ITALY

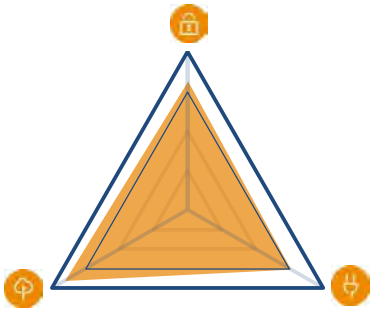
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

16

SCORE

AAA



	2015	2016	2017	Trend	Score
Overall rank and balance score	**23**	**17**	**16**	▶	**AAA**
Energy performance					
Energy security	23	19	17	▶	A
Energy equity	33	32	35	▶	A
Environmental sustainability	19	14	13	▶	A
Contextual performance	40	40	40	▶	

TRENDS AND OUTLOOK

- Italy improves by 1 place this year to rank 16. Excellent scores across the board result in a very well-balanced trilemma profile grade of AAA.
- Italy has one of the most efficient thermoelectric generation systems in Europe and the energy mix for power generation is dominated by natural gas and renewable energy (gas 48%, renewable 28%, coal 15%, oil 3%, other 7%). Energy efficiency improved in the residential, commercial and transport sectors, with impressive achievements in the reduction of GHG emissions and water pollution between 2005 and 2013.
- Recent policy developments include the National Energy Strategy 2017, that aims to 1) increase competitiveness of the country by aligning energy prices with European ones; 2) improve the security of supply; and 3) decarbonise the energy system in line with the long-term objectives of the Paris Agreement.
- Other policy developments include: incentives scheme for PV installations, energy efficiency, seismic retrofitting of buildings, building renovations and energy storage systems; Conto Energia, a mechanism supporting the production of energy from solar PV and solar thermal plants in buildings and businesses; Conto Termico 2.0, which encourages measures to increase energy efficiency and the production of thermal energy from renewable sources; a 20-year plan for funding non-solar renewable energy such as wind, geothermal, biomass and thermodynamic. These measures aim to lower the burden of incentives on energy bills, increase the share of renewables in thermal uses, and improve efficiency. Increased interconnection of the Italian natural gas market with EU markets is expected to increase Italian energy security, also lowering natural gas prices in the wholesale market. The government has also restored the minimum limit of 12 miles from the coast for off-shore oil and gas drilling activities.

KEY METRICS

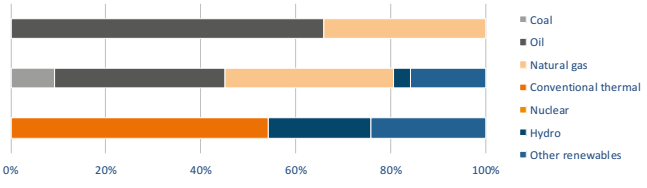
Industrial sector (% of GDP)	23.7	GDP per capita, PPP US$ (GDP Group)	38,161 (I)
Energy intensity (koe per US$)	0.07	Diversity of international energy suppliers	High (HHI = 933)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	0.29	Rate of transmission and distribution losses (%)	6.2
CO_2 intensity (kCO_2 per US$)	0.20	GHG emission growth rate 2000 – 2013 (%)	-1.9

ENERGY PROFILE

Fossil fuel reserves: 124 Mtoe

Total primary energy supply composition

Diversity of electricity generation



JAPAN

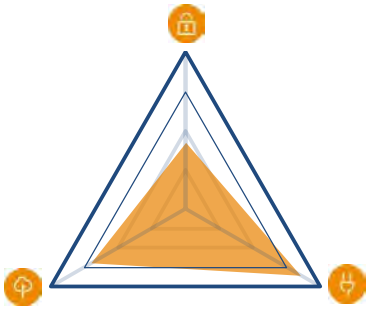
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

30

SCORE

CAB



	2015	2016	2017	Trend	Score
Overall rank and balance score	**30**	**30**	**30**	▶	**CAB**
Energy performance					
Energy security	83	78	77	▶	C
Energy equity	23	23	18	▶	A
Environmental sustainability	40	41	40	▶	B
Contextual performance	21	21	20	▶	

TRENDS AND OUTLOOK

- Although showing improvements across all three dimensions this year, Japan remains unmoved at rank 30. Good performance in both energy equity and environmental sustainability dimensions are offset by a weak score regarding energy security, resulting in a balance grade of CAB.
- The government has amended the five-year-old feed-in tariff (FIT) system, with changes introduced in April 2017. One of the criticisms of the current FIT system is that purchasing prices were set too high. To address this criticism, the new FIT system introduced a bidding system for the purchasing price from large-scale PVs such as mega-solar farms.
- Four years ago the Nuclear Regulation Authority (NRA) started to accept applications from nuclear operators to undergo safety examinations. Up until now, 26 applications for safety examinations have been submitted to the NRA. The NRA is pursuing safety assessment or review of nuclear power plants individually based on the new safety standards, and twelve reactors' safety examinations have now been completed. Five of the reactors with a total power capacity of 4,410 MW have already restarted - these 5 units are Sendai unit 1 and 2 (890 MW each) owned by Kyushu EPCO, Ikata unit 3 (890 MW) owned by Shikoku EPCO, and Takahama unit 3 and 4 (870 MW each) owned by Kansai EPCO. Three out of the remaining seven units are older and so need more time to complete the necessary work in order to meet new safety standards. The other four reactors will restart soon after getting the approval from the local governments.
- Although some challenges might be encountered in restarting the remaining nuclear plants, many of these plants are expected to restart in the long run and Japan's energy security score will improve.

