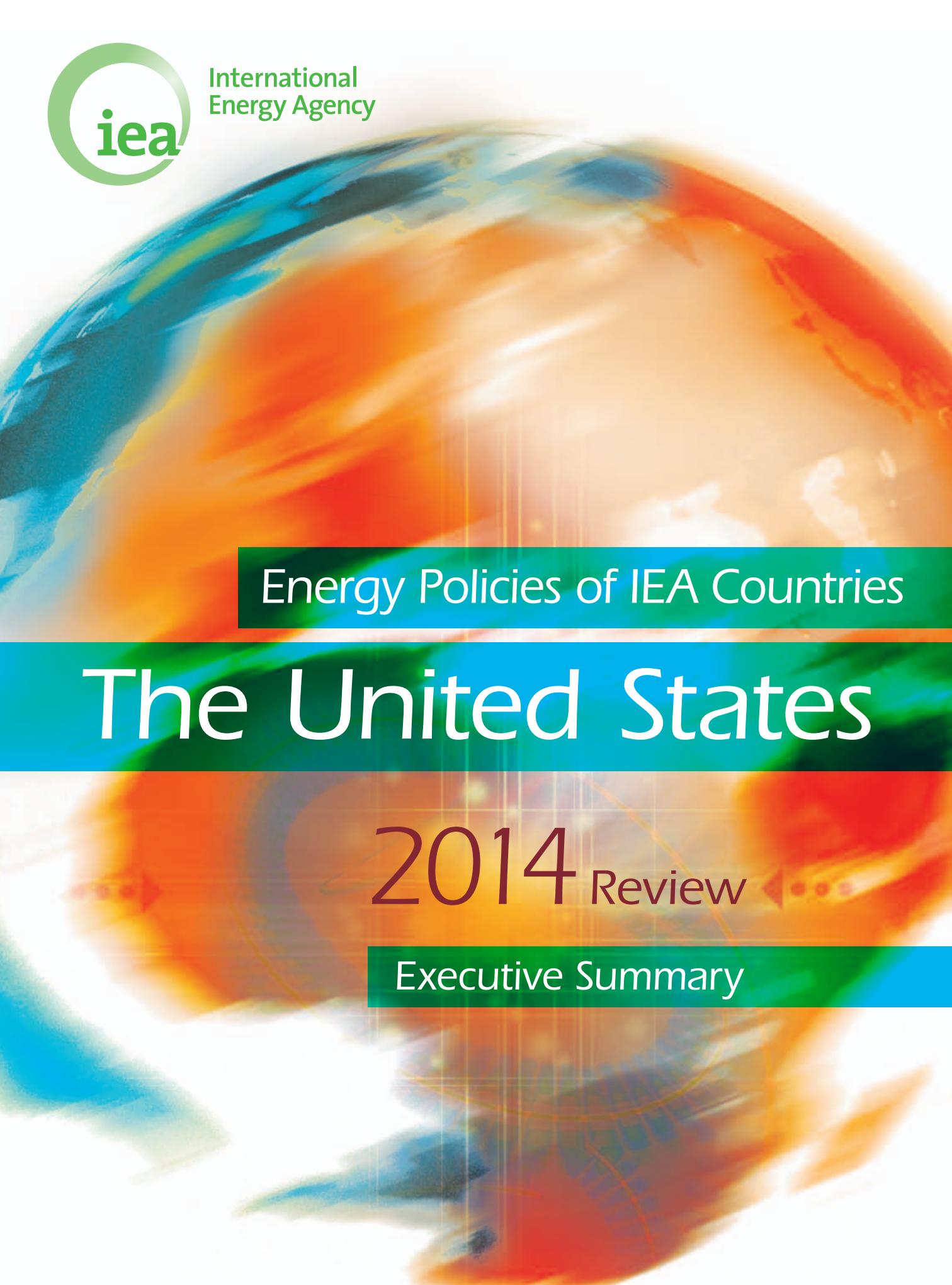
International
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Energy Policies of IEA Countries
The United States
2014 Review
Executive Summary

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Executive Summary

1. EXECUTIVE SUMMARY AND KEY RECOMMENDATIONS

EXECUTIVE SUMMARY

The energy policy framework in the United States has undergone significant change over the six-year period since the last in-depth review was completed. In many aspects there have been significant improvements and the country is well placed to continue to deliver a reliable, affordable and environmentally sustainable energy system. The most obvious trend to have emerged is the resurgence of oil and gas production where output had previously been assumed to be in decline. The growth in unconventional gas production has been a game-changing development in North American markets, and is making a substantial additional contribution to economic activity and employment, both within the energy industry and elsewhere by, for example, lowering energy and input costs for other industrial sectors.

