



WORLD ENERGY COUNCIL
CONSEIL MONDIAL DE L'ÉNERGIE
For sustainable energy.

2014 World Energy Trilemma

Time to get real – the myths and realities of financing energy systems

Project Partner OLIVER WYMAN

Executive Summary

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Foreword

Last year our report World Energy Trilemma 2013: Time to get real - the agenda for change identified 10 areas which policy and business energy leaders saw as a priority for attention if countries are to be able to meet the challenges of the energy trilemma more effectively. They included the need for transparent, flexible and dynamic pricing frameworks, and to enhance engagement with the financial community, in order to facilitate the uplift in investment necessary to deliver secure, sustainable and affordable energy for all.

This report has focused on these issues: through an extensive programme of research; interviews with leading financiers, but also industrialists and policymakers; and analysis of the data underpinning the Energy Trilemma Index. The lessons we have drawn from this work are presented to help the various actors raise their game - in improving the relevant policy frameworks, in making difficult investment decisions, in increasing the scale and velocity of project development, and consequently to scale up what is already an ambitious investment agenda. From a current US\$1.7 trillion year, annual investment needs to grow by at least half, to US\$2.5 trillion or more in 2035 if the world's energy expectations are to be met.

What does the report tell us? We find that there is capital available in the private sector on the required scale, but that patterns of investment will need to change radically in terms of type of energy source, technology, and infrastructure. And it will need to take place across different regions from those to date. Investors and developers will accordingly have to invest way beyond their comfort zones. They will need help to do so – notably from governments, regulators and international financial institutions. Emerging financing mechanisms must evolve quickly in terms of both scale and accessibility. Policy frameworks and regulatory processes will need to evolve to match the new technical and other realities. In doing so policymakers have to strike a difficult balance between providing predictability for investors, and being able to adapt to what the fast evolving market requires. Getting this balance right will not only be crucial to sustaining and growing investment, it will also determine the cost of capital, and hence the viability and end pricing of energy provision.

We offer some practical suggestions for how policymakers, energy business leaders and the financial community can work together to achieve the right sort of outcomes. In particular, they need to arrive at a common understanding of how to align investors' risk–reward expectations with the need for private sector energy investment, and of how emerging technologies can support national and international energy goals. Policymakers must carefully consider the impact of interventions on investor perceptions and on the allocation of risk. To the extent possible, they should aim to decrease the short-term focus and politicisation of energy policy. The financial community should help policymakers and the energy sector to understand better: the role different investors can play, using various financial instruments, during the life cycle of projects; the role of new funding entities; and how to work to embed best practice and build human capacity in developing and emerging economies. As to the energy sector, they, too, can do more to identify and share practices which will augment the pipeline and increase the velocity of projects. They also need to engage more with development banks on capacity building and policymakers on the design of new policy models to take account of technological and other changes.

I am struck by the resonance of the themes in this report – themes around engagement, around the significance of getting the right policy approaches, around the dynamism of technology and around business models in the energy sector – with the findings in our 2012 and 2013 reports. The common thinking which we have uncovered among energy business leaders, policymakers and now the financial community gives us hope that we can secure alignment of business, policy and financial approaches. We are convinced that this report will contribute to securing that alignment, and scaling up the flow of investment, as is so desperately needed.



Joan MacNaughton
Executive Chair, WEC World Energy Trilemma

How to unlock US\$48trn investment in energy infrastructure

OBSTACLES AND BARRIERS

Unlocking capital sources



Roughly US\$48 trillion investment in energy infrastructure is required over the next 20 years to replace ageing assets, build new energy infrastructure, meet climate change targets, and provide access to the 1.2 billion people without energy.

Managing trade-offs



Balancing the three dimensions of the energy trilemma is hard. And, as time elapses, it will get even harder and more expensive.

