Why Do States Adopt Renewable Portfolio Standards?: An Empirical Investigation' (2010) 31 *The Energy Journal* 131; Clean Energy States Alliance, *Developing an Effective State Clean Energy Program: Competitive Grants* (CESA, 2009); Maria

countries²¹ or North East Asia.²² This prompts the question of whether the outcomes of this research are actually generalisable across all countries with such laws, and developing nations in particular.

This thesis seeks to address this gap in the literature. It is the first research to analyse the primary piece of national renewable energy legislation from each of the 95 countries that had such a law on 1 January 2014, as well as the EU Directive²³ and the IRENA Statute.²⁴ This analysis is used to develop a comprehensive scholarly understanding of how different countries legislatively define renewable energy, what they are trying to achieve through the adoption of these laws and which regulatory support mechanisms they utilise. Based on this understanding of the different conceptions of renewable energy and drivers for countries legislating in the sector, an assessment is then made about the likely future development of national renewable energy laws. Will countries seek to actively engage in regulatory competition through their national renewable energy laws in order to attract investment and fulfil other industrial policy objectives such as developing a foothold in the renewable technology export market? Or will they naturally diverge to reflect the local preferences of the country's citizenry, as well as its unique energy security, political, economic,

Ellingson et al, *Compendium of Best Practices: Sharing Local and State Successes in Energy Efficiency and Renewable Energy from the United States* (REEEP/ACORE, 2010); Steffen Jenner et al, 'What Drives States to Support Renewable Energy?' (2012) 33(2) *Energy Journal* 1; Warren Leon and Clean Energy States Alliance, 'Designing the Right RPS: A Guide to Selecting Goals and Program Options for a Renewable Portfolio Standard' (Guide, State-Federal RPS Collective and the National Association of Regulatory Utility Commissioners, 2012).

²¹ See e.g. Lena Maria Schaffer and Thomas Bernauer, 'Explaining government choices for promoting renewable energy' (2014) 68 *Energy Policy* 15; Nicholas Apergis and James E Payne, 'Renewable energy consumption in economic growth: Evidence from a panel of OECD countries' (2010) 38 *Energy Policy* 656; Reinhard Haas, Niels I Meyer, Anne Held, Dominique Finon, Arturo Lorenzoni, Ryan Wisser and Ken-ichiro Nishio, 'Promoting electricity from renewable energy sources – lessons learned from the EU, US and Japan' in Fereidoon P Siosanshi (ed), *Competitive Electricity Markets: Design, Implementation, Performance* (Elsevier Science, 2008) 419; Katrin Jordan-Korte, *Government Promotion of Renewable Energy Technologies: Policy Approaches and Market Development in Germany, the United States, and Japan* (Gabler Research, 2011).

²² See e.g. Kat Cheung and International Energy Agency, 'Integration of Renewables - Status and Challenges in China' (Working Paper, Organisation for Economic Co-Operation and Development, 2011); Cui Huang, Jun Su, Xiaoyun Zhao, Jigang Sui, Peng Ru, Hanwei Zhang and Xin Wang, 'Government funded renewable energy innovation in China' (2012) 51 *Energy Policy* 121.

²³ Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the Promotion of the Use of Energy from Renewable Sources and Amending and Subsequently Repealing Directives 2001/77/EC and 2003/30/EC [1993] OJ L 140/16.

²⁴ Statute of the International Renewable Energy Agency, opened for signature 26 January 2009, [2009] ANTIF 23 (entered into force 8 July 2010).

social, legal and environmental contexts? Will more countries seek to adopt the preferred method among the European Union of a convergence of national laws through cooperation and coordination processes? Or, with the increasing commercialisation of renewable energy technologies throughout the world, will countries consider harmonising or unifying their renewable energy laws to reduce the transaction costs borne by international companies? Without understanding the different countries' approaches to their national renewable energy law, the extent and scale of the patterns and tensions that are emerging globally between the differing approaches are being missed. This thesis seeks to remedy this oversight to provide the first comprehensive scholarly analysis of all countries' national renewable energy laws that have such laws.

1.2 HYPOTHESIS

The hypothesis being tested in this thesis is that, as renewable energy sources and technologies used around the world become commercialised and more widely adopted, renewable energy laws will also come under pressure to harmonise or converge to facilitate trade and improve information sharing and ease administration. This will see similar legislative definitions of renewable energy being adopted, similar legislative objectives found in national renewable energy laws and regulatory support mechanisms acquiring similar designs and used in similar combinations by different countries throughout the world.

1.3 RESEARCH QUESTIONS

In order to test this hypothesis, the research questions addressed in this thesis are:

1. Which countries have a national framework law to govern or promote the accelerated deployment of renewable energy? (Chapter 2 and Appendix 1)
2. How is renewable energy defined in the different national renewable energy laws around the world? (Chapter 3 and Appendices 1 and 2)
3. Which energy sources are recognised as renewable energy sources within the legislative definitions in the national renewable energy laws of different countries? (Chapter 4 and Appendices 1 and 3)
4. What is the theoretical rationale for governments legislating to support the accelerated deployment of renewable energy? (Chapter 5)
5. What are the stated legislative objectives for supporting the accelerated deployment of renewable energy in the primary legislation? (Chapter 6 and Appendices 1 and 4)
6. How have regulatory support mechanisms been designed to accelerate the deployment of renewable energy in different countries? (Chapter 7 and Appendix 5)
7. Given the benefits of national renewable energy laws becoming more similar, how will regulatory support mechanisms likely to develop in the future? Will they be unified, harmonised, converge, diverge or actively compete through regulatory competition? (Chapter 8)

1.4 STRUCTURE OF THE THESIS

This thesis comprises of nine chapters divided into three parts. This first chapter explains the background to the thesis, along with the problem being addressed and the significance of this research as the first academic study of the primary piece of renewable energy legislation in each of the 95 countries that have a national renewable energy law.

Chapter 2 describes the methodological approach of the thesis. It assesses some of the flaws with the existing quantitative research and explains the rationale for selecting a comparative mixed methodological approach for the thesis research. It describes how the thesis uses the available quantitative data, qualitative research methods such as statutory interpretation, comparative textual analysis and doctrinal research, and how this is supplemented by an analysis of primary and secondary legal, political, economic and historical sources. In addition, the challenges of undertaking a large-n study on this scale and the limitations of the research are examined, with a particular focus on the difficulties identifying and accessing the relevant laws, issues associated with the translation of foreign laws and the approach to coding being discussed.

1.4.1 PART ONE: WHAT IS RENEWABLE ENERGY? A CASE OF CONCEPTUAL CONSENSUS

The first substantive part of the thesis, comprising Chapters 3 and 4, seeks to discover whether a common understanding of the concept of ‘renewable energy’ has developed in the laws of countries seeking to accelerate its deployment. In order to do this, the subject matter of national renewable energy laws is examined to assess the:

- form and approach to content of the legislative definitions of renewable energy (Chapter 3); and
- nature of and levels of support for, the various energy sources and renewable energy technologies identified within the legislative definitions of renewable energy (Chapter 4).