Together with strong energy efficiency measures, notably in the transport sector, that are set to curb fossil fuel consumption, alongside regulations for new and existing power plants and other actions, this energy revolution is having far-reaching consequences for energy markets, greenhouse gas emissions (GHG), economic competitiveness and, potentially, for energy security, geopolitics and the global economy. Energy security has been strengthened over the past six years and rising domestic production of oil, shale gas and bioenergy alongside demand-side measures such as policies to support energy efficiency and reduce consumption in the transport sector could result in the United States becoming all but self-sufficient in net terms by 2035 (IEA, 2013a).

THE OIL AND GAS BOOM

Oil continues to be the most significant energy source, accounting for 36% of total primary energy supply (TPES) in 2013. The country produces just under half of its domestic demand for crude oil, including conventional oil sources, field condensates and other hydrocarbons such as shale oil. In 2012, the United States was the third-largest producer of crude oil in the world, behind Saudi Arabia and the Russian Federation. Domestic production was 13% higher in 2013 than in 2012, which was the second consecutive year of strong growth. Compared to 2003, production was 30% higher. An important factor is increased production of light tight oil, a turnaround that has had a dramatic impact for the North American oil industry. Furthermore, productivity of oil and natural gas wells is increasing in many basins as a result of the increasing precision and efficiency of horizontal drilling and hydraulic fracturing in oil and natural gas extraction.

Improvements in advanced crude oil production technologies, such as hydraulic fracturing, are widely expected to continue to lift domestic supply into the medium term. The renaissance that the oil industry is undergoing is largely the result of growth in light tight oil (LTO) production, a boom that is expected to continue until 2020 at least. The International Energy Agency (IEA) projects that production will level off from 2020 and then to start a gradual decline, as it becomes less economically attractive, compared with other sources (IEA, 2014c).

Another defining feature of the energy landscape in the United States has been the unexpected rise in shale gas production and the new-found abundance of inexpensive natural gas. Though shale gas (alongside other unconventional sources of tight gas and coalbed methane) has been produced for several decades, its production only started to expand after 2005, reversing the previous decline in gas production. Proved gas reserves have increased by almost three-quarters since 2000, up to 9.1 trillion cubic metres (or 323 trillion cubic feet) by end 2012, or the equivalent of more than 100 years of production at 2012 consumption rates. Natural gas production is projected to continue to increase over the period to 2040. Almost all of this increase is the result of the projected growth in shale gas production and two of the largest shale plays that have been identified, the Marcellus and Haynesville formations, which are among the largest known gas fields of any type in the world. With the advent of substantial shale gas production, the United States has moved quickly from two decades of increased dependence on imported gas to being a possible significant liquefied natural gas (LNG) exporter. With the approval of the Department of Energy for the export of LNG to countries with which the United States does not have a free trade agreement (FTA) forthcoming, the country has overcome an obstacle on the way to becoming one of the world's largest LNG suppliers.

A NEW ENERGY POLICY FRAMEWORK

Previously, many external and internal critics argued that the United States lacked a coherent national-level energy policy. Nonetheless, a number of strategic energy policy documents have been published over the past six years which go some way towards addressing such criticisms and guide the US economy away from its reliance on fossil fuels and towards a sustainable energy system with greater energy independence. The most notable among these policy documents are the "President's Blueprint for a Secure Energy Future" and the "All-of-the-Above Energy Strategy". The enactment of the American Recovery and Reinvestment Act of 2009 (ARRA) has also had significant impact on the sector by scaling up investment in energy infrastructure, clean energy projects and energy efficiency. By means of the ARRA, the Department of Energy (DOE) invested more than USD 31 billion to support a wide range of clean energy projects and technologies.

The President's Blueprint for a Secure Energy Future of 2011 provided a clear signal to policy makers and industry stakeholders, as well as to the public, as to the medium-term direction of federal energy policy: doubling of electricity generation from wind, solar and geothermal sources by 2020, halving net oil imports by the end of the decade and doubling energy productivity by 2030 as well as providing international leadership in clean energy. The "All-of-the-Above" strategy, announced in 2012, established three clear goals: support for economic growth and job creation, enhanced energy security, and deployment of low-carbon energy technologies, all supported by a series of defined policy actions.