Reducing uncertainty



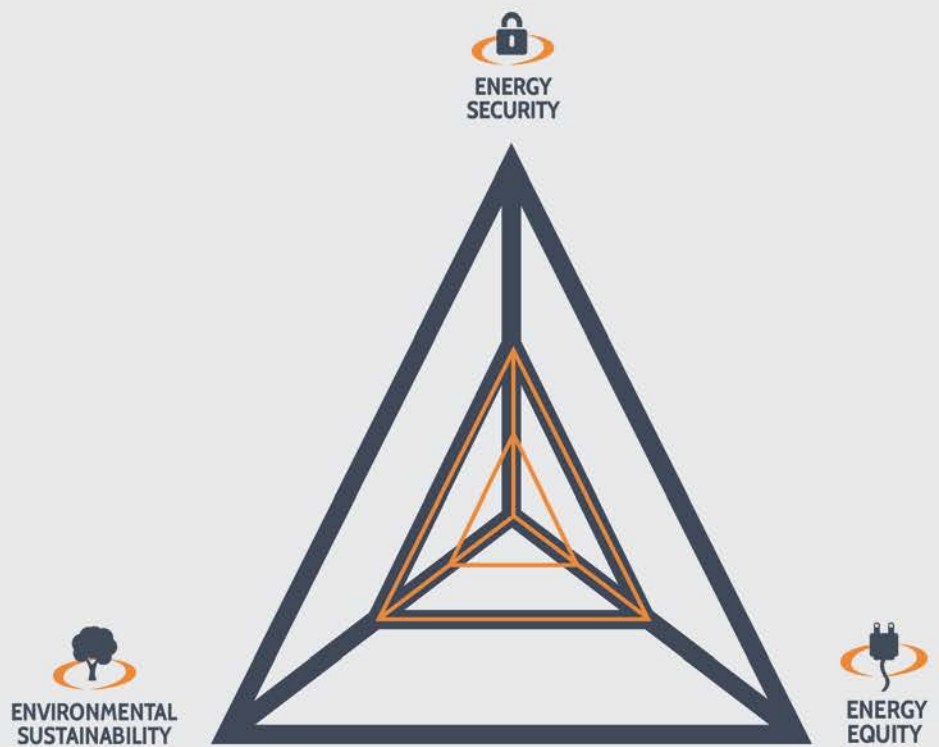
Political and regulatory uncertainty driven by national policy and regulatory changes, lack of an international climate framework, and the speed of technology development drives up the cost of capital and deters investment.

RECIPE FOR SUCCESS

The World Energy Trilemma report helps governments rise to the challenge the World Energy Council has defined as the energy trilemma.

Balancing the three core dimensions of the energy trilemma – energy security, universal access to affordable energy services, and environmentally-sensitive production and use of energy – is the basis for prosperity and competitiveness of individual countries.

Sustainable energy is not only an opportunity to transform societies and grow economies, but also a necessity – a prerequisite to meet growing energy demand and reduce the carbon footprint.



WHAT IS AT RISK?

Meeting energy demands



Secure energy is critical to maintaining and driving economic growth. Meeting rising demands for energy enables the expansion of all sectors of the economy including agriculture, transport, manufacturing, construction, health, and social services.