Chapter 3 asks the question ‘How do we define renewable energy in law?’ In seeking to answer this question, the chapter begins by analysing the nature of definitions and in particular, it considers the role of legislative definitions and how they are interpreted within different legal systems. The chapter then focuses on the challenges associated with defining renewable energy in law including how to incorporate emerging renewable energy technologies, without

the definition being either over- or under-inclusive. The form and the approach to the content used in the legislative definitions of renewable energy from every country with national renewable energy laws are then critically analysed and classified to form a typology of legislative definitions of renewable energy. The use of different combinations of forms and approaches to content are also discussed in this chapter. At the conclusion of the chapter, the best practices from the legislative drafting of the national renewable energy laws, and the international consensus on renewable energy sources are combined to formulate the definition of renewable energy adopted in this thesis.

Chapter 4 considers the different sources of renewable energy and renewable energy technologies that are accepted by countries within their renewable energy laws. In doing so, it draws upon the results of statutory interpretation of the legislative definitions of renewable energy identified in Chapter 3 to provide the first global snapshot of the frequency of renewable energy sources being included in renewable energy laws. It also broadly explores how renewable energy is generated from those renewable energy sources, and highlights the current debates around whether certain energy sources should be considered to be renewable.

1.4.2 PART TWO: WHY DO COUNTRIES INTERVENE IN THE RENEWABLE ENERGY SECTOR? A CASE OF NORMATIVE DIVERGENCE

Once the subject matter of the national renewable energy laws is understood, the second part of the thesis focuses on the rationale of countries engaging in regulatory intervention to support the accelerated deployment of renewable energy. It examines the justifications derived from economic theory for regulatory intervention into the renewable energy sector (Chapter 5) and then compares this to the legislative objectives contained in the national renewable energy laws of countries who have legislated in this area (Chapter 6). In this part, the research in the thesis focuses on normative consensus or divergence, i.e. whether governments are intervening in the renewable energy sector for the same or differing reasons.

Chapter 5 starts from the premise that from an economic perspective, well-functioning, competitive global and domestic markets generally provide the most suitable basis for optimal and timely investment decision-making. It then considers how the features of electricity generally, and generation from renewable sources more specifically, warrant special regulatory treatment due to it being a 'mixed good'. This chapter then examines the market failures within the energy sector and how they negatively impact on the deployment of renewable energy, including: (i) the presence of unpriced negative and positive externalities in the energy sector; (ii) spillovers and learning effects; and (iii) information asymmetries. A range of market barriers that affect the renewable energy sector in different countries are also examined. This forms the background to a review of the literature on the question of whether government intervention into the renewable energy sector is warranted from an economic perspective. Further consideration is given to how such an intervention should be structured in order to minimise distortions to the market.

Chapter 6 explores the role of legislative objectives in the renewable energy laws of countries to assess why countries are regulating to promote the deployment of renewable energy. In particular, the research in this chapter seeks to better understand whether countries are regulating to merely try to correct the market failures that exist within the sector identified in Chapter 5, or whether countries are trying to achieve something more through their renewable energy laws. Chapter 6 begins by evaluating the role of legislative objectives, before critically reviewing the previous research on the reasons why countries seek to accelerate the deployment of renewable energy. This allows an assessment to be made whether existing understandings of the rationale for government interventions within the renewable energy sector are correct and generalisable across all the countries with national renewable energy laws. The focus of the chapter then shifts to each of the broad categories of legislative objectives, before examining the issue of conflicting legislative objectives. The chapter concludes with some recommendations of how legislative objectives in renewable energy laws may be improved in the future.

1.4.3 PART THREE: WHAT ROLE DO REGULATORY SUPPORT MECHANISMS PLAY IN NATIONAL RENEWABLE ENERGY LAWS? A CASE OF SUBSTANTIVE DIVERGENCE

The third part of this thesis examines the range of regulatory support mechanisms used by countries when they intervene in the markets to support the accelerated deployment of renewable energy (Chapter 7), before considering whether these regulatory support mechanisms are likely to converge or diverge over time (Chapter 8).

Chapter 7 highlights the range of regulatory support mechanisms available to countries seeking to ameliorate the market failures and barriers impeding their ability to achieve their legislative objectives. It considers the criteria countries use to select appropriate design options, common classification systems for the mechanisms, as well as providing a detailed account of the common characteristics of the different types of regulatory support mechanisms used within the renewable energy sector. In particular, feed-in tariffs, feed-in premiums, renewable portfolio standards/quota obligations, green certificate trading/ renewable energy credits, competitive tendering (auction bidding), subsidies, loans, grants, net metering, green power schemes, investment tax credits (ITCs), production tax credits (PTCs), rebates, research and development support and other indirect mechanisms are examined. This chapter further considers the implications of the growing use of combinations of multiple regulatory support mechanisms within the sector. The chapter concludes with a brief discussion of some of the lessons learnt for the successful design and implementation of regulatory support mechanisms within the renewable energy sector.

Chapter 8 considers the likely future development of regulatory support mechanisms in the national renewable energy laws. This chapter draws together the analysis conducted in previous chapters to examine whether regulatory support mechanisms found in national renewable energy laws are likely to

internationally harmonise or converge in the future as the renewable energy technologies become more similar, widespread and bankable. Or are the regulatory support mechanisms more likely to diverge internationally or even actively compete via regulatory competition as countries to continue to pursue their national self-interest? This chapter reviews why it is desirable for national renewable energy laws to become more similar internationally, despite the fact that this will mean a loss of local preferences. This chapter further examines the development of the European Union (EU) renewable energy law, as well as some of the international trade conflicts that have emerged in the past five years within the renewable energy sector in order to understand how international legal institutions are shaping the development of regulatory support mechanisms within national renewable energy laws.

1.4.4 CONCLUSION

The thesis concludes in Chapter 9 by returning to the research questions posed at the beginning of this thesis to test the hypothesis that, as different techniques for generating renewable energy become commercialised and the manufacturing of renewable technologies became more concentrated in particular countries, renewable energy laws would also come under pressure to harmonise to facilitate trade, improve information sharing and ease administration. To test this hypothesis, Part One of this research focused on the fundamental concepts of how renewable energy defined is in law and what energy sources were recognised as renewable by different countries. The purpose of this Part was to test whether countries were legislating the same subject matter to see if a degree of conceptual consensus was emerging between the renewable energy laws of different countries. This thesis found in Chapter 3 that among the 95 countries that had a national renewable energy law there was significant variability to the form and approach to the content of the legislative definition of renewable energy adopted. This research identified five different approaches to form and seven different approaches to the content of the legislative definitions, which suggested that different countries would also recognise different renewable

energy sources, leading to conceptual divergence. However, as was highlighted in Chapter 4, this was not the case. Rather, there was a striking degree of conceptual consensus in the energy sources recognised as ‘renewable energy’ within the legislative definitions of different countries, especially for the most commercialised renewable energy sources and technologies. This showed that, despite the different approaches to the form and content of the legislative definitions, conceptual consensus was already evident between many countries’ national renewable energy laws. This conceptual consensus may provide the basis for later international harmonisation or legislative convergence in years to come.

