ENERGY POLICIES OF IEA COUNTRIES

EXECUTIVE SUMMARY

New Zealand

2017 Review

International Energy Agency

Secure
Sustainable
Together

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INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA), an autonomous agency, was established in November 1974. Its primary mandate was – and is – two-fold: to promote energy security amongst its member countries through collective response to physical disruptions in oil supply, and provide authoritative research and analysis on ways to ensure reliable, affordable and clean energy for its 29 member countries and beyond. The IEA carries out a comprehensive programme of energy co-operation among its member countries, each of which is obliged to hold oil stocks equivalent to 90 days of its net imports. The Agency's aims include the following objectives:

- Secure member countries' access to reliable and ample supplies of all forms of energy; in particular, through maintaining effective emergency response capabilities in case of oil supply disruptions.
- Promote sustainable energy policies that spur economic growth and environmental protection in a global context – particularly in terms of reducing greenhouse-gas emissions that contribute to climate change.
- Improve transparency of international markets through collection and analysis of energy data.
- Support global collaboration on energy technology to secure future energy supplies and mitigate their environmental impact, including through improved energy efficiency and development and deployment of low-carbon technologies.
- Find solutions to global energy challenges through engagement and dialogue with non-member countries, industry, international organisations and other stakeholders.

IEA member countries:

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The European Commission also participates in the work of the IEA.

International Energy Agency
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International Energy Agency
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1. Executive summary

Progress and challenges

The energy markets and policy environment in New Zealand have seen rapid changes during the six years since the IEA presented the last in-depth review in 2010. New Zealand has an effective energy-only market. It is a world leading example of a well-functioning electricity market, which continues to work effectively. Amid concerns of price spikes and reliability of supply during the 2000s, the government has implemented a series of reforms to strengthen competition and security of supply in the electricity market following the Ministerial Review of 2010. It has adopted a national energy strategy for 2011-21 and related energy efficiency strategy. It issued a national statement on renewable energy in 2011. It revised the petroleum and minerals regulatory and royalty regime in 2013 to enhance resource development. All these actions contributed to a more reliable, affordable and environmentally sustainable energy system in New Zealand.

The country is endowed with a diverse range of energy sources, notably renewables. Among IEA member countries, New Zealand has the highest penetration of geothermal energy and a significant contribution from hydro. Without any direct subsidies or public support, their share in electricity and heat supply has grown in recent years, as a result of cost-competitive geothermal and hydro and very good conditions for wind power. This performance is a world-class success story among IEA member countries.

Greater market efficiency was expected from the partial privatisation of the three main state-owned generator-retailers (referred to as “gentailers”), and the virtual asset swaps between these corporations, including the sale of Tekapo A&B stations in the South Island (from Meridian Energy to Genesis Energy). The reforms included the renewal of the regulatory framework for the electricity sector. The Electricity Industry Act 2010 established the Electricity Authority (EA) as the regulator of the electricity markets with a mandate to promote competition, reliable supply and the efficient operation of the electricity sector for the long-term benefit of consumers. Improvements derive from market facilitation actions to encourage consumers to switch supplier, to reduce market barriers through continuous reviews of the Electricity Industry Participation Code. The Electricity Authority supports the development of financial markets by introducing financial transmission rights (FTRs) and encouraging cap products. All of these measures, including new spot-price derivative products with the Australian Stock Exchange (ASX future contracts) improve market-based risk management against high spot prices.

In recent years, the market has been able to ensure security of supply and avoid major price spikes during years of lower hydro storage levels, as in 2012. Information provided by Transpower’s adequacy assessments facilitated the conclusion of commercial

agreements by market participants to ensure adequacy in future years. In 2010, the government decided to abolish its reserve mechanism and introduced a new mechanism which requires all retailers to compensate their customers in the advent of a public conservation campaign in a dry year.