The previous in-depth review also highlighted the absence of a clear link at the federal policy level between energy, environmental and security policies, and recommended that the United States pursue closer co-ordination among Congress, the Administration, and state governments, as well as between executive and legislative branches of the federal government. It also emphasised the need for greater co-ordination in order to ensure that energy policy challenges facing the country were addressed in a consistent manner. In this respect, the IEA welcomes the establishment of a quadrennial energy review (QER). The first-ever QER will focus on energy infrastructure and will identify the threats, risks and opportunities for US energy and climate security.

Many executive departments and agencies play an important role alongside the DOE in developing and implementing policies, such as those governing energy resources and their associated environmental impacts. Many non-federal actors, such as the private sector, the states and academia also make a significant contribution to energy policies. There are also many regional, state and local policies and initiatives that complement federal efforts. The President established an interagency Quadrennial Energy Review Task Force, to develop an integrated review of energy policy that integrates all of these perspectives. The IEA welcomes this review of energy policy, which is expected to build on the Blueprint for a Secure Energy Future and the President's Climate Action Plan.

BUILDING A SUSTAINABLE ENERGY SYSTEM

Climate and greenhouse (GHG) gas policy remains an unsettled and disputed area of energy policy between the executive and legislative branches of government. In 2009, at the negotiations of the United Nations Framework Convention on Climate Change (UNFCCC) in Copenhagen, the President committed the United States to the goal of reducing GHG emissions in the range of 17% from 2005 levels by 2020 in conformity with any legislation.[1] More recently, at a speech in Georgetown University on June 2013, the President confirmed his willingness to work with Congress towards enacting a bipartisan, market-based scheme to reduce GHG emissions. He also highlighted the need to take executive branch actions in the absence of congressional support (Leggett, 2014). The Climate Action Plan (CAP), released in June 2013, sets forth a series of executive branch actions that, with Congress unlikely to enact major climate legislation, uses executive powers under existing laws to reduce emissions. The most significant reduction under the plan is likely to come from the Environmental Protection Agency (EPA) which is called on to develop regulations to control CO_2 emissions from power plants, similar to existing federal limits on emissions of arsenic, lead and mercury (Leggett, 2014).

In June 2014, the EPA proposed the Clean Power Plan to cut carbon pollution from existing power plants. The EPA has put forward state-specific, rate-based goals for CO_2 emissions from the power sector, as well as guidelines for states to follow in developing plans to achieve the state-specific goals. This rule, to be in place by 30 June 2016, builds on existing measures to reduce CO_2 emissions similar to existing federal limits on emissions of arsenic, lead and mercury. EPA rules to introduce standards, regulations or guidelines for CO_2 emissions in existing power plants must be finalised by June 2015 and in place by 30 June 2016.

Energy efficiency policies have the potential to boost economic growth while reducing energy demand. In this regard, the United States has made good progress, and improvements are expected to continue over the medium term, as energy performance standards for appliances and equipment and for new buildings are implemented. The ARRA provided USD 12 billion for investment in energy efficiency programmes, notably in favour of low-income households, public buildings and research activities. Energy efficiency standards for new buildings have been progressively tightened over the past decade, culminating in the recent introduction of two new model building energy codes covering both residential and commercial buildings. These codes are projected to produce a 30% improvement in the energy efficiency of new buildings compared to buildings constructed to comply with

1. On 11 November 2014, the United States and China made a joint announcement on climate change and clean energy co-operation. As part of this co-operation, President Obama announced a new target to cut net GHG emissions 26% to 28% below 2005 levels by 2025.The possible impact of this announcement is not included in our analysis.

the 2006 model code (IEA, 2013b). Since 2008, over one million low-income homes have been weatherised to improve energy efficiency. Furthermore, minimum energy performance standards (MEPS) for household appliances and commercial equipment have been strengthened and approximately 20 new standards have been completed since 2009, with more expected over the medium term.

In the transport sector, which is the largest oil consumer, new regulations have been introduced to reduce energy consumption. In 2012, federal agencies finalised a programme to improve the fuel economy of cars and trucks sold in the United States. More stringent fuel economy standards for light-duty vehicles model years 2012-16 (phase one) and model years 2017-25 (phase two) have been established alongside standards for heavy-duty vehicles for model years 2014-18. These fuel economy standards for vehicles are projected to save about 6.3 billion barrels of oil over the life of light-duty vehicles built from 2012-24 model years and heavy-duty vehicles built from 2014-18 model years, which is equivalent to almost one-half of US oil imports in 2012 (IEA, 2013a).[2] The country is also investing in electric vehicle technologies and by 2015 will be able to produce enough batteries and components to support the manufacture of one million plug-in hybrid and electric vehicles.