In Part Two of the thesis, the emphasis shifted to considering whether different countries shared a common rationale for regulatory intervention in the renewable energy sector. This was testing to see whether normative consensus was present between the renewable energy laws of the different countries. Chapter 5 showed that economic theory operates on the premise that governments should only intervene in the market to correct the three market failures present in the renewable energy sector: (i) the presence of unpriced negative and positive externalities in the energy sector; (ii) spillovers and learning effects; and (iii) information asymmetries. This suggested that there should be normative consensus between different countries laws. However, when these market failures were compared to the legislative objectives contained in the national renewable energy laws in Chapter 6, this was found not to be the case. Rather, a much broader range of legislative objectives were identified than in any of the previous research, with countries having legislative objectives that fell in eight themes and 28 different sub-categories. Further, while some legislative objectives that addressed the market failures addressing unpriced externalities such as ‘energy security’ and ‘diversify supply,’ were highly weighted in priority, others that also addressed the issue of unpriced environmental externalities such as ‘reduce greenhouse gas emissions and address climate change,’ were lowly weighted in priority. In this Part it was evident that countries continue to engage in regulatory intervention not merely to address the market failures that exist in the sector but rather to address a

much broader range of, often domestic, concerns. As a result, while the economic theory suggests that normative consensus between different countries' rationale for regulatory intervention in the renewable energy markets should exist, it was clear from Chapter 6 that a significant degree of normative divergence was present between the laws.

In Part Three, the research in this thesis considered whether there was substantive convergence between the regulatory support mechanisms adopted by different countries in their national renewable energy laws. It further considered the likely future development of the national renewable energy laws. In Chapter 7, it was established that while common types of regulatory support mechanisms exist, such as the feed-in tariff, renewable portfolio standards or competitive tendering, every country has different design features and adopts different combinations of them to accelerate their deployment of renewable energy. This suggests that no one mechanism or combination of mechanisms will meet the needs of every country. Thus, the starting position for most countries seems to be one of substantive divergence, with different regulatory support mechanisms being designed and implemented in different countries. This view was reinforced by the case studies in Chapter 8, which showed that a number of countries are taking the divergence one step further and are actively adopting the process of regulatory competition through their laws.

The initial hypothesis of this thesis — that over time the national renewable energy laws should come under pressure to harmonise as countries seek to engage in either a 'race to the bottom' or a 'race to the top' — was proven correct at least initially in the European Union (EU), which had two separate failed harmonisation attempts. However, the EU Member States have successfully resisted this pressure, with the Member States explicitly inserting into the Treaty of the Functioning of the European Union a reservation that will ensure their ability to control their own energy mix and support systems going forward. This has led to the EU having to, at least temporarily, drop its preference for harmonisation in favour of adopting a process of cooperation and coordination. Meanwhile some other countries around the world such as China and Japan have

proactively pursued a concerted policy of regulatory competition as they seek to become the lead market. Thus, contrary to the initial hypothesis, this thesis demonstrates that while there is strong conceptual consensus within the legislative definitions of renewable energy, significant normative and substantive differences still exist within the national laws governing the promotion or accelerated deployment of renewable energy of many countries.

Chapter 9 concludes by identifying emergent themes for further research to build on the work of this thesis.

CHAPTER 2: METHODOLOGICAL FRAMEWORK

This thesis seeks to understand why and how countries seek to accelerate the deployment of renewable energy through the use of legislative instruments. Unlike many of the previous studies, which have tended to focus on Europe and/or a relatively small number of jurisdictions, this thesis greatly expands the previous comparative renewable energy law research. This thesis adopted a large-n sample that studied the primary piece of renewable energy legislation in each of the 95 countries that had a national renewable energy law as at 1 January 2014.

Section 2.1 of the chapter reviews some of the problems with the existing research. In particular, the fact that the available quantitative data on the renewable energy sector are not readily comparable, due in large part to the lack of a uniform legislative definition of ‘renewable energy.’ As discussed in Section 2.2, this led to the adoption of a comparative mixed methodology approach using qualitative research methods such as the statutory interpretation of the relevant legislation and a doctrinal study of some of the relevant cases. To better understand the context of regulatory development in the sector, this was supplemented by analysis of primary and secondary legal, political, economic and historical sources. The theories associated with using comparative functional and textual analyses are discussed in Section 2.3 of the chapter.

Section 2.4 describes the comparative review of the national renewable energy laws undertaken within this thesis. In particular, issues such as the data sources and identification of the relevant laws, translation and coding are considered. Section 2.5 considers the difficulties associated with using a comparative mixed methodological approach for this research, including: the time and costs involved in working with laws in foreign languages, the problems of incomplete or outdated legislative databases and the limited case law available to assist with the interpretation of these laws. Despite these difficulties, the chapter concludes in Section 2.6 that the comparative mixed methodological approach best

facilitated a study of the similarities and differences of the primary legislative instruments covering the renewable energy sector. Further, it enabled a wider geographic scope and thus broadened the applicability of the research by providing a deeper and more nuanced understanding of the outcomes of different regulatory approaches. The use of a large n-sample meant that generalisable inferences could be drawn and conclusions reached about the current state of renewable energy law globally. This provided a better understanding of the emerging norms for renewable energy laws against which the laws of individual countries can now be compared, as well as furthering knowledge of the way that specific regimes fit the particular developmental or other characteristics of the countries studied.

2.1 THE PROBLEMS WITH THE EXISTING RESEARCH

Any study of the effectiveness of renewable energy law will necessarily involve the measurement of the impact that different regulatory mechanisms have had on the deployment of renewable energy. However, a key methodological challenge for research in the area of international or comparative renewable energy or renewable electricity law is the problem of the lack of a uniform legal definition of ‘renewable energy.’ As will be shown in Chapter 3, the process of defining ‘renewable energy’ in legislation is inherently political, with countries adopting definitions that favour their own indigenous energy sources. Not only does this lack of a uniform definition make international efforts to accelerate the deployment of renewable energy difficult, but it also poses significant problems when trying to measure the success or failure of regulatory support mechanisms.