Energy system transformation

Besides electricity market reforms, the government has adopted a number of new energy policy initiatives. Since the last IEA in-depth review in 2010, a key development has been the release of the New Zealand Energy Strategy (NZES) (2011-21) and the New Zealand Energy Efficiency and Conservation Strategy (NZEECS) (2011-16). These strategies provide a clear set of overall policy priorities, and some specific targets, which complement the New Zealand Emission Trading Scheme (NZETS). In 2016, New Zealand adopted an electric vehicle programme which targets the doubling of the electric vehicles (EVs) fleet every year to reach around 64 000 EVs by the end of 2021.

Market liberalisation, relatively low international fuel prices, decarbonisation and rapid technological change are precipitating the transformation of the economy. New Zealand's energy sector is still dependent on the use of oil, natural gas and coal, is already facing a number of challenges in terms of the future use of fossil fuels in the economy, amid low international fuel prices and the commitments made to reduce emissions under the Paris Agreement. Domestic hard coal production is on the decline, mines are being closed, the coal industry is restructuring amid low international coal prices.

The electricity system is experiencing significant shifts including the decreasing use of fossil fuels and a higher contribution from hydro, geothermal and, increasingly, wind and solar photovoltaics (PV). Over the past decade, the energy intensity of the economy remained stable, despite solid GDP growth. This, however, hides changes across the sectors. Energy savings in the residential sector were offset by growing energy intensity in the industry sector and stable efficiencies in the transport sector. The largest increase in greenhouse gas (GHG) emissions stems from energy-related carbon dioxide (CO_2) emissions that grew by 44% between 1990 and 2014, primarily from transport and electricity and heat.

New Zealand's 2021-30 target is to reduce GHG emissions to 30% below 2005 levels by 2030, curbing an increase in emissions in the recent past. Under the Kyoto Protocol, the NZETS has been the main tool to reach this target. The government is currently reviewing the NZETS in order to strengthen carbon pricing. In May 2016, the government passed legislation to phase out the "one-for-two" transitional measure which up to now allows non-forestry businesses to pay for one emission unit for every two tonnes of carbon dioxide-equivalent emissions. However, the carbon price alone is unlikely to be the sole driver of the energy sector transformation, notably in transport. Half the light fleet consists of vehicles imported second-hand and there are no blending requirements for alternative fuels nor vehicle fuel economy or emission standards outside vehicle exhaust emission rules.

Next to changes in the fuel mix of the sectors and the role of different fuels, New Zealand will have to address energy system challenges in the course of its energy transition. These include the longer-term prospect of electrified transport, the increase in geothermal energy, or the greater use of bioenergy in the industry and power sectors.

The use of natural gas and coal in power generation has declined, largely replaced by geothermal. Conversely, residential gas use has seen a strong increase. Geothermal has doubled its share of the energy mix, however, its related (for some reservoirs significant) GHG emissions may bring about new challenges. New Zealand's farming industry strongly relies on coal use (domestic lignite) for process heat, and current carbon prices do not encourage biomass co-firing or the switch to solid biomass in agriculture.

Looking ahead to 2030, New Zealand has yet to adopt additional policies required for the investment in decarbonising the economy up to 2030 and beyond, towards 2050. Current energy efficiency targets and carbon price policies are not sufficient.

With a view to implement the Paris Agreement, the government should reassess its policies and adopt sectoral energy action plans, notably for the transport, built environment and industry sectors. New technology choices in the energy system (solar PV, electric vehicles, smart grids and storage) may have implications for electricity demand and system operation. In 2016, the government is preparing a refreshed NZEECS and new energy targets, which will need to be consistent with the Paris Agreement and the trends in efficiency and GHG emissions.

Special focus 1: Renewable electricity towards 90%

An electricity system based more and more on renewables will be at the heart of the energy system transformation. Over the past years, the share of renewable electricity has further increased in the power mix and reached 80.2% in 2015. New Zealand ranked second after Norway among IEA member countries and has ambitions to expand the contribution from renewable energy sources to 90% by 2025. Target achievement is likely to rely on a stable contribution with small additions from hydro generation (with inevitable variations in rainfall levels); further expansion in geothermal generation; investment in generation from wind; and perhaps also a continued growth of the residential solar PV market.