KEY METRICS

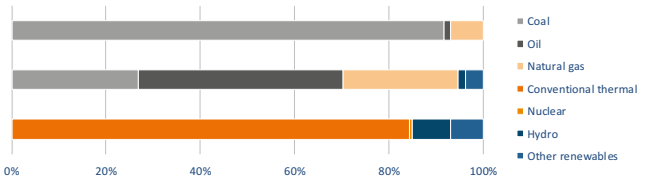
Industrial sector (% of GDP)	28.9	GDP per capita, PPP US$ (GDP Group)	41,470 (I)
Energy intensity (koe per US$)	0.07	Diversity of international energy suppliers	High (HHI = 1,003)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	0.10	Rate of transmission and distribution losses (%)	4.6
CO_2 intensity (kCO_2 per US$)	0.27	GHG emission growth rate 2000 – 2013 (%)	0.4

ENERGY PROFILE

Fossil fuel reserves: 264 Mtoe

Total primary energy supply composition

Diversity of electricity generation



JORDAN

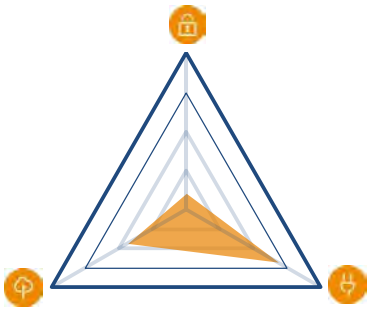
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

87

SCORE

DBC



	2015	2016	2017	Trend	Score
Overall rank and balance score	**67**	**75**	**87**	▶	**DBC**
Energy performance					
Energy security	100	106	121	▶	D
Energy equity	50	52	56	▶	B
Environmental sustainability	83	82	78	▶	C
Contextual performance	68	72	69	▶	

TRENDS AND OUTLOOK

- Jordan drops by 12 places this year, from rank 75 in 2016 to rank 87 in 2017. Energy equity remains the top performing dimension, while energy security is particularly weak, resulting in a balance score of DBC.
- The major current challenges for the country are an extremely high dependence on imports, with over 95% of its energy demand annually being imported. These imports impose a heavy cost burden, representing about 20% of the GDP in 2014. The Arab Spring leaves the country in constant instability of supply of oil and natural gas. Energy demand is projected to continue to grow between 5−7% annually with the flow of refugees, national population growth, and expansion of development projects. The country's current and future top priorities are to achieve a diversification of energy sources by introducing alternative energy, exploiting domestic reserves, and switching from import of Piped Natural Gas (PNG) to Liquefied Natural Gas (LNG).
- The country has been attempting to increase the share of nuclear, solar and wind power to 16% of the total energy mix by 2020 compared to 2% in 2013, signing a $10bn deal for construction of 2,000 MW nuclear power reactors with Russian state-owned company Rosatom in March 2015. The oil shale reserve has been developed by the Jordan Oil Shale Company and Shell, with the expectation that shales will contribute 14% to the nation's energy mix in 2020. A new LNG terminal opened in July 2015 to replace the import of oil and unstable PNG. This will also contribute to reducing CO_2 emissions as well as increasing energy security.

KEY METRICS

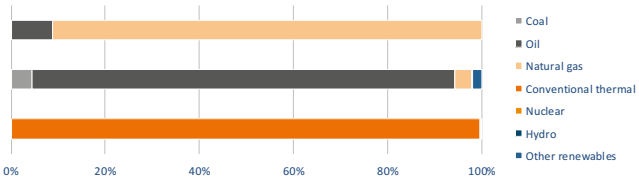
Industrial sector (% of GDP)	29.6	GDP per capita, PPP US$ (GDP Group)	9,050 (III)
Energy intensity (koe per US$)	0.08	Diversity of international energy suppliers	Low (HHI = 2,962)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	10.9
CO_2 intensity (kCO_2 per US$)	0.34	GHG emission growth rate 2000 – 2013 (%)	3.8

ENERGY PROFILE

Fossil fuel reserves: 6 Mtoe

Total primary energy supply composition

Diversity of electricity generation



KAZAKHSTAN

TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

78

SCORE

CBD

	2015	2016	2017	Trend	Score
Overall rank and balance score	**84**	**82**	**78**	▶	**CBD**
Energy performance					
Energy security	72	65	65	▶	C
Energy equity	52	54	59	▶	B
Environmental sustainability	122	122	120	▶	D
Contextual performance	60	50	45	▲	

TRENDS AND OUTLOOK

- A jump of 4 places sees Kazakhstan climb to rank 78 in this year's Index. Good scores in energy security and equity dimensions are combined with a poor score in environmental sustainability, resulting in a balance grade of CBD.
- Recent policy developments in Kazakhstan include: strengthening state institutions responsible for energy efficiency in production, extraction and consumption of energy; clear and comprehensive energy saving programmes to reduce the energy intensity of industry (a 25% reduction by 2020 compared to 2008); the adoption of policies to support the development and inclusion of available renewable energy sources (RES) into the energy mix (renewable and alternative sources by 2050 should provide 50% of the country's electricity); and plans and programmes to facilitate the modernisation of existing power generation, power grids and oil refining installations. The diversification of the generation portfolio will be enhanced by Kazakhstan's Transition to a Green Economy, approved by the Order of the President of Kazakhstan in 2013.
- Policymakers will continue existing successful practices to maintain a favourable investment climate, which allows improvements to the country's trilemma balance, and attracts investment into the exploration and production of energy resources for export to world markets. There is a need to further develop power generating facilities by introducing cutting-edge technologies that will not only ensure domestic supply, but also enable the country to offer significant amounts of electricity to markets in neighbouring countries.