2.1.1 THE QUANTITATIVE DATA

The lack of a uniform legal definition of ‘renewable energy’ is matched from a statistical perspective by a lack of international agreement on an operational definition that ‘captures the meaning of the abstract concept that they are trying

to measure.’²⁵ Each study instead seemingly adopts a different operational definition for ‘renewable energy’, and this inconsistency even occurs between different jurisdictions being compared within the same study. This means that the existing quantitative data for different jurisdictions collected by international organisations active in the renewable energy sector such as the OECD, the IEA, the IRENA, Obsev’ER and REN-21 are neither comparable nor reliable.

Common problems in previous research studies include that the available quantitative data often included or excluded different energy sources or technologies, adopted different methodologies, or provided incomplete datasets. For example, the OECD, under the heading of ‘Renewable Energy’ in its 2013 Factbook, acknowledged that ‘the data give only a broad impression of developments and are not strictly comparable between countries.’²⁶ While REN-21 stated in its 2012 Global Status Report that:

existing shares are indicative and are not intended to be a fully reliable reference. Share of electricity can be calculated using different methods. Reported figures often do not specify which method is used to calculate them, so the figures ... for share of electricity are likely a mixture of different methods and thus not directly comparable or consistent across countries. In particular, certain shares sourced from Observ’ER are different from those provided to REN 21 by report contributors. In situations of conflicting shares, figures provided to REN 21 by report contributors were given preference. The difference likely stems from calculations using different (and equally valid) methods.²⁷

Furthermore, some countries in the REN-21 study include large-scale hydropower in their legislative definition, while other countries do not, which again makes strict statistical comparisons of the share of renewable energy problematic.²⁸ There are also significant variations in the measurement of constructed or installed capacity, versus operational or grid-connected

²⁵ Scott W VanderStoep and Deirdre D Johnston, *Research Methods for Everyday Life: Blending Qualitative and Quantitative Approaches* (Jossey-Bass, 2009) 48.

²⁶ This comment was made with a particular emphasis on the role that biofuels and the renewable fraction of municipal waste could be relied upon in the renewable energy statistics: Organisation for Economic Co-Operation and Development, *Factbook 2013: Economic, Environmental and Social Statistics* (2013) OECD <<http://www.oecd-ilibrary.org/sites/factbook-2013-en/06/01/05/index.html?itemId=/content/chapter/factbook-2013-45-en>> 9.

²⁷ REN21 Secretariat, ‘Renewables 2012 Global Status Report’ (Report, REN21, 2012) 108-9.

²⁸ Ibid.

capacity.²⁹ The ‘frequent changes to support frameworks and/or technical or legal frameworks for grid connection’³⁰ exacerbate these problems.

For example, Table 2.1 (below) comparing statistics reported by the IRENA, REN-21, Observ’ER and other sources on the contribution of renewable energy as a percentage of the electricity generated within Australia, China, the United Kingdom and the EU-27, reveals very different results between data sets/sources. This is most pronounced in the comparison of the percentage of renewable energy as a share of electricity production in Australia in 2011. Observ’ER reports the share of renewable energy as 10.5 per cent, the Australian Clean Energy Council as 9.64 per cent, and Enerdata as 6.9 per cent.

TABLE 2.1: THE PERCENTAGE OF RENEWABLES AS A SHARE OF ELECTRICITY PRODUCTION (2010-2011)

Jurisdiction	Reporting institution	Percentage of renewables as a share of electricity production 2010	Percentage of renewables as a share of electricity production 2011
Australia	Observ’ER 2012	8.9% ³¹	10.5% ³²
	REN-21 2012	8.7% ³³	-
	Clean Energy Council, ‘Clean Energy Australia Report 2011’ 2011, Australia	-	9.64 % ³⁴
	Enerdata, ‘Global Energy Statistical	7.63% ³⁵	6.9% ³⁶

²⁹ Ibid 128.

³⁰ Ibid.

³¹ Observatoire des énergies renouvelables (Observ’ER), ‘Worldwide electricity production from renewable energy sources’ in *Fourteenth inventory – Edition 2012* (Observ’ER, 2012) 417 <<http://www.energies-renouvelables.org/observ-er/html/inventaire/Eng/>>.

³² Ibid.

³³ REN21 Secretariat, ‘Renewables 2012 Global Status Report’, above n 3, 108.

³⁴ Clean Energy Council, *Clean Energy Australia Report* (2011) 4 <<http://cleanenergyaustraliareport.com.au>>.

³⁵ Enerdata, ‘Share of renewables in electricity production (incl. hydro)’ in *Global Energy Statistical Yearbook 2012* (Enerdata, 2012) <<http://yearbook.enerdata.net>>.

³⁶ Ibid.

Jurisdiction	Reporting institution	Percentage of renewables as a share of electricity production 2010	Percentage of renewables as a share of electricity production 2011
	Yearbook 2012'		
China	Observ'ER 2012	18.6% ³⁷	16.7% ³⁸
	REN-21 2012	-	-
	Enerdata,'Global Energy Statistical Yearbook 2012' 2012	18.35% ³⁹	16.05% ⁴⁰
EU-27	Observ'ER 2012	20.9% ⁴¹	21.5% ⁴²
	REN-21 2012	19.9% ⁴³	-
	Enerdata,'Global Energy Statistical Yearbook 2012' 2012	21.33% ⁴⁴	21.5% ⁴⁵
United Kingdom	Observ'ER 2012	7.6% ⁴⁶	10.3% ⁴⁷
	IRENA 2013	-	9.4% ⁴⁸
	REN-21 2012	7.4% (Scotland) ⁴⁹	-
	Department of Energy & Climate Change, 'Energy trends' 2011, United Kingdom	8.1 % ⁵⁰	-

³⁷ Observ'ER, above n 7, 358.

³⁸ Ibid.

³⁹ Enerdata, above n 11.

⁴⁰ Ibid.

⁴¹ Observ'ER, above n 7, 237.

⁴² Ibid.

⁴³ REN21 Secretariat, 'Renewables 2012 Global Status Report', above n 3, 108.

⁴⁴ Enerdata, above n 11.

⁴⁵ Ibid.

⁴⁶ Observ'ER, above n 7, 168.

⁴⁷ Ibid.

⁴⁸ International Renewable Energy Agency, *Renewable Energy Country Profiles United Kingdom* (IRENA, 2013).

⁴⁹ REN21 Secretariat, 'Renewables 2012 Global Status Report', above n 3, 109.

⁵⁰ Department of Energy and Climate Change, 'Energy Trends' (Paper, United Kingdom Parliament, December 2011) 44.