New Zealand's power system can accommodate further renewables in meeting the 90% target without raising issues of power system security. If growth relies predominantly on geothermal and hydropower, operational impacts will be limited as both provide baseload generation. To date, New Zealand's market design and operation of an energy-constrained system offer a high degree of operational variability, and the system has managed peak and seasonal demand variability successfully for decades. The transmission system operator Transpower is experienced and adept at managing supply and demand adequacy, and the power system demonstrates considerable flexibility and resilience. Other IEA member countries could learn from this experience.

The seasonal electricity demand profile and the negative correlation of many relevant variable renewable energy (VRE) resources with demand make the integration of VRE challenging, despite some good correlation of wind and hydro. However, the distribution of generation between the two interconnected islands, and significant uncertainties around future supply and demand patterns can create challenges. New Zealand has had a lack of long-term visibility of natural gas production for many years. The main backup Huntly coal- and gas-fired power plant is reaching the end of its lifetime and New Zealand's aluminium smelter, which currently takes 15% of total electricity demand, has an option to end its contract and presence.

New Zealand's power system is well placed to accommodate more variable renewable energy sources (RES) but, as IEA experience suggests, more substantial market shares may have implications for efficient market operation and maintaining power system security.

With growing shares of wind and solar power, as well as electric vehicles, the transmission system operator (TSO), distribution companies, regulators and policy makers have to manage the impact on the operational security of the power system, including in dry years, and notably at electricity distribution levels. They have to enhance the market design to maximine the energy security benefits from seasonal availability of the renewable electricity portfolio and that load management can contribute to alter load patterns to meet supply. This can be facilitated by market rules that are suitable to the variable dispatch, by efficient transmission pricing, shorter gate closures, full participation of wind generators to bidding for dispatch and ancillary services market, as well as by the flexibility required from retail demand-side response.

With higher shares of variable renewable energies in a small, energy-constrained and isolated energy system, like New Zealand, the market design of the electricity retail and distribution sectors and electricity security will need to be kept under review.

Special focus 2: Electricity distribution development

New Zealand's electricity distribution sector is facing a period of rapid change, following the widespread deployment of advanced interval metering and the emergence of new technologies (electric vehicles, battery storage, and rooftop solar PV). These developments provide an opportunity to consider more efficient, innovative, cost-effective and responsive electricity markets throughout New Zealand, which can deliver a range of benefits for all electricity consumers. However, these developments also have the potential to radically transform the distribution system use and power flows, making the systems far more dynamic and complex to manage in an efficient and secure manner.

Distribution businesses will be at the forefront of managing these challenges. At present the distribution sector has 29 separate businesses − some large, some very small – with a range of ownership structures, including private companies, local governments and many consumer- or community-owned trusts; 17 of the 29 distributors are regulated under a price-quality path regulation by the Commerce Commission. The other 12 are exempt but have to publish performance information annually, which is evaluated by the Commerce Commission.

Concerns have been raised about the financial, technical and managerial capability of the distribution sector to respond effectively to this challenge. No evaluation has been made with regard to the productivity of the distribution companies and their capacity to efficiently and cost-effectively invest in the monitoring, management and control systems required to maintain reliability as distribution systems become more complex and subject to more dynamic real-time power flows. Concerns have also been raised about the governance and decision-making capability of the distributors and their capacity to manage this potentially complex transition in an efficient and timely manner that will help to realise the potential benefits for consumers. Recent independent audits conducted by the Auditor General have revealed several examples of investment decisions that appear inconsistent with prudent management practices. The wide range of managerial

approaches and governance arrangements, as well as connection agreements applied within the distribution sector, are reflected in a myriad of different operational and investment practices, which may reduce sector efficiency and unduly increase the cost of co-ordinating investment and operational activities. Emerging technologies and sector consolidation change the nature of competitive and regulated activities, posing challenges to the current regulatory approach.