Delivering social benefits



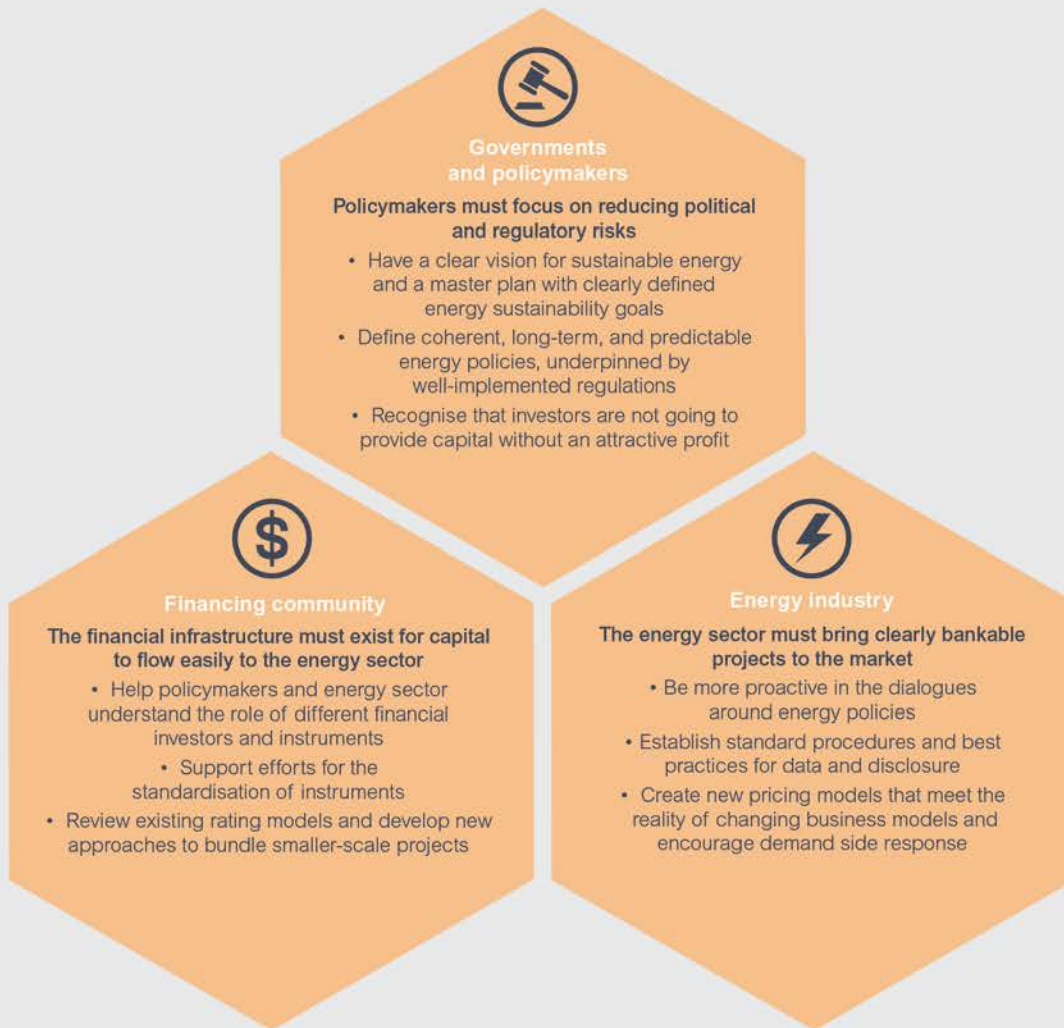
Energy must be accessible and affordable at all levels of society. The shift from primary energy to electricity is a key feature of modern society and increased energy access is strongly correlated to growth in education, life expectation, and economic development.

Minimising environmental impacts



The impact of energy production and energy use on the environment must be minimised in order to combat climate change as well as the implications of local air and water pollution.

TIME TO GET REAL



Collaborative action is required



WHAT GETS MEASURED, GETS DONE

The **Energy Trilemma Index** provides the world's most comparative assessment of how countries perform in delivering sustainable energy systems. The Index enables countries to visualise their energy system and identify areas for action. Further information can be found online at www.worldenergy.org/data/sustainability-index

2014 Energy Trilemma Index – Top 20 countries

01	Switzerland	AAA
02	Sweden	AAA
03	Norway	AAB
04	United Kingdom	AAA
05	Denmark	AAB
06	Canada	AAB
07	Austria	AAB
08	Finland	ABB
09	France	AAB
10	New Zealand	AAB
11	Germany	BBB
12	United States	AAC
13	Australia	AAD
14	Netherlands	BBB
15	Spain	ABB
16	Colombia	AAC
17	Slovakia	ABB
18	Luxembourg	AAD
19	Costa Rica	ABB
20	Qatar	AAD

Executive summary

In 2013 the World Energy Council (WEC) exposed a number of myths that influence the understanding of important aspects of the global energy landscape. It pointed out that, if not challenged, these misconceptions may lead us down a path of complacency and missed opportunities as current pathways may fall short of delivering on the global aspirations of energy access, energy security, and environmental sustainability – the three dimensions that must be balanced in the energy trilemma.

As energy markets become more complex, driven by accelerated change in energy policy, technological innovation, and consumer expectations, current market designs and business models in some countries may be unable to cope. The pressures of meeting increasing demand and the need to transition and replace existing infrastructure must be met with robust policy and regulatory frameworks that include the right investment conditions for the energy and financial sectors.