Jurisdiction	Reporting institution	Percentage of renewables as a share of electricity production 2010	Percentage of renewables as a share of electricity production 2011
United Kingdom (continued)	Enerdata, 'Global Energy Statistical Yearbook 2012' 2012	8.13% ⁵¹	10.04% ⁵²

The other feature evident in Table 2.1 above is that the statistics are often incomplete, even within the same data sets, further adding to the difficulty of making comparisons. This problem has also been acknowledged by REN-21 in the methodology section of their 2012 Global Status Report:

Generally, there is no single exhaustive source of information for global statistics. Some global aggregates must be built from the bottom up, adding or aggregating individual country information. Very little material exists that covers developing countries as a group, for example. Data for developing countries are often some years older than data for developed countries, and thus extrapolations to the present must be made from older data, based on assumed and historical growth rates. More precise annual increments to capacity are generally available only for wind, solar PV, and solar hot water.⁵³

Such issues pose significant problems for studies solely or primarily reliant upon a quantitative methodology, as they can convey a false impression of the degree of accuracy of the observations. These flaws in the existing quantitative data are not entirely fatal however: the quantitative statistical data provides valuable impressions on key trends within the sector and within different jurisdictions, especially when used in conjunction with other methodological approaches.

2.2 A MIXED METHODOLOGICAL APPROACH

To overcome the limitations of existing quantitative data sets, as identified above, this thesis incorporates qualitative methodologies within a broader comparative mixed methodological approach. Mixed methodology is defined as

⁵¹ Enerdata, above n 11.

⁵² Ibid.

⁵³ REN21 Secretariat, above n 3, 130.

research that ‘involve[s] the collection, analysis and integration of quantitative and qualitative data in a single or multiple phase study.’⁵⁴ Research that adopts a mixed methodology is often viewed as being more reliable than studies that adopt a single methodology.⁵⁵ This is because if the findings using different methodologies converge (or ‘triangulate’), this enhances confidence in the research findings.⁵⁶ In addition, the inclusion of qualitative data such as ‘words, pictures and narrative can be used to add meaning to numbers,’⁵⁷ provides greater depth to the analysis⁵⁸ and ‘allows the researcher to explore anomalies or subgroups within the data.’⁵⁹

The inclusion of qualitative research methods in the study design for this thesis had four key advantages.⁶⁰ First, it provided *descriptive validity*, that is, a means of checking the factual accuracy of the quantitative data such as that outlined above. Second, the examination of some of the relevant case law provided *interpretive validity*. In particular, the study of some of the emerging conflicts between different countries over their renewable energy laws in Chapter 8 enabled the thesis to make a comparison between a strict legalistic interpretation of the renewable energy laws and the way they are pragmatically implemented in the field. This legal realist frame examining ‘law on the books’ and ‘law in action’ also yielded important background information to supplement the analysis of the primary and secondary sources about the legal, economic,

⁵⁴ William E Hanson, John W Creswell, Vicki L Plano Clark, Kelly S Petska, and J David Creswell, ‘Mixed Methods Research Designs in Counseling Psychology’ (2005) 52 *Journal of Counseling Psychology* 224, cited in Sharlene Nagy Hesse-Biber, *Mixed Methods Research: Merging Theory with Practice* (Guildford Press, 2010) 3.

⁵⁵ Laura Beth Nielsen, ‘The Need for Multi-Method Approaches in Empirical Legal Research’ in Peter Kane and Herbert M Critzer (eds), *The Oxford Handbook of Empirical Legal Research* (Oxford University Press, 2010) 953.

⁵⁶ Hesse-Biber, above n 30, 3-4.

⁵⁷ R Burke Johnson and Anthony J Onwuegbuzie, ‘Mixed Methods Research: A Research Paradigm Whose Time Has Come’ (2004) 33(7) *Educational Researcher* 14, 21.

⁵⁸ See e.g. Lisa Webley, ‘Qualitative Approaches to Empirical Legal Research’ in Peter Kane and Herbert M Critzer (eds), *The Oxford Handbook of Empirical Legal Research* (Oxford University Press, 2010) 933; Hazel Genn, ‘Hazel Genn and Paths to Justice’ in Simon Halliday and Patrick Schmidt (eds), *Conducting Law and Society Research: Reflections on Methods and Practices* (Cambridge University Press, 2009) 227.

⁵⁹ Hesse-Biber, above n 30, 6.

⁶⁰ See e.g. Joseph A Maxwell, ‘Understanding of Validity and Qualitative Research’ (1992) 62 *Harvard Educational Review* 279.

political and historical context in which these laws operate. Third, the statutory interpretation of the national renewable energy laws and information obtained, provided the ability to test the accuracy of the proposed *causal and theoretical understanding* extrapolated in the thesis. Fourth, the inclusion of qualitative research was important for reasons of *generalisability*. Generalisability is important because of the need to be able to extend the argument made throughout the thesis as a way of predicting how countries that do not yet have renewable energy laws may act when they choose to develop such laws.

In short, this thesis draws upon a wide range of sources, including the primary renewable energy legislation in the relevant jurisdictions, both raw data and information on energy production and usage, explanatory notes and memoranda, second reading speeches, government and committee reports, analysis of the academic literature and popular press and interviews. This breadth of research is designed to overcome problems of source coverage and source bias⁶¹ and offer a deeper and more nuanced assessment of the regulatory regime.

2.3 COMPARATIVE ANALYSIS

In order to broaden both the applicability and geographical scope of the research and to increase the legal knowledge gleaned, a comparative approach is adopted in this study. Comparative legal research ‘investigates legal rules, structures, approaches and techniques in more than one system or society’⁶² to assess the nature and significance of their similarities and differences.⁶³ One of the strengths of comparative legal research is that it recognises that the underlying objectives of regulatory interventions can be achieved through a range of

⁶¹ For greater detail of these problems, see e.g. Ingo Rohlwing, *Case Studies and Causal Interference: An Integrative Framework* (Palgrave Macmillan, 2012) 169.

⁶² Alan Watson, ‘Comparative Law and Legal Change’ (1978) 37 *Cambridge Law Journal* 313, 317.

⁶³ John Henry Merryman, ‘Comparative Law Scholarship’ (1998) 21 *Hastings International and Comparative Law Review* 771, 775.

'different rules and institutions in different social contexts.'⁶⁴ This in turn fosters a discussion of which regulatory response is the most efficient and effective, why that is the case, and whether the factors that contribute to its success might be transplanted to other legal environments.

2.3.1 THE METHODOLOGY OF COMPARATIVE ANALYSIS

One challenge in undertaking a comparative study is that the methodology of comparison has long been contentious, due to there being no 'decisive definition of what the comparative field and the comparative matter is.'⁶⁵ Merryman has argued that 'the comparative study of texts was the natural and most important subject of comparison.'⁶⁶ Textual analysis operates by identifying authoritative texts, the most common of which form legal rules, which are then subjected to a comparative analysis.⁶⁷ The 'traditional technique employed in a comparative study of substantive law involves translating a legal text from the legal vocabulary of one system into the legal vocabulary of another system or into a 'universal' vocabulary, one that is equally meaningful to describe all legal systems.'⁶⁸ This technique converts the legal terminology employed in the system under study to the nearest approximation of law in the receiving jurisdiction. However, foreign textual analysis has been criticised as not having enough focus on legal translations and not being sufficiently equipped to handle instances where the subject of the study is legally foreign in another jurisdiction.⁶⁹ These criticisms are addressed in this thesis through a reliance on the official English translations where these are available, the use of legally trained translators to translate the laws from the authoritative version into

⁶⁴ John Bell, 'Legal Research and the Distinctiveness of Comparative Law' in Mark Van Hoecke (ed), *Methodologies of Legal Research: Which Kind of Method for Which Kind of Discipline?* (Hart, 2011) 155, 158.