KEY METRICS

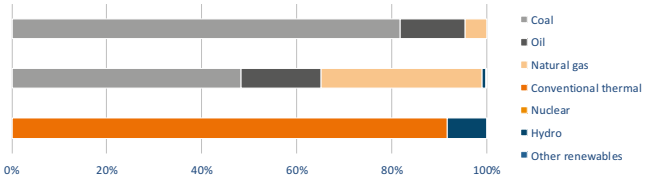
Industrial sector (% of GDP)	32.5	GDP per capita, PPP US$ (GDP Group)	25,264 (II)
Energy intensity (koe per US$)	0.10	Diversity of international energy suppliers	Low (HHI = 5,081)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	80 | 99
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	7.5
CO_2 intensity (kCO_2 per US$)	0.60	GHG emission growth rate 2000 – 2013 (%)	6.3

ENERGY PROFILE

Fossil fuel reserves: 28,663 Mtoe

Total primary energy supply composition

Diversity of electricity generation



KENYA

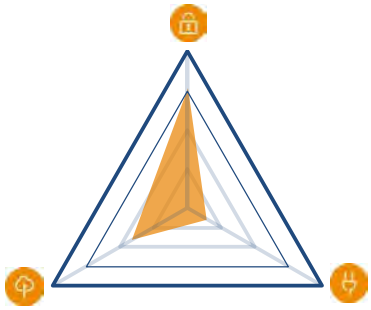
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

100

SCORE

ADC



	2015	2016	2017	Trend	Score
Overall rank and balance score	**107**	**107**	**100**	▶	**ADC**
Energy performance					
Energy security	37	47	24	▶	A
Energy equity	117	118	109	▶	D
Environmental sustainability	55	58	80	▶	C
Contextual performance	93	89	85	▲	

TRENDS AND OUTLOOK

- Kenya improves its ranking to 100 in this year's Index. Whilst the country performs particularly well when it comes to energy security, poor scores in both energy equity and environmental sustainability result in grades of D and C respectively, resulting in a balance score of ADC.
- Kenya's power supply situation has transformed significantly recently in terms of generation capacity, having addressed perennial supply shortages that have affected the country for over a decade. In the past Kenya had to rely heavily on diesel fired plants including emergency thermal power plants (EPPs), especially during periods of drought when hydro reservoirs were low. This has since improved with the increase in generation from geothermal and other renewable sources, allowing the retirement of a total of 120 MW of Emergency Power Producers (EPPs), with the last 30 MW phased out in mid-2016. Currently, the installed capacity stands at 2,333 MW, while peak demand is 1,665 MW.
- Power supply reliability is another area of great importance to Kenya. Recent initiatives include system overhauls and the construction of dedicated or alternative supply routes for industrial and commercial consumers, as well as for urban areas. Recently, the country has achieved a major milestone through the energisation of the 400kV Suswa-Isinya-Rabai line. This will evacuate excess power from the geothermal plants at Olkaira to the coast, reducing dependence on thermal generation in the region.
- In its long-term development strategy 'Vision 2030', energy was identified as one of the critical foundations and enablers of the socio-economic transformation envisioned for the country. To this effect, a number of policies and regulations have been developed: the 2015 Energy Bill to consolidate all laws relating to energy, the National Energy and Petroleum Policy 2015 to support the administration of all the proposed laws and the Petroleum Exploration, Development and Production Local Content Regulations 2014 Act for local content provisions, to name a few.

KEY METRICS

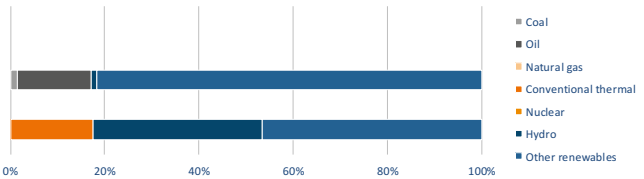
Industrial sector (% of GDP)	19.1	GDP per capita, PPP US$ (GDP Group)	3,156 (IV)
Energy intensity (koe per US$)	0.16	Diversity of international energy suppliers	Medium (HHI = 1,857)
Population with access to electricity (%)	36	Access to clean cooking in rural | urban areas (%)	3 | 58
Household electricity prices (US$/kWh)	0.12	Rate of transmission and distribution losses (%)	16.3
CO_2 intensity (kCO_2 per US$)	0.12	GHG emission growth rate 2000 – 2013 (%)	2.7

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



KOREA (REP.)

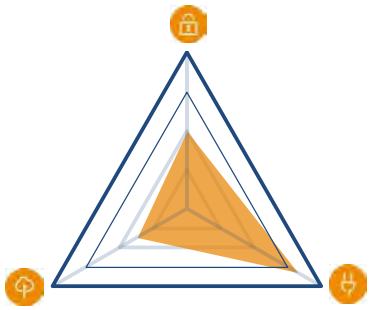
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

39

SCORE

CAC



	2015	2016	2017	Trend	Score
Overall rank and balance score	**46**	**44**	**39**	▶	**CAC**
Energy performance					
Energy security	76	72	64	▲	C
Energy equity	38	35	26	▶	A
Environmental sustainability	89	88	84	▶	C
Contextual performance	29	28	28	▶	

TRENDS AND OUTLOOK

- Koreas (Rep.) improves by 5 places this year to rank 39. Performing particularly well on energy equity, it receives C grades in both energy security and environmental sustainability, resulting in a balance score of CAC.
- Energy security remains a major challenge with a very low stability of resource supplies and an energy import dependency of around 97%.
- Recent policy measures to enhance energy security include: expanding cooperation with resource-rich countries; strengthening the competitiveness of energy developing companies and establishing the Overseas Resource Development Fund to fund energy development projects in addition to giving government loans and guarantees. Nuclear energy plays a transitional role in the country's energy policy as part of its goal to move from traditional energy resources towards renewable energy. Environmental sustainability policy measures include the expansion of renewable energy, with targets set until 2030 and the strong support of R&D.
- Policymakers need to continue focusing on: 1) the reinforcement of demand management, with development of effective demand resources; 2) the development of renewable energy through expansion of institutional support and deregulation; and 3) the enhancement of overseas energy development on a long-term basis, with a focus on stabilising energy security.