The WEC's 2014 Energy Trilemma Index highlights those countries that are able to balance energy demands to deliver more sustainable energy systems for their people and help secure long-term competitive economies. Switzerland, Sweden and Norway take top honours in the 2014 Index overall. The highest ranking country for energy security is once again Canada, with the United States (US) maintaining its position as the most equitable energy system, and Switzerland leading the way on environmental sustainability.

As the world economy and population grows, global energy demand is predicted to increase and even double by 2050. To keep pace with this demand, cumulative investment requirements in electricity generation alone will be between US\$19.3trn¹ and US\$25.7trn between now and 2050.² Looking at the broader energy infrastructure, an estimated cumulative investment of US\$40.2trn is required across the energy infrastructure supply chain over the period 2014 to 2035 with an additional US\$8trn investment needed in energy efficiency. This is equal to an annual investment need of US\$1.7trn (rising to US\$2.5trn by 2035) in energy supply infrastructure and to improve energy efficiency. To put this into perspective, this equates to an investment of around US\$240 per capita per year today to US\$285 per capita per year in 2035, considering the current and future world population. A significant figure even for people living in developed countries, and especially high for those in developing and emerging economies. These investment requirements rise by a further 10% to a total of US\$53trn in cumulative investment by 2035 if the goal is set

¹ This publication uses the short scale version of a trillion, i.e. one trillion means one thousand billion.

² World Energy Council (WEC), 2013: World Energy Scenarios: Composing energy futures to 2050; The lower number refers to the WEC's 'Symphony' scenario, which focuses on achieving environmental sustainability through internationally coordinated policies and practices, while the higher number reflects WEC's 'Jazz' scenario, which focuses on energy equity with priority given to achieving individual access and affordability of energy through economic growth.

to a 2°C emissions path (a target to limit the average global temperature increases and the resulting climate change).³

The investment needs offer a significant market opportunity if robust and equitable pathways are provided for the investment community. However, capital is extremely sensitive to perceived political and regulatory risks. Moreover, due to the growing pressures on public finances in most countries, there is a limited availability of public funds to substitute or augment the private financing of energy infrastructure. Increasing private sector investment in the energy sectors enables governments to direct their resources to other economic and social needs that may not otherwise be met. It is therefore critical to improve the understanding of the nature of risk and the way to price it. In the absence of such understanding, investment will not flow.

Building on the findings of the recent work with ministers, policymakers and industry leaders, the WEC and global management consultancy, Oliver Wyman, along with the Global Risk Center of its parent Marsh & McLennan Companies, engaged directly with the finance community to explore if it is possible to meet these investment needs, or if the challenge is too great. The interviews provided a clear understanding of the barriers to investment and identified pathways to deliver competitive and sustainable energy systems.

In addressing the investment challenges, three key questions need to be at the centre of attention:

- ▶ Is there enough available capital at the right cost?
- ▶ Will the existing funding instruments be able to channel capital from the investor community to the energy sector?
- ▶ Can the energy sector attract and absorb capital on this scale?

The report found that there is enough money available from the private sector if the right conditions are provided. Policymakers and regulators must clearly signal their future energy strategies, recognising the need for appropriate risk-reward structures, and to put in place lasting policy and regulatory frameworks, free from populist political interference. Alongside this, it is increasingly clear that there needs to be a focus on the development of technical, financial and management skill sets to support energy projects around the world and enable the energy sector to absorb capital.

There is an emerging risk that, under regulatory pressure of Basel III (the global, voluntary regulatory standard on bank capital adequacy), banks may reduce their infrastructure loans. This will put added pressure on other forms of funding which are not yet prepared or incentivised to meet the challenge.

To ensure a robust pipeline of projects that meets the emerging demand dynamics, the energy sector will need to 'get real' about the way it engages with the financial sector, and policymakers will be called on to make some hard choices. The money to catalyse the transition exists – as an example, the International Monetary Fund (IMF) estimates annual global cost of government subsidies for fossil fuels in 2012 was almost US\$2trn (factoring lost tax revenues).⁴ It is therefore clear that there is scope to deliver a sustainable energy system that meets the triple challenge of the energy trilemma (to balance energy access, energy security, and environmental

³ International Energy Agency (IEA), 2014: World Energy Investment Outlook; The 2°C scenario would require double the investments in low-carbon technologies and energy efficiency.