⁶⁵ Esin Örucü, 'Unde Venit, Quo Tendit Comparative Law?' in Andrew Harding and Esin Örucü (eds), *Comparative Law in the 21st Century* (Institute of Advanced Legal Studies, 2002) 1.

⁶⁶ Merryman, above n 39, 773.

⁶⁷ *Ibid.*

⁶⁸ G C Hazard, 'Substance, Procedure and Practice in Comparative Law' in Nihon Hikakuho Kenkyūjo (ed), *Toward Comparative Law in the 21st Century: The 50th Anniversary of The Institute of Comparative Law in Japan* (Chuo University Press, 1998) 1091.

⁶⁹ *Ibid* 1092; see also Edward J Eberle, 'The Method and Role of Comparative Law' (2009) 8 *Washington University Global Studies Law Review* 451, 459.

English where official English translations are not available and by only studying the laws of the countries that have national renewable energy laws.

Another challenge is in obtaining an understanding beyond a superficial reading of the 'law on the books'. Cotterrell has argued that exclusive reliance on textual analysis tends to skew results in favour of unity and consistency of legal meaning.⁷⁰ Such an approach fails to consider context: how the law operates in practice and the 'legal presumptions, fictions, and arbitrary cut off points that are inherent in the texts.'⁷¹ It is the recognition of these flaws that has led many comparativists to include a consideration of the functional application of the texts. As a result, it has become a common feature of comparative methodologies that 'one should not simply attempt to perform a textual analysis of legal rules, but one should also examine the function, which the law is trying to serve.'⁷² To this end, this thesis relies upon both a comparison of the texts of the law and the functions that those laws perform in practice.

2.3.2 INCORPORATING A FUNCTIONAL ANALYSIS INTO THE COMPARISON

Zweigert and Kötz have argued strongly that the basic methodological problem of all comparative law is that of functionality.⁷³ Functionality is viewed by many theorists to be the basis from which other decisions — including that of 'the choice of laws to compare, the scope of the undertaking and the creation of a system of comparative law'⁷⁴ — all stem.⁷⁵ Zweigert and Kötz placed significant weight on the assessment of functionality because 'in law the only things which are comparable are those which fulfill the same function.'⁷⁶

⁷⁰ Roger Cotterrell, 'Seeking Similarity, Appreciating Difference: Comparative Law and Communities' in Andrew Harding and Esin Örucü (eds), *Comparative Law in the 21st Century* (Institute of Advanced Legal Studies, 2002) 38.

⁷¹ David Nelken, 'Can Law Learn from Social Science?' (2001) 35 *Israel Law Review* 205, 221.

⁷² John Bell, 'Comparing Public Law' in Andrew Harding and Esin Örucü (eds), *Comparative Law in the 21st Century* (Institute of Advanced Legal Studies, 2002) 235.

⁷³ Konrad Zweigert and Hein Kötz, 'The Method of Comparative Law' in *An Introduction to Comparative Law* (Clarendon Press, 3rd ed, 1998) 34.

⁷⁴ *Ibid.*

⁷⁵ See e.g. Watson, above n 38, 317; Örucü, above n 41, 12.

⁷⁶ Zweigert and Kötz, above n 49.

Such a study of functionality involves a focus on both the theory and the practice of the relevant legal text.⁷⁷ Theory is interpreted here to mean a study of why the law exists and practice means the way in which the law is commonly applied. Functionality is a difficult element to study because often ‘accurate information is not available in written form.’⁷⁸ However, it is also significant because of its role in creating an understanding of precedent that in turn generates predictability, which is critical to any meaningful legal system. Örucü has argued that functionality is particularly important when legal systems in transition seek to resolve problems by looking to comparative law because they often ‘utilise models that are either socio-culturally and or legal-culturally diverse from their own.’⁷⁹ However, Nelken has argued that ‘even the same legal rules and institutions have widely different consequences, depending on the operation of ‘contextual’ factors.’⁸⁰

This problem is clearly exemplified by considering the function of renewable energy laws. Arguably, the primary function of all renewable energy laws is to promote the accelerated deployment of electricity generated from renewable energy sources. From an economic perspective, the regulation of energy markets is only warranted in order to correct market failures. The analysis in this thesis shows that there are a limited number of market failures and a much larger range of market barriers that exist within the energy sector that adversely affect the ability of renewable energy to compete with other energy sources (see Chapter 5). These market failures are fairly similar across many jurisdictions, with only concerns around energy security showing significant variance depending on the relative energy self-sufficiency of a country. This suggests that the national renewable energy laws should be reasonably similar. However, despite this similar function, the ways in which countries have legislated to achieve this accelerated deployment varies, at times quite significantly, (see Chapters 3, 4, 7 and 8), as do their legislative objectives (see Chapter 6).

⁷⁷ Watson, above n 38.

⁷⁸ Hazard, above n 44, 1099.

⁷⁹ Örucü, above n 41, 12.

⁸⁰ David Nelken and Johannes Feest (eds), *Adapting Legal Cultures* (Hart Publishing, 2001), 9.

Such crucial perspectives are, however, often missing from comparative law scholarship, where ‘the broad mainstream of comparative law [is] careful to distance itself from the work of governance and the choices of public life,’⁸¹ to ‘protect their reputation for objectivity, scientific neutrality, technical precision and insulation from ideological distortion.’⁸² This results in ‘a failure to envisage as pertinent to an appreciation of the posited law the socio-historical, socio-cultural, and epistemological context in which the law has been embedded for centuries.’⁸³ To create an appropriately sound comparative methodology, it is vital that a greater understanding of the source of law and its social, economic and political context is incorporated in order to determine whether the regulations actually serve the function they were designed to create.⁸⁴ It is for this reason that statutory interpretation of laws, the use of quantitative data and, where available, case law is utilised in this thesis as key primary sources. This affords a better understanding of the development of national renewable energy laws and their social, economic and political context.