Smart grids have developed significantly over the past five years. Approximately 33 million households are equipped with advanced meters, and the number of measurement points on the transmission and distribution networks has increased by several orders of magnitude. Funding for research and development from both the public and private sectors of the technology has been strong although declining in the latter case. Despite the advantages offered by investment in smart grids – for example demand response – integration of renewables and resilience, market take-up has been slow. Market frameworks and regulations should encourage private-sector investment in these advanced technologies and practices. Recent developments regarding demand response are encouraging and the deployment of smart grids, smart meters and smart devices should drive down costs. Demand response also includes the development of time-of-use retail prices for electricity, which remain underdeveloped. Greater co-ordination between federal and state policies can benefit all stakeholders and create a larger market for demand response technologies. In particular, state retail demand-response programmes and policies can be better co-ordinated with organised wholesale market programmes.

The United States has set a goal to double renewable energy production from wind, geothermal and solar sources by 2020 compared to 2012, but there is no explicit national policy mechanism to ensure the country reaches this target, although many states have put in place renewable portfolio standards (RPS). In the absence of explicit national obligations or a binding national target, one of the key tools the federal government has at its disposal to support renewable energy is fiscal mechanisms. The durability of existing federal tax incentives for some forms of renewable energy, however, remains a persistent uncertainty. In early 2013, the federal government extended for one year its renewable energy production tax credit (PTC) for wind. With a one-year federal PTC extension granted in early 2013, a more robust outlook for onshore wind projects has emerged, at least during 2014 and 2015. Yet, there is uncertainty over whether there may be another renewal of the PTC. Such uncertainty continues to undermine investor confidence and contributes to the volatile pattern of annual wind deployment.

2. EPA and NHTSA are developing, in collaboration with the California Air Resources Board, plans to extend the Heavy-Duty National Program beyond model year 2018.

Alternatively, extending the PTC for a fixed period of time while gradually reducing its level to zero on a permanent basis would provide greater investor certainty and spur continued reductions in wind costs. Similar uncertainties exist for solar energy incentives. Furthermore, proposals to amend the US renewable fuels standard have created difficulty in the market for renewable transport fuels. Lack of long-term durability associated with federal incentives represents a challenge for investment in new projects that must be addressed.

The federal government remains one the largest funding entities for energy technology research, development and demonstration (RD&D) in the world, and energy RD&D has historically played a critical role in achieving advances in all fields of energy, including nuclear, fossil fuels, renewables, and end-use technologies. The DOE's 2014 Strategic Plan provides a path to achieving national energy goals and demonstrates the government's firm commitment to basic research, development, demonstration and deployment of priority clean energy technologies. The quadrennial technology review (QTR) is providing a platform to help align energy technology and programme priorities to achieve national energy goals and guide the Department's priority-setting over a five-year horizon. The government should continue to develop approaches to secure a stable, long-term funding environment which would help meet energy technology goals and avoid negative impacts on programme stability.

The push to develop unconventional sources of gas in the United States using hydraulic fracturing techniques has attracted a great deal of criticism on environmental grounds. For example, greater volumes of associated gas as a by-product of oil production are being flared as there is little incentive to market the associated gas or build and upgrade the necessary infrastructure needed to transport it. The publication in March 2014 of Strategy to Reduce Methane Emissions is a welcome step. Water use also presents a problem as shale gas production may consume large volumes of water. Wastewater, if not properly treated, can threaten supplies of drinking water. As more and more areas of the United States are opened up to exploration and production, public concern about the environmental effects on water resources as well as road use/degradation, local traffic, ecosystems and urban disruption is likely to grow. The environmental consequences of hydraulic fracturing are not only of interest in the United States but worldwide as new areas of rich shale gas plays are being explored. The United States has a significant leadership opportunity to develop and showcase best practice at a time when other countries seek to benefit from this resource.

The boom in oil production has also given rise to new environmental and safety concerns. One example is the lack of pipeline infrastructure or where existing pipelines lack sufficient available capacity, which in some regions has forced unprecedented amounts of oil to be transported by rail. The exponential growth in the amount of crude oil having to be moved by rail has given rise to safety and environmental unease and a number of serious accidents have occurred across North America, some of which involved oil being moved from the Bakken Shale (which tends to be more volatile and flammable than crude produced elsewhere). United States rail infrastructure was not built to manage large volumes of crude oil and has a limited amount of specially designed rail trucks. If large movements of oil by rail are to continue, major investments in infrastructure need to be made alongside significant strengthening of safety regulations such as those proposed by the Department of Transport in July 2014.