⁴ International Monetary Fund (IMF), 2013: Energy Subsidy Reform: Lessons and implications

sustainability) but, as this report sets out, energy leaders will need to act quickly and adapt the way they engage with the finance community.

Financial sector recommendations

Countries exhibit a wide diversity of energy policies and strategies but nearly all share a common goal: increasing private sector investment as well as developing skills and expertise. Achieving the necessary investment levels will require that capital can be accessed at the right cost, that there are effective financial instruments to support a flow of investments across the energy sector, and that there is a strong pipeline of energy projects available for investments. Policymakers, the financial sector and the energy sector each have a role to play and must work together to devise and implement approaches that will drive investments.

Research and interviews with financial sector stakeholders have identified three action areas that must be attained to attract greater investment in energy. Unlike complex macroeconomic forces, all of these conditions, while challenging, are still well within the control of governments, investors and energy companies.

Action area 1

Policymakers must focus on implementing the regulatory and policy frameworks to encourage investment and reduce political and regulatory risks.

For many developing and emerging economies, this will include a focus on creating the prerequisite strong legal, regulatory and financial frameworks that provide investors in any sector of the economy with confidence that rules will be followed and investments can be recouped. Policymakers and regulators must clearly signal their future energy strategies and put in place lasting policy and regulatory frameworks. Coherent, long-term, accessible, predictable, and transparent energy policies, underpinned by well-implemented regulations and independent regulatory bodies, can significantly increase investors' confidence.

Along with this, policymakers must strive to keep politics out of energy policy and reduce concerns that investing in energy results in unrewarded exposure to political and regulatory risk. The energy sector has been particularly vulnerable to policy intervention and changes, driven in part by the mismatch between political cycles (five years or less) and asset lifetimes (often spanning decades). This results in a risk premium – and higher cost of capital – being applied on a country-by-country basis to investment in the sector and, in some cases, discouraging investment altogether.

Politicking around energy investments has been compounded by the uncertainty created by ongoing climate framework negotiations, as well as technological changes in energy supply, including the expansion of renewables and unconventional oil and gas. As new technologies come to the fore, policymakers face real challenges in developing policies that will drive necessary changes to decarbonise energy and ensure a secure energy supply that is accessible and affordable, while minimising the impact of energy production and use on the environment in order to combat climate change as well as local air and water pollution. It is more important than ever that policymakers maintain a robust engagement with the energy and financial sector on emerging technologies, accompanying financial opportunities, and effective regulatory

frameworks to meet energy goals. This will enable policymakers to shape thriving energy markets and establish competitive risk–return frameworks for investors, while ensuring the needs of their citizens and economies are met.

Action area 2

The financial infrastructure must exist for capital to flow easily to the energy sector.

Many of the potential financing sources for energy infrastructure are expected to evolve over the coming decades in many countries. Under regulatory pressure of Basel III, banks are expected to reduce their infrastructure loans. At the same time, the regulation opens the space for insurance companies to increase their infrastructure loans. Other investors, for example, pension funds and other long-term investors around the world are also looking to increase their allocations to infrastructure. Over time, more experienced funds may increasingly invest directly and others may invest through dedicated infrastructure funds to bring substantial increases in investments.

Additional developments include the maturing of financial markets in emerging economies, or allowing expanded use of financial mechanisms such as project, infrastructure and green bonds.

As the financial structures evolve, the sector must overcome bias toward conventional energy projects. Currently, approximately 70% of energy investments (not including investments for energy efficiency) are directed to fossil-fuel related projects. Indeed, through to 2035 it is expected that fossil fuels will require 65% of total investments.⁵ Nonetheless, increasing the level of comfort and confidence of investors to fund low- and zero-carbon technology projects will be key – especially if a meaningful post-2015 climate change agreement is to be achieved and more investments are to flow in emerging technologies and economies. This will require regulatory stability and new approaches to assess opportunities, aggregate smaller-scale projects, and a greater use of targeted financing mechanisms.