In view of these concerns, it would be prudent for the government to examine opportunities to improve the investment and operational incentives governing the performance of the distribution sector. For instance, opportunities may exist to harness economies of scale, to invest more cost-effectively and to improve the quality of management through more integrated regional operation and management of distribution networks.

A range of options could be considered, including:

- regional service and management agreements between distributors
- formation of joint ventures to manage and operate distribution assets on behalf of distributors
- amalgamation of distributors.

The government should encourage the development of more efficient structural arrangements by the distribution sector in close consultation with other key stakeholders. The New Zealand Productivity Commission could be well placed to review the electricity distribution sector, with a view to identifying opportunities to improve the sector's productivity, flexibility and its capacity to more effectively respond to the challenges. Such a review should examine the sector's structure, governance and options for encouraging the sector to develop a more integrated regional management, operation and the development of distribution networks. In addition, the Commerce Commission has the role of analysing the performance of electricity distributors.

As distribution activities increase, there is also an opportunity to review the scope and nature of the price-quality path regulation to ensure more consistent and comprehensive incentive-based regulation of the distribution sector. The introduction of more effective management across the sector may serve to reinforce the incentives for more efficient performance through price-quality path regulation.

Regulation of distribution will need to take account of the new investment and operational environment to make sure that it does not create undue regulatory risks or costs for distributors. In particular, the government should ensure that sufficient flexibility is provided to accommodate timely and prudent investment in "smart grid" and related network control technologies in the context of the current review of price-quality path input methodologies. There may also be opportunities to complement the existing price-quality path framework with innovative performance-based incentives, including initiatives to encourage the procurement of demand response, energy efficiency, distributed generation and other local network management resources where it is efficient and cost-effective to do so.

Potential barriers to the development of more cost-reflective, real-time distribution pricing, including various forms of peak pricing and capacity charging should also be examined in the context of the various reviews currently under way. Consideration should also be given to the future of the low fixed-charge tariff/regulation, especially as more flexible and efficient products for harnessing demand response and energy efficiency begin to emerge. Consistent application of the regulatory regime would also allow for the simplification of existing distribution arrangements, especially those relating to distribution charges and connection agreements. This may help to remove a potentially significant barrier to entry for new retailers, and to strengthen effective retail competition, customer choice and access to a range of more innovative products and services. The Electricity Authority is currently reviewing distribution pricing and has recently proposed to extend the distribution sector regulatory framework through a default distribution use-of-system agreement. This proposal seeks to standardise such agreements by updating and making mandatory an existing set of model terms and conditions.

Energy security

Natural gas in New Zealand is 100% domestic, a by-product of oil exploration. The country does not have a liquefied natural gas (LNG) terminal for imports but it has now a gas storage facility and its two pipeline systems are now owned and operated by one company. The role of natural gas has grown in the residential/commercial sector, power generation, and industry (methanol production). For decades, the long-term availability of natural gas reserves has not been publicly known beyond 3 to 5 years, and no major finds were made in recent years. This continues to have significant implications for the future of industry and residential demand.

Domestic oil reserves are declining fast and the country is relying on global product markets. The refining and downstream market is in the process of consolidation, with fewer players present, while international oil companies have decreased their investments in New Zealand's upstream sector, amid a low oil-price environment. All of New Zealand's oil stocks are held on a commercial basis with the country having no strategic oil stocks and not placing any stockholding obligation on industry. The commercial stocks alone are not sufficient to meet the countries' 90-day obligation under the IEA rules and the government resolved this issue a decade ago by purchasing "ticket" contracts with oil stockholders in other IEA countries, which are now financed by a levy on oil users.

