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Introduction

Over the past fifteen years, the renewable energy sector has experienced an unprecedented boom. In 2017, renewable energy accounted for an estimated 70 per cent of net additions to global power generation,[1] with $US298 billion invested in new renewable generation capacity (including hydropower).[2] This continues the trend witnessed over the past five years of renewables attracting more than double the annual investment into new fossil fuel generation capacity.[3] Nor does the boom show any sign of abating. As part of the adoption of the Paris Agreement, 145 Parties included domestic action to support renewable energy to help mitigate and adapt to climate change as part of their Nationally Determined Contributions.[4] Further, 109 Parties to the Paris Agreement provided quantifiable targets for renewables. These developments are having significant flow-on effects to the global generation mix, with renewable energy now comprising 26.5 per cent of global power generation capacity from all sources and delivering 25 per cent of global electricity supply.[5] 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, substantially more investment is needed if projections from the International Energy Agency (IEA) of an almost tripling

[1] REN21 Secretariat, 'Renewables 2018 Global Status Report' (Report, Renewable Energy Policy Network for the 21st Century, 2018) 18.
[2] IEA, *World Energy Investment 2018* (OECD/IEA, 2018) 23.
[3] Ibid.
[4] IRENA, *Untapped Potential for Climate Action: Renewable Energy in Nationally Determined Contributions* (IRENA, 2017) Executive Summary.
[5] REN21 Secretariat, above n 1, 32, 40.

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of renewable generation by 2040 are to be met.[6] 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% of which should be spent on power generation technologies'.[7] The International Renewable Energy Agency (IRENA) puts the level of cumulative investment needed to enable the energy transition far higher, estimating that $US120 trillion will need to be spent between 2015 and 2050, with the vast majority of the spending targeted at renewable energy and energy efficiency.[8] Regardless of the figure, both the IEA and IRENA agree that significantly more investment is needed within the sector. To date, global investment in the renewable energy sector has been highly variable year on year, although there has been a trend towards upwards growth. However, due to a confluence of factors, the precise investment in any year can be unpredictable, with, for example, investment in 2016 some 23 per cent lower than the global peak in investment in 2015.[9]

The downturn in renewable energy investment in 2016 is not a new phenomenon, with similar declines experienced in 2012, 2013 and 2014 from the previous global peak in investment in 2011.[10] Historically, the variable nature of global investment in the renewable energy sector can be attributed to several factors such as:

- Policy and regulatory support: The renewables sector needs policy and regulatory certainty in order to be able to function efficiently, plan investments to avoid boom and bust cycles, and to enable the energy transition. The expiry of the green infrastructure stimulus packages following the end of the global financial crisis[11] and the subsequent increased uncertainty about national renewable energy laws and policy following the early closure or retroactive declines in support schemes in some countries[12] has had a marked impact on investment in the sector. This has been shown by the huge growth in investor–state disputes and

6 See the Sustainable Development Scenario in IEA, *World Energy Outlook* (OECD/IEA, 2017) 257, 299.
7 IEA, Renewable Energy Outlook in IEA, *World Energy Outlook* (OECD/IEA, 2014) 239.
8 IRENA, *Global Energy Transformation: A Roadmap to 2050* (IRENA, 2018) 11.
9 REN21 Secretariat, above n 1, 140.
10 Angus McCrone (ed.) et al., *Global Trends in Renewable Energy Investment 2017* (Frankfurt School-UNEP Centre and Bloomberg New Energy Finance, 2017) 14.
11 Ibid.
12 Thomas Gerke, *Italy Imposes Retroactive Changes to Feed-in Tariff for Solar PV*, Renew Economy, 15 August 2014 <http://reneweconomy.com.au/2014/italy-imposes-retroactive-changes-feed-tariff-pv-38857>; Nilima Choudhury, *Spain Announces Retroactive FiT Cuts*, PV Tech, 19 February 2013 <www.pv-tech.org/news/spain_announces_retroactive_fit_cuts>.