Action area 3

The energy sector must bring clearly bankable projects to the market.

One of the biggest barriers to increased energy investments, especially in non-OECD countries, is the limited number of projects that can secure financing. A bankable project is one that has all the necessary components aligned, so that investors have confidence in the project success.

In some countries, the lack of bankable projects, or the lack of a steady project pipeline, is resulting in a ‘crowding-out’ of private investors, which compete with public funding institutions such as multilateral development banks to invest in effectively scoped energy projects.

⁵ IEA, 2014: World Energy Investment Outlook

Many factors can limit the availability of bankable projects. In some instances, there are constraints on investments due to restrictions on foreign direct investments. In many other cases, the lack of human capital is a real impediment. Focusing on the development of necessary technical, financial and management skill sets is crucial to support energy projects around the world.

Preparing a project and arranging for funding can account for between 5% and 10% of a project's costs and add several years to the project's development. It is critical to increase the number and the velocity at which projects are developed. The energy sector can establish standard procedures and best practices on the type of information – for example, technical assessments for wind power projects – as well as financial information required to allow investors to effectively and efficiently assess projects. Common practices, such as the EU infrastructure procurement procedures have facilitated investments in Eastern Europe. Emerging economies could look to adapt these best practice models as a means to efficiently build a pipeline of projects and the associated human capital to attract investments.

Benchmarking the sustainability of national energy systems

A second common energy goal for countries is to balance the three dimensions of the energy trilemma. The evolving challenges facing countries are vividly illustrated by the WEC's 2014 World Energy Trilemma Index. The Index is increasingly being seen as a benchmark for assessing good energy policy at a country level. It points to key areas that countries must give extra attention to in order to further develop a balanced energy profile and minimise the risk and uncertainties investors face due to an unbalanced approach. Comparative rankings highlight how a country is addressing the energy trilemma overall, as well as each of the three dimensions. The balance score provides a snapshot of how well a country manages the trade-offs between the three dimensions (see Figure 1 and Figure 2).⁶

Box 1: Energy trilemma dimensions

- ▶ **Energy security:** The effective management of primary energy supply from domestic and external sources, the reliability of energy infrastructure, and the ability of energy providers to meet current and future demand.
- ▶ **Energy equity:** The accessibility and affordability of energy supply across the population.
- ▶ **Environmental sustainability:** The achievement of supply- and demand-side energy efficiencies and the development of energy supply from renewable and other low-carbon sources.

⁶ Note, the sequence of the letters in the balance score does not correspond to a specific dimension but rather presents the letter scores in descending alphabetical order.

The results of the 2014 Energy Trilemma Index show that the top 10 countries are developed countries with higher shares of energy coming from low- or zero-carbon energy sources, supported by well-established energy-efficiency programmes. Beyond these commonalities, there are differences in energy resources and supply, such as large discrepancies in the use of nuclear energy. The differences reinforce the conclusion that there is no single solution, but that countries need to take full advantage of available indigenous resources where appropriate and develop policy frameworks that support energy sustainability through the value chain to the end user.