New Zealand's energy system is unique in many respects: Its geographical remoteness and low population density, and isolation from the global energy markets supply chain mean that it must be robust against sudden changes in energy supply/demand, which impact New Zealand's economy and its globally competing energy-intensive industries (steel, aluminium and agriculture). Specific structural issues remain, notably the market dominance of the five major vertically integrated generator-retailers (gentailers), three of which remain majority state-owned enterprises. New Zealand's hydro resources have limited storage and cannot ensure multi-seasonal water management due to low storage - an average of around 6 to 10 weeks in New Zealand. Hydropower is largely situated in the South Island and

transported along the thin transmission grid through the high-voltage direct current link to the North Island, where most demand is located.

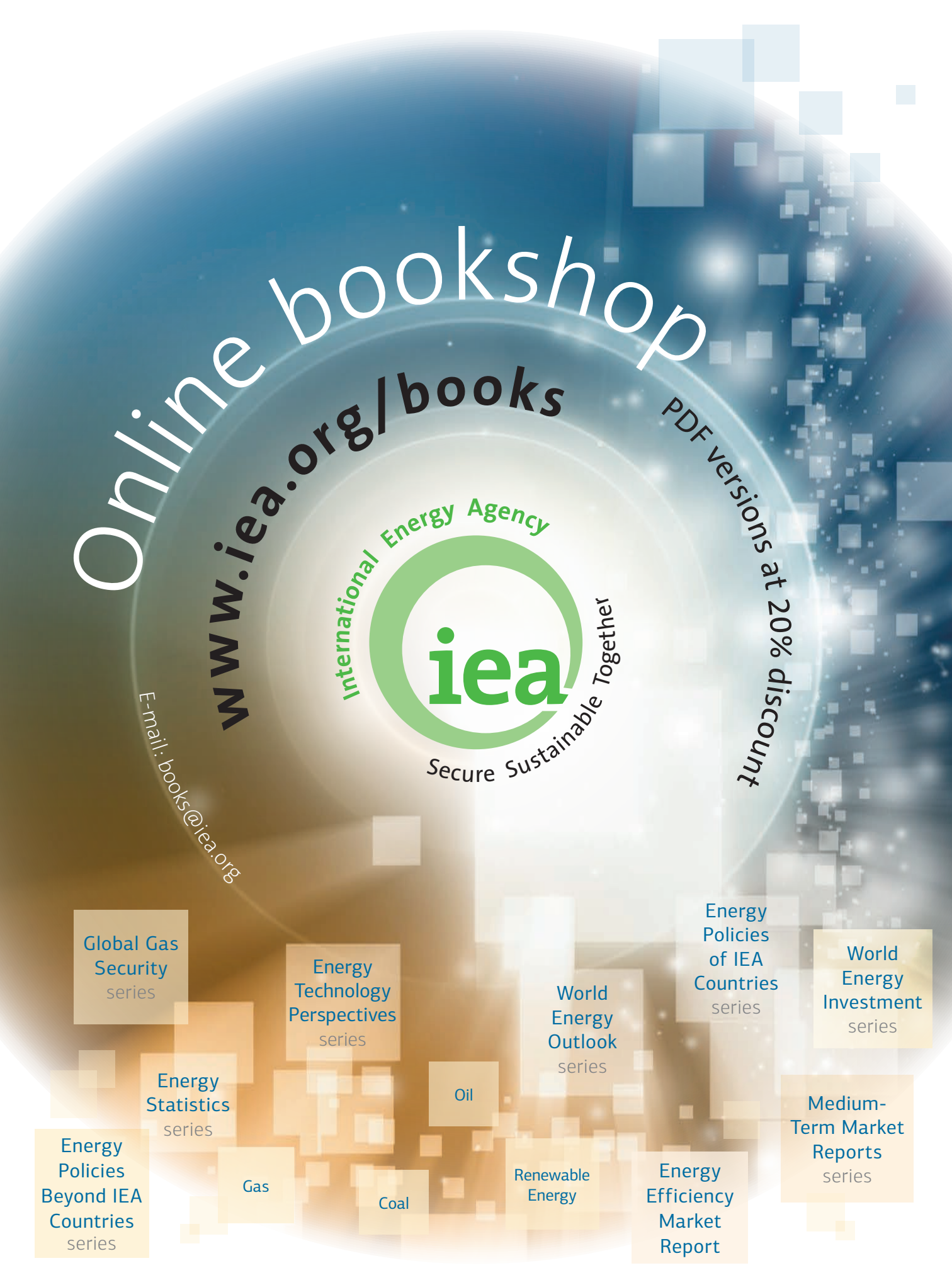
New Zealand's power system brings about a unique set of challenges for maintaining security of supply. The market-based and market facilitation measures may not provide a timely or effective response in all circumstances. All recent supply crises involved hydro storage levels falling to the defined emergency thresholds and resulted in price spikes on the spot market, triggered major government reform programmes. In the past decade, security of supply crises were narrowly averted by timely rainfall. Despite recent improvements in the market design, the IEA believes that security of supply cannot be taken for granted at all times, and will need to be carefully monitored. Depending on the emerging technology and sector changes, the government may wish to adopt an additional safety-net mechanism, taking inspiration from solutions adopted in other IEA jurisdictions, like for instance the Swedish strategic energy reserve, which is market-based and includes demand-side bids.