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associated compensation claims within the sector, particularly in Spain, the Czech Republic, Bulgaria and Italy.[13]

- Technology and equipment costs: The average capital cost of renewables projects has declined markedly as onshore wind and photovoltaic solar became increasingly cost competitive with fossil fuel generation projects. Since 2009, photovoltaic solar module prices have declined by approximately 80 per cent and wind turbine equipment costs have fallen by 30 to 40 per cent.[14] In turn, this led to a decline in the levelised cost of electricity (LCOE) from solar PV between 2010 and 2016 of more than 68 per cent, with an 18 per cent decline in the LCOE of onshore wind over the same period.[15] This is obviously a positive development, though the benefit of falling costs will only be realised if there is sufficient regulatory certainty to encourage investment.
- Fossil fuel costs: A further factor that has impacted investment within the sector in recent years is the comparatively low cost of fossil fuels, following large discoveries of shale gas and oil in the United States.[16] In 2016, US gasoline prices dropped to levels not seen since 2004.[17] This meant that the cost imperative to substitute fossil fuelled generation with renewable energy, which had been present when oil prices reached their historic peak in 2014,[18] was no longer as pressing. While global oil and gas prices have now largely recovered, the linkages between the prices of different sources of electricity generation can lead to the attractiveness of investing in the renewables sector being impacted by other factors. This means that international fossil fuel commodity prices or conflicts in the Middle East and Russia continue to impact on investment in the renewable energy sector.

The renewable energy sector is also affected by the presence of at least three market failures within the energy sector: the presence of unpriced negative and positive externalities in the energy sector; spillovers and learning effects; and information asymmetries. These market failures, which afflict countries

[13] See e.g. Energy Charter Treaty, *List of All Investment Dispute Settlement Cases* (2018) <https://energycharter.org/what-we-do/dispute-settlement/all-investment-dispute-settlement-cases/>.
[14] IEA and IRENA, *Perspectives for the Energy Transition: Investment Needs for a Low-Carbon Energy System* (OECD/IEA and IRENA, 2017) 27.
[15] IRENA, *Renewable Energy: A Key Climate Solution* (IRENA, 2017) 5.
[16] European Renewable Energy Council, 'Shale Gas and Its Impact on Renewable Energy Sources' in EREC (ed.), *EREC Factsheet* (2013).
[17] Trading Economics, *United States Gasoline Prices 1992–2018* (2018) <https://tradingeconomics.com/united-states/gasoline-prices>.
[18] Ibid.

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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 $US260 billion in 2016 alone[19] (or 0.34 per cent of global gross domestic product (GDP)).[20] This may be compared to the direct subsidies provided to renewable energy used for power generation over the same period of $US140 billion.[21] These factors mean that without government intervention in the sector, many sources of 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.[22]

As a result, a majority of the countries in the world engage in some form of government intervention in the renewable energy sector, with the numbers consistently growing year on year. By 2018, 146 countries had national renewable power targets,[23] 138 countries had support policies directed at renewable energy[24] and 113 countries had national renewable energy laws in force. 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,

[19] IEA, *World Energy Outlook*, above n 6, 85.
[20] Author's own calculations using the global gross domestic product data for 2016 from World Bank, *World Development Indicators database* (1 July 2018) <https://databank.worldbank.org/data/download/GDP.pdf>.
[21] IEA, *World Energy Outlook*, above n 6, 82.
[22] See e.g. Department of Energy & Climate Change, *UK Renewable Energy Roadmap Update 2013* (Government of the United Kingdom, 2013) 5; Australian Renewable Energy Agency, *The Business of Renewables: A Report into Renewable Energy Take-up by Large Corporates in Australia* (ARENA, 2017) 44–5; Ernst & Young, *Capitalizing on China's Renewable Energy Opportunities: Innovative Financing Models for China's Solar and Wind Markets* (Ernst & Young (China) Advisory, 2014) 4.
[23] REN21 Secretariat, above n 1, Table R8.
[24] Ibid.

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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 available.[25] These studies have analysed whether feed-in tariffs, quota systems such as renewable portfolio standards (RPS), competitive tendering, tax incentives, subsidies or other regulatory support mechanisms are preferable.[26] 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.[27] Further, the existing multi-country comparisons in this area have tended to focus on Europe,[28]

[25] 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 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).

[26] 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; C G 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.

[27] See e.g. Lesser and Su, 'Design of an Economically Efficient Feed-in Tariff Structure', above n 25; Severin Borenstein, 'The Private and Public Economies of Renewable Electricity Generation' 26 *The Journal of Economic Perspectives* 67.