Figure 1

Top 10 Energy Trilemma Index performers overall and per dimension

Source: WEC/Oliver Wyman, 2014

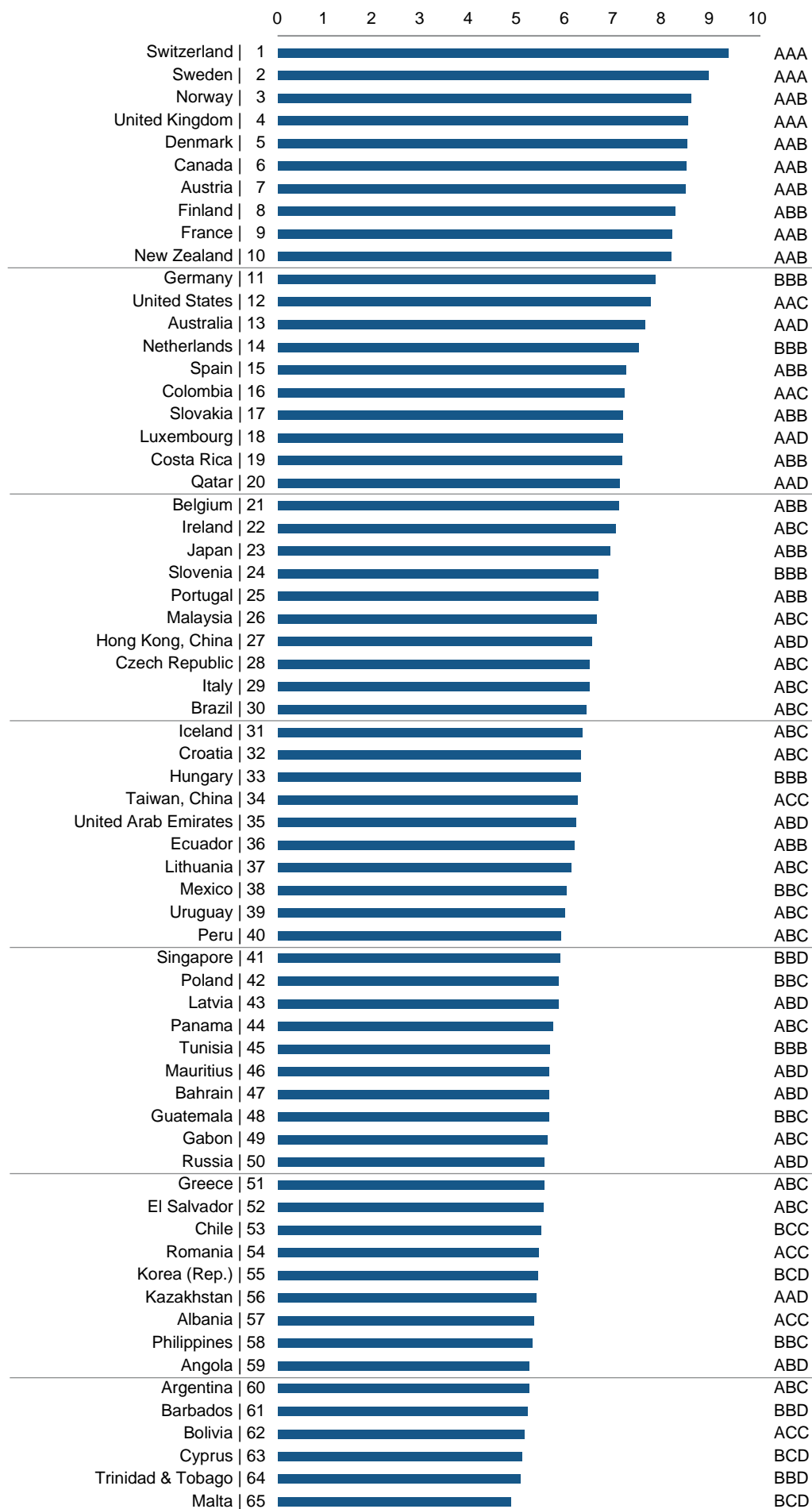


The 2014 Index rankings and balance scores also show changes for a number of countries – including high performers. Both Germany and Spain are showing downward trends since 2012 and have moved out of the top 10 overall ranking. Germany's changes are driven by rising prices for both gasoline and electricity and their impact on energy equity as the country works to transform its energy system. Germany's bold energy transition plans, which include the goals of increasing power generation from renewable sources, a reduction of primary energy usage and CO₂ emissions, and a phase-out of nuclear energy by 2022, require significant and costly changes to Germany's incumbent energy system. It is estimated that close to US\$470bn of investments are needed by 2033. Of this amount, about US\$280bn will be needed as soon as 2023. Renewable power generation will be the highest cost item, followed by investments in expanding distribution and transmission networks, including the introduction of smart meters. This alone will likely require around US\$110bn. Conventional power generation (including gas and new coal-fired power stations) and storage will require investments in the order of US\$60bn in order to secure supply given the intermittency of renewable power generation.⁷