KEY METRICS

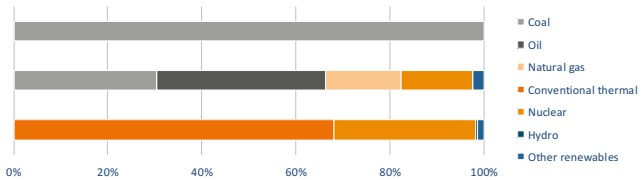
Industrial sector (% of GDP)	38.3	GDP per capita, PPP US$ (GDP Group)	35,751 (I)
Energy intensity (koe per US$)	0.09	Diversity of international energy suppliers	High (HHI = 900)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	0.21	Rate of transmission and distribution losses (%)	3.5
CO_2 intensity (kCO_2 per US$)	0.36	GHG emission growth rate 2000 – 2013 (%)	2.3

ENERGY PROFILE

Fossil fuel reserves: 88 Mtoe

Total primary energy supply composition

Diversity of electricity generation



LATVIA

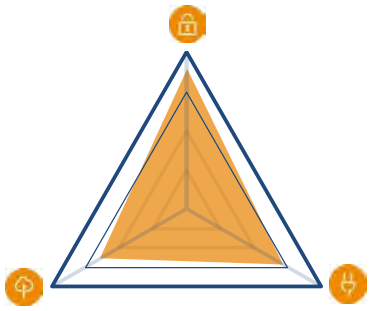
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

23

SCORE

ABB



	2015	2016	2017	Trend	Score
Overall rank and balance score	**24**	**25**	**23**	▶	**ABB**
Energy performance					
Energy security	15	18	5	▶	A
Energy equity	41	38	46	▶	B
Environmental sustainability	49	56	45	▶	B
Contextual performance	23	26	33	▶	

TRENDS AND OUTLOOK

- Latvia improves by 2 spots this year to rank 23. The country exhibits a well-balanced trilemma profile, especially for energy security where it is placed 5th globally, resulting in a balance score of ABB.
- The Latvian Energy Long Term Strategy 2030 sets a target of 50% energy from renewable energy sources and a 50% reduction in energy imports from third country suppliers by 2030. An ongoing renovation of Latvia's hydroelectric power plants (eleven aged hydro units in total), as well as a reconstruction of natural gas CCGT plants has meant that Latvia has so far managed to sustain its low level of GHG emissions in the power sector. CHP projects using biomass are also in progress and wind projects are awaiting RES support schemes.
- A declaration by Baltic Prime Ministers in 2016 regarding the regional gas market development by 2020, as well as increased diversification of gas imports via a new LNG terminal in Lithuania and ongoing BEMIP-G projects, mean that Latvia's energy security and equity dimensions of the trilemma are all expected to improve in the future. In addition, the opening of the Latvian natural gas market to free trade in 2017, and progress on the implementation of a planned connection from Latvia to Estonia, to be completed by 2020 as a part of the Baltic Energy Market Interconnection Plan (BEMIP), are also expected to have benefits for energy security and equity. The main political challenges for Latvia lie in preventing market failures, achieving energy policy neutrality and avoiding improperly promoted economic incentives, in the light of ensuring a balanced development of renewable energy.

KEY METRICS

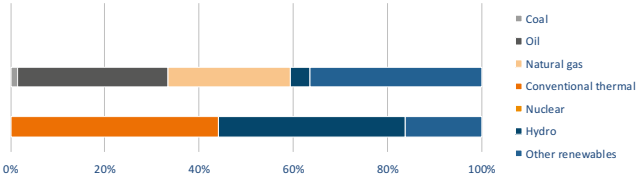
Industrial sector (% of GDP)	22.9	GDP per capita, PPP US$ (GDP Group)	26,031 (II)
Energy intensity (koe per US$)	0.10	Diversity of international energy suppliers	Low (HHI = 2,773)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	78 | 100
Household electricity prices (US$/kWh)	0.18	Rate of transmission and distribution losses (%)	6.5
CO_2 intensity (kCO_2 per US$)	0.19	GHG emission growth rate 2000 – 2013 (%)	0.2

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



LEBANON

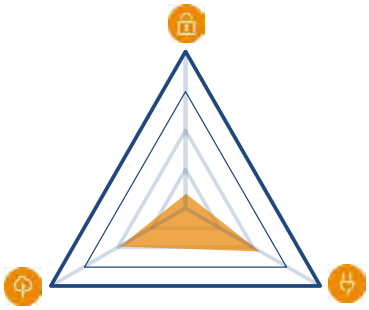
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

95

SCORE

DBC



	2015	2016	2017	Trend	Score
Overall rank and balance score	**86**	**86**	**95**	▶	**DBC**
Energy performance					
Energy security	112	113	122	▶	D
Energy equity	76	74	75	▶	B
Environmental sustainability	58	61	71	▶	C
Contextual performance	99	95	95	▶	