2.3.3 THE USE OF THE COMPARATIVE METHODOLOGY IN THIS THESIS

In the context of this thesis, some of the areas of renewable energy law that are to be assessed for similarities and differences using both a comparative textual and functional analysis include:

- a) the subject matter of the primary legislation, i.e., what is the legal definition of renewable energy adopted in the primary legislation?
- b) the rationale for and the objectives of the primary legislation, i.e., why is regulatory intervention into the renewable energy sector required and what are the outcomes that the primary legislation is seeking to achieve?

⁸¹ David Kennedy, ‘The Methods and the Politics’ in Pierre Legrand and Roderick Munday (eds), *Comparative Legal Studies: Traditions and Transitions* (Cambridge University Press, 2003) 345.

⁸² *Ibid* 347.

⁸³ Pierre Legrand, ‘How to Compare Now’ (1996) 16 *Legal Studies* 232, 237.

⁸⁴ See e.g. Mary Ann Glendon, Michael W Gordon and Christopher Osakwe, *Comparative Legal Traditions* (West Publishing, 2nd ed, 1994) 12.

- c) the structure and form of the regulatory support mechanisms contained within the primary legislation.

This component of the research cannot only be concerned with whether there were similarities or differences present in the primary legislation of the countries studied but necessarily will also focus on *why* these similarities and differences have emerged.⁸⁵ This will enable an assessment of the ‘fit’ between different regulatory models and particular stages of development or other domestic considerations within the host countries studied in this thesis.⁸⁶ To this end, the thesis considers the significance of the similarities and differences within the distinct legal cultures of the jurisdictions in the case studies. One example of this is the implications of empowering government bureaucrats with discretion as to whether energy generated from an emerging renewable energy technology will be included within the definition of ‘renewable energy’ under the *Renewable Energy Law 2005* in China versus the detailed definition contained in the *Renewable Energy (Electricity) Act (Cth) 2000* in Australia. This comparison then forms the basis of an assessment of whether common principles of renewable energy law are emerging internationally that might support mutual cooperation and trade. It is also used to identify and better understand the legal, political, economic and cultural factors that best support the acceleration of the deployment of renewable energy.

2.4 COMPARATIVE REVIEW OF THE NATIONAL RENEWABLE ENERGY LAWS

The majority of the original research in this thesis was derived from a comparative analysis of the primary national renewable energy laws of the 95 countries that had adopted such laws and had those laws in force as at 1 January 2014.

⁸⁵ Guiseppe Bellantuono, ‘Comparative Energy Law: Some Methodological Issues’ (2011) 9(2) *Oil, Gas and Energy Law Intelligence* 1, 15.

⁸⁶ Eberle, above n 45, 460-461.

2.4.1 DATA SOURCES AND IDENTIFICATION OF THE RELEVANT LAWS

Renewable energy is primarily used for three purposes. First, it can be used to generate electricity. Second, it can be used for heating or cooling. Third, it can be used in transportation. This thesis focuses only on the national renewable energy laws, which are used to support electricity generation from renewable energy sources. One of the most difficult aspects of this research was identifying and locating the national renewable energy laws in every country that possessed them, as well as confirming that such laws did not exist in the remaining countries.

While the renewable energy laws were generally publicly available, they were not compiled into a single database. Thus the first step in this process was to identify the correct databases to search for the relevant laws for each country. Where a regularly updated national collection of legislation could be identified for a country, this was the preferred source of the legislation. The relevant legislation may be hosted on any one of a number of websites but common sources included comprehensive national legislation databases such as Government Gazettes, databases on the website of the national Parliament or Government, databases on the website of the relevant Minister, and databases on the website of the Attorney General or Department of Justice. The process of determining the best website to use and its correct address was aided by the use of internet search engines, the country guides on the United States Library of Congress website, WorldLii and the GlobaLex website (hosted by the Hauser Global Law School Program at the NYU School of Law), as well as links from the International Renewable Energy Agency's (IRENA) Policies and Measures database, the IEA website, the Political Databases of the Americas (Georgetown University), the Renewable Energy and Energy Efficiency Partnership (REEEP) database and the REN-21 website.

Once the correct website and collection of legislation was identified, searches were then carried out. English was used as the language of the search where this was an available option. Where this was not available, online and hard copy

foreign language dictionaries were used to identify the correct search terms in the official language of the host government. This meant that searches in Catalan were used for the Andorran legislative database, Dhivehi for the Maldivian legislative database and Arabic for the Yemeni legislative database.

The searches used a wide range of possible terms to capture the subject matter of the various laws that may be functionally equivalent: 'renewable energy', 'renewable energy sources', 'renewable electricity', 'renewable energy resources', 'energy from renewable sources', 'new and renewable energy', 'renewable and sustainable energy sources', 'alternative energy', 'green power', 'non-conventional energy', 'non-traditional energy sources' and 'non-fossil energy'. The most fruitful search terms were truncated phrases with a Boolean search modifier: 'renewable energ*', and 'alternative energ*'. The search parameters excluded legislation that:

- was not national or supranational (thereby excluding consideration of state, regional or provincial Laws such as the Ontario Feed-in Tariff);
- had ended, been superseded or planned but was not in force as at 1 January 2014; and
- was specifically focused on heating and cooling or transport rather than electricity.

Once the relevant law in a country was identified, this was then cross-checked against the subject specific databases including the IRENA Policies and Measures database, the IEA website, the REEEP database, the REN-21 website, FAOLEX, as well as regional databases such as RES_Legal (Europe), RCREEE (the Middle East and Africa), the Political Databases of the Americas (North, Central and South America) and NARUC (the Americas and the Caribbean Islands). Multiple websites were always checked during this step, as many legislative databases and websites purporting to be comprehensive were found to be incomplete or out of date.

Where multiple laws were identified, they were checked for coverage to see which law aimed to best cover the field. If subsequent laws were identified that amended or repealed the primary national renewable energy law, searches were carried out in an attempt to locate a consolidated version of the legislation. If this search was unsuccessful, the legislation was then consolidated manually.

In addition, there were some relevant laws that were identified through the above process that were not publicly available. These laws were the Energy Act 2012 (Act 11 of 2012) of the Seychelles, a law amending the Tax Exemption Act (Law No. 7400) in Costa Rica and the Palau Net Metering Act 2009 (RPPL No. 8-39). For each of these jurisdictions, a range of local experts were contacted for the very limited purpose of accessing the relevant legislation, including members of the relevant ministry, representatives of the national public utilities company, senior government or public officials, and local legal counsel.⁸⁷ Through this process, both the Seychellois and the Palauan legislation were provided for the purposes of this research.⁸⁸ Unfortunately, the Costa Rican legislation was not made accessible through these steps and so was excluded from the research.

There were a further two countries for which it was not possible to determine whether they had national renewable energy laws due to either the applicable websites hosting malware or the country not hosting government websites or legislative databases. These countries were Cape Verde, and Sao Tome and Principe, where a draft Bill had been proposed by the multi-sectoral regulatory agency, Autoridade General de Regulação (AGER), but the current status could not be discovered due to the presence of malware on the AGER website.