[28] 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 Río et al., 'Key Policy Approaches for a Harmonisation of RES(-E) Support in Europe – Main Options and Design Elements' (Report, European IEE Project Beyond2020, March 2012); Lena Kitzing, Catherine Mitchell and Poul Erik Morthorst, 'Renewable Energy Policies in Europe: Converging or Diverging?' (2012) 51 *Energy Policy* 192; Gustav Resch et al., 'Coordination or Harmonisation? Feasible Pathways for a European RES Strategy Beyond 2020' (2013) 24

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North America,[29] Organisation for Economic Co-operation and Development (OECD) countries[30] or north-east Asia.[31] 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 book 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 113 countries that had such a law on 1 August 2018, as well as the EU Directive[32]

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 Stripple 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.

[29] 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 Ellingson et al., above n 25; 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).

[30] 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 et al., '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).

[31] See e.g. Kat Cheung and IEA, '*Integration of Renewables – Status and Challenges in China*' (Working Paper, OECD, 2011); Cui Huang et al., 'Government Funded Renewable Energy Innovation in China' (2012) 51 *Energy Policy* 121.

[32] 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.

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and the IRENA Statute.[33] 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 the rationales for countries legislating in the sector, an assessment is then made about the likely future development of national renewable energy laws. Will countries actively seek to 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, 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 going unnoticed. This book seeks to remedy this oversight by providing the first comprehensive scholarly analysis of the national renewable energy laws of all countries that have such laws.

1.2 HYPOTHESIS AND RESEARCH METHODOLOGY

The hypothesis tested in this research 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, improve information sharing and ease administration. This will see similar legislative definitions for renewable energy being adopted, similar legislative objectives found in national renewable energy laws and regulatory support mechanisms acquiring similar designs and being adopted in similar combinations by different countries throughout the world.

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

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

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

This research involved the study of the primary piece of renewable electricity legislation in each of the 113 countries that had a national renewable energy law on 1 August 2018. This original research was aided by the adoption of a comparative mixed methodological approach, using the available quantitative data and qualitative research methods such as statutory interpretation, comparative analysis, and doctrinal research, supplemented by analysis of primary and secondary legal, political, economic and historical sources. The breadth of research was designed to overcome problems of source coverage and source bias and offer a deeper and more nuanced assessment of the regulatory regime.

The comparative mixed methodological approach best facilitated a study of the similarities and differences of the primary legislative instruments covering the renewable energy sector. The comparative analysis was based on both a textual and functional analysis of the national renewable energy laws drawing upon the research of eminent scholars in these fields.[34] This approach was

[34] This research drew upon the methodological approaches of Alan Watson, 'Comparative Law and Legal Change' (1978) 37 *Cambridge Law Journal* 313, 317; John Henry Merryman, 'Comparative Law Scholarship' (1998) 21 *Hastings International and Comparative Law Review* 771, 775; 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; Konrad Zweigert and Hein Kotz, 'The Method of Comparative Law' in *An Introduction to Comparative Law* (3rd edn, Clarendon Press, 1998) 34.

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adopted because 'even the same legal rules and institutions have widely different consequences, depending on the operation of "contextual" factors'.[35]

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 in 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 and authoritative national collection of legislation could be identified for a country, this was the preferred source of the legislation.[36] Once the correct 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, Dari for the Afghan 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 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); or
- had ended, been superseded or planned but was not in force on 1 August 2018; or
- was specifically focused on heating and cooling or transport rather than electricity.

Out of the total 113 countries with national renewable energy laws, there were laws studied that were drafted in 47 different languages. 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

[35] David Nelken and Johannes Feest (eds.), *Adapting Legal Cultures* (Hart Publishing, 2001) 9.
[36] The numerous sectoral databases of policies and measures were not used as a reliable source of the laws, as they were often found to be incomplete or out of date. They did however play a valuable role in cross-checking the data collected.

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in English, an official or non-binding translation of the authoritative version conducted by or for a governmental body or organisation was then used. If no official translation existed, the laws then had to be legally translated from their original language into English.[37]

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 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. 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. were concepts and themes mentioned in a certain order? Was this indicative of the relative priority assigned to that concept or theme in the legislation?).

This methodology was selected because 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.

1.2.1 *Limitations of the Research Methodology Adopted*

At this juncture, several limitations to the research methodology adopted should be acknowledged. First, due to the number and diversity of the countries studied in this research, it was not possible to track the changes in the law over time. Nor was it possible to consider the potential layering impact

[37] 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. 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).

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