Key recommendations

The government of New Zealand should:

- Drive decarbonisation of the economy through a suite of integrated actions, including an enhanced New Zealand Emission Trading Scheme and sectoral energy action plans, especially for the transport and industry sectors, with performance-based targets which should be aligned with energy and climate goals and provide a long-term and stable framework for energy investments.
- Continue to foster well-functioning wholesale and retail electricity markets, power system flexibility and thus security of supply by:
  - accelerating steps towards a liquid and deep financial market as means of efficient risk management for wholesale and retail market participants
  - ensuring efficient transmission pricing
  - adapting the market design for the market integration of greater shares of variable renewable electricity, including wind and solar PV
  - considering adopting, as a market-based safety net, a strategic reserve auction for dry years, as part of the reliability monitoring and response of the system operator.
- Conduct a systematic and detailed review of likely scenarios for a portfolio of wind, solar and geothermal resources and assess impacts on grid and system reliability in a detailed integration study of the operational and system stability.

- Direct the New Zealand Productivity Commission to review the electricity distribution sector, with a view to identifying opportunities to improve the sector's productivity, flexibility and its capacity to more effectively respond to the challenges posed by the potential transformation of the sector, including by examining the sector's structure, governance and options for encouraging the sector to develop more integrated regional management, operation and development of distribution networks.
- Extend the price-quality path regulation to all distributors where it is cost-effective to do so. This would be facilitated through regional integration, starting with enforcement of reliability standards, and would enhance the regulation of all distribution services.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New Zealand

2017 Review

Since the last IEA in-depth review in 2010, New Zealand has further developed its energy policy, as reflected in its energy strategy to 2021 and new rules for more competitive electricity markets.

With its unique resource base, New Zealand is a success story for the development of renewable energy, notably hydro and geothermal, without government subsidies. Geographically isolated, New Zealand has developed robust policies for security of supply. Outside of its largely low-carbon power sector, managing the economy's energy intensity and greenhouse gas emissions while still remaining competitive and growing remains a challenge.

The IEA review highlights the areas that are critical to the success of the energy policy agenda in New Zealand.

To support sustainable growth in line with the Paris Agreement, the government should facilitate technology opportunities for renewable energy and energy efficiency, in buildings, industrial heat, transport and agriculture.

The government has ambitious plans to boost the share of electric vehicles and renewable energy. The country has a flexible power system, but future growth requires fine-tuning of market rules in favour of even more flexibility, demand response, smart and effective electricity retail and distribution.

While security of supply is well ensured by effective markets, an energy-constraint system can benefit from market-based risk managements tools, including a safety net for dry years as well as access to global LNG markets.

This review analyses the energy policy challenges facing New Zealand and provides recommendations to help guide the country towards a more secure, sustainable and affordable energy future.