⁸⁷ By way of example, the content of the request for Palau was as follows, 'Dear Public Information Officer, I am currently conducting research into the renewable energy laws of a number of countries, including Palau. As a result, I would be most grateful if you could please send me a copy of the Palau Net Metering Act 2012? I would be very happy to send you a copy of my research when it is concluded.'

⁸⁸ This information was provided by Tmetuchl Baules, Director of Administration (and Public Information Officer) at the Palau Public Utilities Commission and Ginny Elizabeth, Board Member of the Seychelles Public Utility Corporation.

2.4.2 TRANSLATION

Preference was given to authoritative versions of the renewable energy laws where these were available in English. Where no authoritative version of the law was available in English, an official or non-binding translation of the authoritative version conducted by or for a governmental body or organisation was then used.⁸⁹

If no official translation existed, the laws then had to be translated from their original language into English.⁹⁰ Out of the total 95 countries, there were 42 national renewable energy laws in 20 different languages that did not have an authoritative version or an official or non-binding version available in English. The translation of these laws was conducted by legally trained translators, predominantly from a professional legal translation service, 'Linguistico.' In addition, some senior year law students from the Faculty of Law at the University of Sydney, who were native speakers in the original language, also volunteered to assist with this exercise in order to reduce the costs.⁹¹ Where either a translator or an official non-binding version has been used in the research, details of the original language and the translator have been identified in Appendix 1.

For cost and time considerations, only the most relevant portions of the legislation were translated as some of the laws were lengthy (for example, the United States Energy Policy Act of 2005 runs to 551 pages) or covered multiple topics. In particular, the definitions section and the legislative objectives sections (or preamble or legislative purpose sections) were translated, as there was no alternative source for this information. The sections on the regulatory support mechanisms were not translated as much of the classification of these

⁸⁹ Marci Hoffman and Mary Rumsey, *International and Foreign Legal Research: A Coursebook* (Brill, 2nd ed, 2012) 17.

⁹⁰ For a description of how legal translation may impact on the methodology adopted, see: Marcus Galdia, 'Comparative law and legal translation' [2003] (1) *The European Legal Forum* 1, 3.

⁹¹ The names of these students are Stephanie Watson, Tallulah Bur and Ashley Richards (French), Ellen Marie O'Brien (Indonesian), Levi Romanov (Russian), and Laura Peck and Mitchell Cleaver (German).

sections has already been conducted by the Renewable Energy Network for the 21st Century (REN-21).

2.4.3 CODING

Once the relevant laws were identified, located and where necessary, translated, they were then coded to make sense of the data collected. The coding process was important as the codes were used to examine the similarities, differences and frequency of key concepts and themes between the national renewable energy laws of different countries. They were also used to look at the sequencing of concepts and themes (i.e. Did concepts and themes get mentioned in a certain order? Was this indicative of the relative priority assigned to that concept or theme in the legislation?).

The coding process focused on two separate sections of the legislation (or their functional equivalent): the legislative definition of renewable energy (or the synonym adopted by the jurisdiction) and the legislative objectives. In each case, the coding was conducted in two rounds. In the first round (the 'pre-coding' round), the relevant legislation of the first 30 countries alphabetically with national renewable energy laws was construed in accordance with the plain and ordinary meaning of the words and analysed to identify its inherent characteristics. Once this step was completed, the relevant codes to be adopted within the coding framework were then devised. This ensured that the codes could be applied consistently across the renewable energy laws of the different countries. In the second round, the sections of the national renewable energy laws from every country with such laws were then manually coded using the pre-determined coding categories. If new coding categories were uncovered during the second round of coding, the new categories were incorporated into the coding framework and the legislation that had been previously coded was then re-coded to reflect the new coding framework. Further details of the specific categories and codes used are contained within Chapter 3 for the legislative definitions and Chapter 6 for the legislative objectives.

2.5 LIMITATIONS OF THE RESEARCH METHODOLOGY ADOPTED

At this juncture, several limitations to the research methodology adopted should be acknowledged. First, due to the breadth of the countries studied in this thesis, it was not possible to track the changes in the law over time. Nor was it possible to consider the potential layering impact of regional, provincial, state or local government laws operating in addition to the national law. This limited the ability at this point in the research to be able to make a thorough assessment of whether the laws are currently converging or diverging, although in the latter chapters a number of hypotheses are drawn as to the likely future development of the laws based on the existence of similarities and differences between them.

Second, the range of languages in which the primary laws were drafted created a language barrier. In order to overcome this barrier, it would have been preferable to have had the entirety of all of the relevant laws translated into English using professional legal translators. This would have enabled more accurate statutory interpretation that considered the section in the context of the legislation as a whole. However, given the time delays and costs already associated with translating only a limited section of laws (over \$AU 5,000), this was not possible for a doctoral-level research project.

Third, this research would have also benefited from a greater emphasis of 'law in action,' through the use of expert interviews and a questionnaire to assess how the laws were practically implemented, monitored and compliance was enforced. This was initially considered as part of the proposed research but as the number of countries included in the thesis expanded to all of the countries with a national renewable energy law, this element of the research was not pursued. This was because the comparative research methodology adopted in this thesis yielded an enormous amount of rich primary data (as evidenced by the summaries contained in the Appendices). Further, with the laws of 95 countries being studied, it was simply not feasible to conduct interviews and questionnaires for each country with the limited resources available. While case

law was used to a limited extent to this end, the comparative lack of available case law also hampered these efforts.

Despite these limitations, when the primary data was combined with the substantial secondary resources used throughout the thesis, it enabled significant and methodologically robust results and conclusions to be reached. It is proposed that these methodological limitations will be addressed in future research, providing more financial resources, time and case law are available.

2.6 CONCLUSION

This chapter has explained that, due to the lack of a uniform legislative definition of 'renewable energy,' the available quantitative data on renewable energy were not readily comparable. This has led to the adoption of a comparative mixed methodological approach within this thesis, using the available quantitative data and qualitative research methods such as statutory interpretation, comparative textual analysis and doctrinal research, supplemented by analysis of the primary and secondary legal, political, economic and historical sources.

This thesis significantly extends the existing research in the field by studying the national renewable energy laws of every country with such laws in force by 1 January 2014. This facilitated a study of the similarities and differences of the primary legislative instruments covering the renewable energy sector. Further, it enabled the study of a wider geographic scope and thus broadened the applicability of the research by providing a deeper and more nuanced understanding of the different regulatory approaches. The use of a large n-sample meant that generalisable inferences could be drawn and conclusions made about the current state of renewable energy law globally. This provided a better understanding of the emerging norms for renewable energy laws against which the laws of individual countries can now be compared, as well as furthering knowledge of the way that specific regimes fit the particular developmental or other characteristics of the countries studied.