TRENDS AND OUTLOOK

- Lebanon drops 9 places in this year's Index to rank 95. Although performing well in energy equity, energy security is particularly weak, giving an overall balance score of DBC.
- In 2010, the government approved a strategy for the rehabilitation of the power sector, including the development of energy efficiency and renewable energy to address the country's energy security concerns.
- The national target is for 12% of total electricity production to come from renewable energy by 2020. A recent move towards developing larger solar power plants, such as the Beirut River Solar Snake project, is a promising sign of the country's progress on its renewables targets.
- With regards to energy efficiency targets, progress is slowing down. The National Energy Efficiency Action Plan, adopted in 2011, expired in 2015, and no successor plan has been formulated to ensure continuing energy efficiency gains.
- A key challenge to successful implementation will be to update the legislative framework that governs the power sector. Policymakers should focus on creating an enabling legislative framework for the development of renewable energy and energy efficiency, which has the potential to improve both the trilemma's environmental sustainability and security dimensions.

KEY METRICS

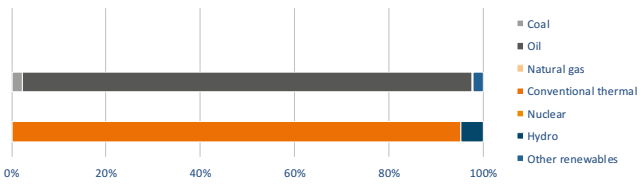
Industrial sector (% of GDP)	20.9	GDP per capita, PPP US$ (GDP Group)	13,996 (III)
Energy intensity (koe per US$)	0.07	Diversity of international energy suppliers	High (HHI = 1,220)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	10.4
CO_2 intensity (kCO_2 per US$)	0.33	GHG emission growth rate 2000 – 2013 (%)	3.2

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



LITHUANIA

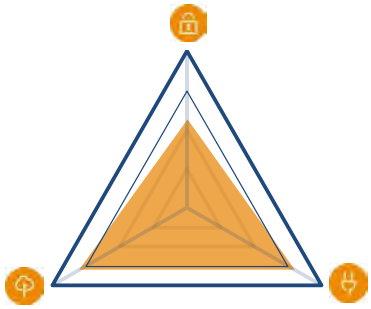
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

28

SCORE

BAA



	2015	2016	2017	Trend	Score
Overall rank and balance score	**28**	**28**	**28**	▶	**BAA**
Energy performance					
Energy security	25	46	55	▶	B
Energy equity	34	34	29	▶	A
Environmental sustainability	67	40	26	▲	A
Contextual performance	32	34	34	▶	

TRENDS AND OUTLOOK

- Lithuania maintains its position at rank 28 in this year's Index. Strong scores in both energy equity and environmental sustainability are complemented by a good score in energy security, resulting in a balance grade of BAA.
- Lithuania expects to see improvements on the energy security and energy equity in the coming years due to the recent shift from relying on district heating and imported natural gas towards producing their own domestic biomass. The newly created biomass energy equipment and technology manufacturing industry has created over 7,000 jobs, with Lithuania also exporting this equipment and technology abroad. Lithuania remains among the few European countries where electricity consumption grows steadily every year, and this trend is expected to continue in the next 10 years.
- Considering the historic disruption of gas supply from Russia to isolated energy countries, including not only Lithuania but also Latvia and Estonia, the next important policy challenge will be to strengthen regional energy integration via the synchronisation of its electricity system with Continental Europe by 2025. Lithuania is a regional LNG leader and is focusing its attention on creating a LNG hub in Klaipeda.
- Lithuania opened power links with Poland and Sweden in December 2015 and the establishment of an LNG terminal in December 2014 was another effort to enhance its independence from a monopoly exporter. The country saw a drop of 63% in the share of total gas imports that came from Russia in the first quarter of 2016, which indicates that the country's energy security performance is likely to continue to increase given the improvement of its energy import ratio.

KEY METRICS

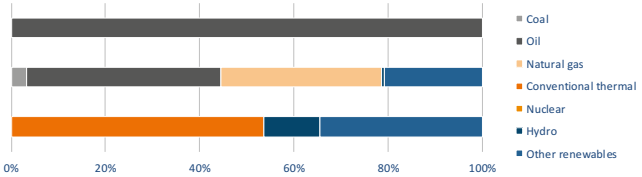
Industrial sector (% of GDP)	29.8	GDP per capita, PPP US$ (GDP Group)	29,966 (II)
Energy intensity (koe per US$)	0.08	Diversity of international energy suppliers	Low (HHI = 4,515)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	0.15	Rate of transmission and distribution losses (%)	7.6
CO_2 intensity (kCO_2 per US$)	0.19	GHG emission growth rate 2000 – 2013 (%)	-0.3

ENERGY PROFILE

Fossil fuel reserves: 1 Mtoe

Total primary energy supply composition

Diversity of electricity generation



LUXEMBOURG

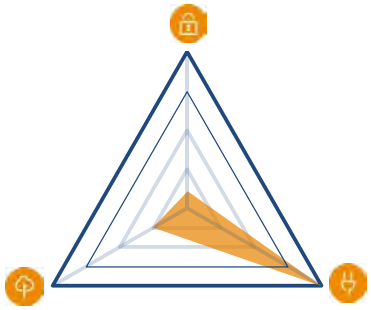
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