SECURING THE LONG-TERM STABILITY OF THE ELECTRICITY SECTOR

Since the last in-depth review, the electricity sector in the United States has experienced considerable changes. The arrival of inexpensive domestically produced natural gas has resulted in stable wholesale electricity prices and delivered other benefits such as lower GHG emissions when replacing coal and greater system flexibility. Nonetheless, if natural gas is to continue to play a key role in the electricity sector, there is a need to improve consistency between the operation of the gas pipeline system and the high and extra-high voltage power transmission system. While both systems are regulated by the Federal Energy Regulatory Commission (FERC), and in fact there is a series of gas-electricity co-ordination initiatives that FERC has put in place, the two systems' different regulatory and business models mean there is a need to better co-ordinate operations, as well as market and planning rules, in order to address increasing interdependence of the two systems.

The New Policies Scenario described in IEA *World Energy Investment Outlook 2014* projects that the US power sector will require USD 2.1 trillion of new investments between 2014 and 2035. This cumulative investment includes 579 gigawatt (GW) of new generating capacity, 260 000 km of new transmission lines, 1.3 million km of new distribution lines and extensive refurbishment of both the transmission and distribution networks (IEA, 2014b). The Energy Independence and Security Act of 2007 made it "the policy of the United States to support the modernization" of the electrical grid. The Edison Electric Institute (EEI) highlighted over 170 planned projects totalling approximately USD 60.6 billion in transmission investments through to 2024 that are required to modernise the transmission system (EEI, 2014). Three-quarters of this investment relates to projects supporting the integration of renewable resources and 43% to interstate transmission projects (projects may fall into more than one transmission investment category). The EEI highlighted the need for effective policies for planning and siting, cost allocation and cost recovery in order to achieve the levels of transmission investments required for a reliable and cost-effective service to electricity customers. The decision of President Obama in June 2013 to sign a Presidential Memorandum that directed federal agencies to streamline the siting, permitting and review process for transmission projects across federal, state and tribal governments represents good progress in this regard but more is needed.

System resilience, especially in the aftermath of Hurricane Sandy and other recent weather-related reliability events, remains a concern. The response to Hurricane Sandy by the federal government, led by DOE and the Federal Emergency Management Agency (FEMA), can be considered a model for future federal-state-local disaster relief and co-ordination of service restoration. Lessons learned will be carried forward in managing a future emergency response.

The existing electricity system delivers relatively inexpensive electricity to consumers across the country, and over time several regional transmission organisations (RTOs) and independent system operators (ISOs) have emerged. These entities have developed operating rules and protocols that allow generation dispatch and transmission co-ordination over increasingly wide geographic areas and that bring many benefits in terms of efficient use of existing assets and minimisation of electricity costs to consumers. Conversely, even between well-integrated RTOs in the Northeast, there are inefficiencies in the interregional co-ordination between the various system operators such as mid-continent independent system operator (MISO), PJM interconnection, New York independent system operator (ISO) and ISO New England.

Achieving the right balance between consolidation of system operators and co-ordination between these systems is important for the efficient regional integration of electricity markets (IEA, 2014a). While all RTOs have adopted locational marginal pricing, there remains a considerable degree of diversity in the design of capacity markets and the lack of harmonisation between RTOs is a concern. To the extent that these capacity markets are justified by federal regulation (there is a cap on electricity bids in these markets), FERC should seek to achieve greater harmonisation and co-ordination of capacity markets.

Owners and operators of critical energy infrastructure have long had the operational duty to maintain their system security and reliability against threats from physical damage, weather and other hazards. However, over the previous two decades, the threats to energy delivery systems have expanded as a result of the increased use of automation, information technology (IT), telecommunications and other electronic communication-enabling devices. DOE, in collaboration with industry and other partners in the federal government, has released a Roadmap to Achieve Energy Delivery Systems Cybersecurity, which features a strategy and related milestones for addressing cybersecurity in the energy sector. The roadmap is used to collaborate with industry on specific research and development (R&D) projects, as well as operational guidance documents for energy stakeholders, including recent efforts with the Administration, the Department of Homeland Security (DHS), the National Institute for Standards and Technology (NIST) and FERC. With the modernisation of the grid, there are many cybersecurity challenges. The new technology is both advanced and complex and will contain vulnerabilities that may be exploited. It is important, therefore, to ensure the reliability and resilience of the sector regardless of cybersecurity events. Industry, with collaboration and leadership from DOE, is continuing to advance its cybersecurity and resilience capabilities to meet the growing cybersecurity risks in the energy sector.