⁷ Oliver Wyman, 2014: Financing Germany's Energy Transition, (Oliver Wyman Energy Journal)

Figure 2
2014 Energy Trilemma Index rankings and balance scores

Source: WEC/Oliver Wyman, 2014



Germany's challenges are symbolic of issues facing mature developed economies working to craft and finance a successful transition from an ageing energy system (largely built 50 years ago) to one that serves the needs of economies and societies for the next 50 years and beyond. It must also do so within sharply defined political constraints and changing business models. As further changes in rankings and balance scores may occur during the transitional period, Germany has been included in WEC's watch list. Additional countries on the watch list are the United Kingdom (UK), Japan, Italy, Mexico and the United Arab Emirates (UAE). Here, recent changes or unscheduled events that are not yet reflected in the data may lead to a change in Index performance, both positively in the case of Mexico and the UAE and negatively in the case of the UK, Japan and Italy.

By contrast, other countries have moved up the Index rankings with improvements in different dimensions. For example, the Philippines have continued their upward trend with constant improvements on all dimensions, including an increased diversity of electricity fuel mix. Yet the country continues to struggle with energy equity, as energy prices remain expensive and 17% of Filipinos continue to live without access to modern electricity services.⁸ In Latin America, Colombia strengthens its overall Index position and continues to benefit from the energy security and sustainability impacts of hydropower, but its performance is still somewhat unbalanced with a relatively lower performance on energy equity. Overall, however, as an active member of the Rio+20 Summit (the United Nations Conference on Sustainable Development), the country is seeing the benefits of a sustained policy focus on how to address its energy trilemma.

Over the next five years we can expect to see more changes in Index performance as recent investments and policy decisions begin to take effect. These include the effects of industrialised emerging economies' efforts to manage energy demand growth and enhance environmental sustainability, the continued rapid growth in renewable energy in developed and developing countries, the United Nations (UN) Sustainable Energy for All initiative beginning to make inroads, and the tapping of other energy resources. For example, one key area is in Africa, where huge resources remain untapped: it is estimated that only 7% of the continent's hydropower potential and less than 0.7% of its wind potential has been used.⁹ Using even a small proportion of these resources could have a transformational impact on the quality of life in Africa, as African countries economically progress and also on its contribution to the global economy.

Conclusion

There are significant challenges for governments, the energy sector and the financial community over the next 20 years and beyond to meet the projected investment needs to expand energy access, develop new energy technologies, replenish ageing infrastructure assets and associated supply chains, and make energy infrastructure more resilient. Greater engagement is needed from all stakeholder groups to build understanding and trust among policymakers, investors and the energy sector.

Leadership is needed from governments to set targets, develop strategies and create policies and regulations that give the energy and financial sectors certainty that their investments can be recouped and profits made, while meeting the needs of citizens and the economy as a whole.

⁸ Sustainable Energy for All (SE4ALL), 2013: Global Tracking Framework

⁹ The Economist, 2013: Lighting up Africa, 18 November, 2013

It is important for the energy sector to ensure that public policy is attractive and business-friendly by engaging in the policymaking process and sharing knowledge and feedback to overcome the information asymmetry. Together, energy leaders from the public and private sectors must actively engage the financial community, highlight the significant opportunities presented by energy sector investments, and find solutions to operate within the challenges.

As the energy system looks to be more market orientated, market dynamics become more important and, with competing demands for capital, external economics will play a more influential role in the success or failure of energy policy goals. The findings and recommendations in this report and the benchmarking the Energy Trilemma Index provides, can help to ensure that countries deliver the conditions to provide for sustainable energy systems.

Appendix A: Project participation

The project team would like to thank the individuals who informed the project's approach, supplied information, provided ideas, and reviewed drafts. Their support and insights have made a major contribution to the development of the report.

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Indonesia	Tanzania
Iran (Islamic Republic)	Thailand
Iraq	Trinidad & Tobago
Ireland	Tunisia
Israel	Turkey
Italy	Ukraine
Japan	United Arab Emirates
Jordan	United Kingdom
Kazakhstan	United States
Kenya	Uruguay
Korea (Republic)	Zimbabwe
Kuwait	

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