63

SCORE

DAC



	2015	2016	2017	Trend	Score
Overall rank and balance score	**57**	**55**	**63**	▶	**DAC**
Energy performance					
Energy security	120	122	120	▶	D
Energy equity	1	1	1	▶	A
Environmental sustainability	108	103	99	▲	C
Contextual performance	3	5	4	▶	

TRENDS AND OUTLOOK

- Luxembourg drops by 8 places to rank 63 in this year's Index. Whilst exhibiting an excellent performance for energy equity, assuming 1st position globally, it lags behind in terms of energy security and environmental sustainability, resulting in an imbalanced trilemma score of DAC.
- A major challenge that Luxembourg faces is its dependence on energy imports (96.8% in 2010). Due to the country's limited resource endowment, there is little potential for Luxembourg to develop domestic energy sources. Instead, the country needs to focus on promoting regional interconnection, diversifying its energy sources and suppliers, and improving its energy efficiency and intensity to promote its energy security. To this end, Luxembourg is planning to transition towards a new industrial model in which it hopes to merge ICT, renewable energy and new transport models.
- The wider deployment of renewables continues to be a major challenge for Luxembourg, with renewables accounting for 4.5% of final energy consumption in 2014, above the trajectory planned for 2013-2014. However, the 2020 target of 11% will be harder to reach. Despite its support mechanisms, including feed-in tariffs, investment incentives and tax deductions, the country is unlikely to meet the target given current progress.
- Luxembourg has implemented an Energy Efficiency Obligation Scheme for natural gas and electricity suppliers that encourages and provides incentives for customers that invest in more efficient appliances, insulation and when renovating buildings. Energy and carbon intensity in Luxembourg's economy is the lowest among EU-15 countries. However, for the industry and transportation sectors, energy intensity is the highest among all EU-15 countries, with a low diesel price one of the contributing factors.

KEY METRICS

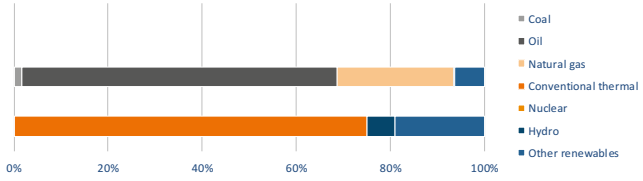
Industrial sector (% of GDP)	12.4	GDP per capita, PPP US$ (GDP Group)	105,882 (I)
Energy intensity (koe per US$)	0.09	Diversity of international energy suppliers	Low (HHI = 4,588)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	0.21	Rate of transmission and distribution losses (%)	1.9
CO_2 intensity (kCO_2 per US$)	0.21	GHG emission growth rate 2000 – 2013 (%)	1.7

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



MALAYSIA

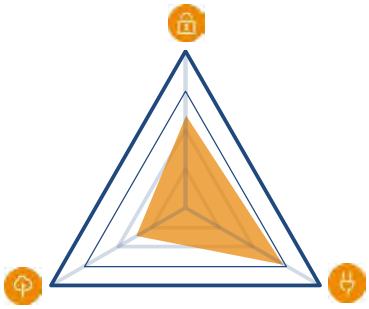
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

41

SCORE

BBC



	2015	2016	2017	Trend	Score
Overall rank and balance score	**38**	**35**	**41**	▶	**BBC**
Energy performance					
Energy security	55	37	53	▶	B
Energy equity	40	41	39	▶	B
Environmental sustainability	75	83	85	▶	C
Contextual performance	33	33	30	▶	

TRENDS AND OUTLOOK

- Malaysia drops by 6 places this year to rank 41. It scores well across all trilemma dimensions, with a slightly lower score received for environmental sustainability, giving an overall balance score of BBC.
- According to the eleventh Malaysia Plan (2016−2020), rural electrification and renewable energy development will be key aims for the Malaysian energy sector. The share of households with access to electricity increased to approximately 98% in 2015. In order to complete the electrification of the entire country by 2020, construction of new generation plants with 7.6 GW of total capacity, and a number of grid interconnection projects will be implemented. New power plants will contribute to not only the improvement of energy equity, but also enhance energy security and sustainability through replacing older, inefficient plants.
- The country is also seeking to improve its generation mix, which will reduce its high dependency on oil and gas. The potential of several alternative sources is being examined by the government; in particular biomass, biogas, geothermal and wind are expected to be at the heart of government policy. The target share of renewable sources in total generation capacity is 7.8% in Peninsular Malaysia and Sabah by 2020. Under this aim, the first geothermal plant is currently under construction and will start operation in 2018.

KEY METRICS

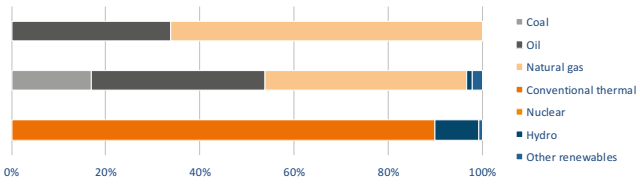
Industrial sector (% of GDP)	36.4	GDP per capita, PPP US$ (GDP Group)	27,681 (II)
Energy intensity (koe per US$)	0.07	Diversity of international energy suppliers	High (HHI = 1,305)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	6.1
CO_2 intensity (kCO_2 per US$)	0.32	GHG emission growth rate 2000 – 2013 (%)	4.6

ENERGY PROFILE

Fossil fuel reserves: 1,395 Mtoe

Total primary energy supply composition

Diversity of electricity generation



MEXICO

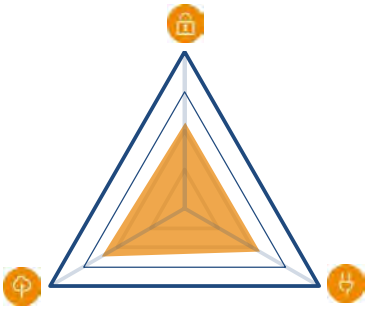
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