There is a concern that competitive electricity markets may not trigger investments in large, high fixed-cost investments with long lead time such as nuclear, carbon capture and storage (CCS) and large renewable portfolio projects. This could result in a lack of diversity in the generation portfolio, exposing consumers to the risk of rising gas prices in future. The federal government should continue its efforts to create a better and consistent national regulatory framework to ensure resource adequacy over wider geographic areas and make the most of existing infrastructure.

The United States has long been a leader in nuclear technology and has a mature industry with high availabilities and low stable costs alongside an established regulatory environment. In the recent past, however, the retirement of four reactors has led to the first significant decline in nuclear capacity for many years. This has happened as many other reactors are moving into extended lifetime operation and in a period when only four new reactors are under construction. The economic basis of nuclear power has been severely challenged by competition from shale gas developments as well as weak power prices and slow growth in electricity demand. The domestic nuclear industry is therefore at a critical juncture as a consequence of its declining economic competitiveness, and existing market mechanisms do not favour investment in high capital-intensive nuclear technology. There is a need, therefore, to develop and articulate a clear strategy for nuclear power, including a statement of how the federal government will provide long-term support. Given the long lead times for construction and the declining share of nuclear power in the energy mix, these considerations should be concluded quickly.

KEY RECOMMENDATIONS

The government of the United States should:

- *Complete the process leading to the quadrennial energy review (QER) and utilise its outcomes to re-establish a stable and co-ordinated strategic outlook for the energy sector.*
- *Maintain its path towards a secure sustainable energy system by:*

  Supporting the development and implementation of demand-side measures and energy efficiency policies with an emphasis on the transport and building sectors.

  Offer greater durability and predictability of fiscal incentives for renewable energy in order to maintain investor confidence.
- *Enhance the long-term sustainability of the electricity sector by:*

  Developing effective, co-ordinated national policies to reduce the uncertainties which impede investments in secure electricity infrastructure, including transmission, distribution, smart grids, renewable energy integration and climate resilience.

  Introducing measures to deliver greater co-ordination between different grid operators in order to facilitate the integration of greater shares of variable renewables and to optimise regional transmission investments.

  Articulating a clear strategy for the future diversity of the power sector, including a statement of how the federal government will provide long-term support for nuclear power.

References

EEI (Edison Electric Institute) (2014), *Transmission Projects at a Glance*, EEI, March.

IEA (International Energy Agency) (2014a), *Seamless Power Markets: Regional Integration of Electricity Markets in IEA Member Countries*, OECD/IEA, Paris.

IEA (2014b), *World Energy Investment Outlook Special Report*, OECD/IEA, Paris.

IEA (2014c), *World Energy Outlook 2014*, OECD/IEA, Paris.

IEA (2013a), *World Energy Outlook 2013,* OECD/IEA, Paris.

IEA (2013b), *Energy Efficiency Market Report 2013: Market Trends and Medium-Term Prospects,* OECD/IEA, Paris.

Leggett, Jane A. (2014), *President Obama's Climate Action Plan*, Congressional Research Service, Washington, D.C., May.

Energy Policies of IEA Countries

The United States

Since the last IEA review of the United States was published in 2008, the country's energy policy landscape has fundamentally changed. In many aspects there have been significant improvements, and the country is in a strong position to deliver a reliable, affordable and environmentally sustainable energy system.

The most obvious change has been the renaissance of oil and gas production: the growth in unconventional gas production, alongside increased output of light tight oil, is making a substantial contribution to economic activity and competitiveness. Conversely, the expansion in energy production is also raising unease on environmental and safety grounds, concerns which must be addressed appropriately.

The U.S. natural gas boom has resulted in stable wholesale electricity prices, lower greenhouse gas emissions and greater system flexibility. The electricity system, however, is in need of significant investment if the country is to meet demand growth forecasts and strengthen its resilience to climate change. Renewable energy production is growing but the durability of federal tax incentives remains a persistent uncertainty.

At policy level, a number of strategic initiatives have created a new policy framework over the past six years. Among them, the Climate Action Plan has the potential to guide the U.S. economy away from its reliance on fossil fuels and towards a more sustainable energy system.

This review analyses the energy policy challenges facing the United States and provides recommendations for further policy improvements. It is intended to help guide the country towards a more secure, sustainable and affordable energy future.