57

SCORE

BBB



	2015	2016	2017	Trend	Score
Overall rank and balance score	**59**	**52**	**57**	▶	**BBB**
Energy performance					
Energy security	62	59	57	▶	B
Energy equity	72	71	73	▶	B
Environmental sustainability	57	55	50	▶	B
Contextual performance	56	55	55	▶	

TRENDS AND OUTLOOK

- Mexico falls by 5 places in this year's Index, from rank 52 in 2016 to rank 57 in 2017. The country performs well across the board, receiving a balance score of BBB.
- The Mexican energy sector is facing a dual challenge: a) the transition from a monopolistic structure to a competitive market scheme, following the market liberalisation in 2013; and b) the transition from a high-carbon to a low-carbon economy.
- Mexico is the second country, after the UK, which has enacted a law that frames the actions to be taken with regards to climate change (2012 General Law on Climate Change, LGCC), both from an emission mitigation point of view, as well as measures of adaptation. Mexico's Intended Nationally Determined Contributions for COP21 include a 25% reduction in GHG emissions by 2030 (compared to a business-as-usual projection), with 35% of electricity generation to come from clean energies by 2024 and an aspirational goal of a 50% reduction in GHG emissions by 2050.
- The greatest challenges policymakers need to focus on to meet the targets are: 1) the continuation of a renewable energy programme and the re-initiation of a nuclear programme; 2) continued increase of production of both oil and natural gas on and offshore as well as the development of shale gas resources; and 3) improved energy efficiency and energy conservation including cogeneration in order to reduce Mexico's energy intensity.

KEY METRICS

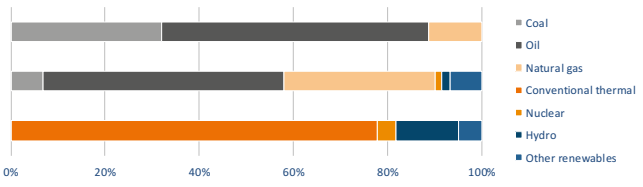
Industrial sector (% of GDP)	32.7	GDP per capita, PPP US$ (GDP Group)	17,862 (II)
Energy intensity (koe per US$)	0.07	Diversity of international energy suppliers	Low (HHI = 7,147)
Population with access to electricity (%)	99	Access to clean cooking in rural | urban areas (%)	53 | 94
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	14.3
CO_2 intensity (kCO_2 per US$)	0.26	GHG emission growth rate 2000 – 2013 (%)	1.7

ENERGY PROFILE

Fossil fuel reserves: 2,638 Mtoe

Total primary energy supply composition

Diversity of electricity generation



MONGOLIA

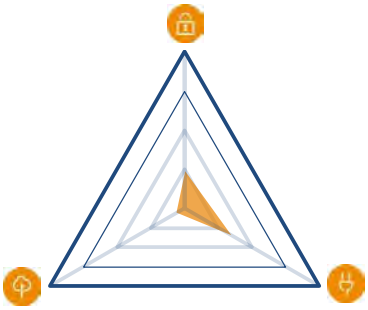
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

106

SCORE

DCD



	2015	2016	2017	Trend	Score
Overall rank and balance score	**111**	**114**	**106**	▶	**DCD**
Energy performance					
Energy security	115	114	102	▶	D
Energy equity	95	95	92	▶	C
Environmental sustainability	123	124	124	▶	D
Contextual performance	69	65	77	▶	

TRENDS AND OUTLOOK

- Mongolia is placed 106 in this year's Index, rising by 8 places. With low scores seen in both energy security and energy equity dimensions, Malaysia has a balance score of DCD.
- An important challenge for the Mongolian energy sector is to develop a national integrated energy system. Currently, four separate electricity grids are in operation. Therefore, the country is planning to connect these grids and expand the distribution system under the Programme on Mongolian Integrated Power System (2007−2040).
- Modernisation and increasing electric production capacity are priorities for the country. According to the Asian Development Bank, the share of electricity that is being imported from Russia to manage peak demand has been increasing over the past years. Due to ageing power plants it is essential to reduce losses by improving existing plants and operational management and to develop new plants to secure a reliable energy supply.
- Lastly, the government is aiming to increase the share of renewables in the national energy mix to 20% by 2020. The government is strengthening its international cooperation and working with international companies to develop the country's renewables potential, which has been estimated by the Mongolian National Renewable Energy centre to be approximately 2,600 GW.

KEY METRICS

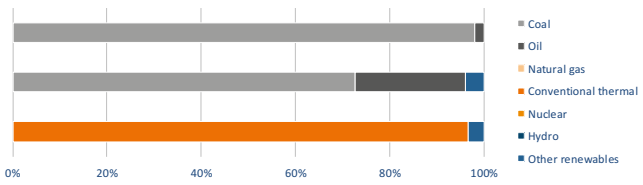
Industrial sector (% of GDP)	33.8	GDP per capita, PPP US$ (GDP Group)	12,220 (III)
Energy intensity (koe per US$)	0.11	Diversity of international energy suppliers	Low (HHI = 6,614)
Population with access to electricity (%)	86	Access to clean cooking in rural | urban areas (%)	10 | 49
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	12.8
CO_2 intensity (kCO_2 per US$)	0.56	GHG emission growth rate 2000 – 2013 (%)	6.4

ENERGY PROFILE

Fossil fuel reserves: 1,793 Mtoe

Total primary energy supply composition

Diversity of electricity generation



MOROCCO

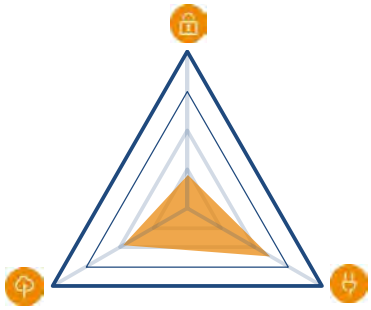
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

77

SCORE

DBC



	2015	2016	2017	Trend	Score
Overall rank and balance score	**78**	**80**	**77**	▶	**DBC**
Energy performance					
Energy security	118	111	109	▶	D
Energy equity	57	59	66	▶	B
Environmental sustainability	76	75	74	▶	C
Contextual performance	81	81	70	▶	

TRENDS AND OUTLOOK

- Morocco improves its ranking by 3 places to rank 77 in this year's Index. The country performs poorly on energy security; however, receives a letter grade B for energy equity. The country receives an overall balance score of DBC.
- Morocco has taken a strong initiative to develop renewable energy since 2008 in order to deal with high levels of energy imports and to reduce its dependency on fossil fuels. The country set a target to establish 6GW of renewable energy from solar, wind and hydropower, which will lead to 42% of installed power capacity in 2020 compared with 13% in 2015.
- According to the Climate Investment Funds, the first phase of the NOOR project, a group of 5 solar plans that was opened in 2016, can play a vital role to improve energy security and sustainability by producing enough energy to power over one million homes by 2018 and reducing emissions by an estimated 760,000 tons of CO_2 per year. At the same time, the country is focusing on promoting energy efficiency. The goal for energy efficiency is to achieve a 20% improvement by 2030.
- Renewable energy and energy efficiency will keep its position as the heart of the national energy strategy in the country as US$11bn is projected to be invested in solar and wind over the next five years in Morocco.

KEY METRICS

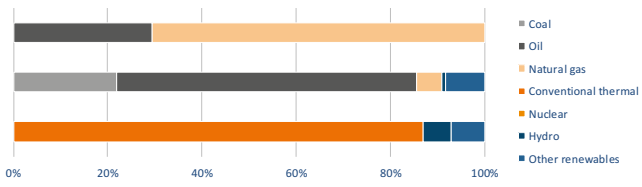
Industrial sector (% of GDP)	29.2	GDP per capita, PPP US$ (GDP Group)	7,838 (III)
Energy intensity (koe per US$)	0.06	Diversity of international energy suppliers	High (HHI = 1,034)
Population with access to electricity (%)	92	Access to clean cooking in rural | urban areas (%)	85 | 100
Household electricity prices (US$/kWh)	0.13	Rate of transmission and distribution losses (%)	13.0
CO_2 intensity (kCO_2 per US$)	0.24	GHG emission growth rate 2000 – 2013 (%)	4.4

ENERGY PROFILE

Fossil fuel reserves: 2 Mtoe

Total primary energy supply composition

Diversity of electricity generation



NAMIBIA

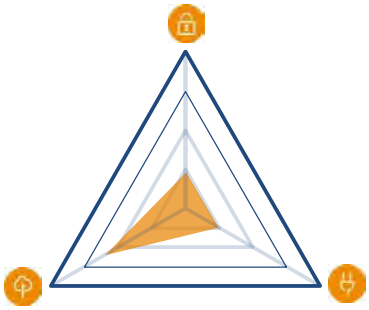
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

97

SCORE

DDB



	2015	2016	2017	Trend	Score
Overall rank and balance score	**100**	**96**	**97**	▶	**DDB**
Energy performance					
Energy security	113	103	105	▶	D
Energy equity	100	100	100	▶	D
Environmental sustainability	52	45	53	▶	B
Contextual performance	57	59	60	▶	

TRENDS AND OUTLOOK

- Namibia drops by 1 place in this year's Index to rank 97. It performs well regarding the environmental sustainability dimension; however, energy security and energy equity dimensions are both weak, resulting in a balance score of DDB.
- Namibia struggles to meet local demand. In addition to its own installed capacity, the country relies on imports from neighbouring countries such as Zimbabwe, Zambia, Mozambique and South Africa. However, the country plans to tackle these difficulties, particularly through the expansion of its renewable energy sector. To this effect the country has recently developed a framework to include Independent Power Producers (IPPs) in the energy supply, and the national regulator, the Electricity Control Board (ECB), has already issued 14 IPP licences. These developments have the potential to improve the country's energy trilemma performance across all dimensions.
- Formulating an integrated long-term energy strategy remains a key challenge for the country. The National Integrated Resource Plan and the Renewable Energy Policy, as well as the transformation of the ECB into the Namibia Energy Regulatory Authority (NERA) with an expanded regulatory remit are positive recent developments. In addition, the 1998 White Paper on Energy Policy – to be renamed as the National Energy Policy - is currently in the final stages of adoption by the government. When passed, it will serve as Namibia's main energy policy document that will guide the entire national energy industry (electricity, renewables, fuels, gas and others).

KEY METRICS

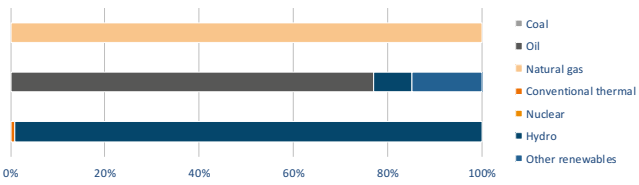
Industrial sector (% of GDP)	31.	GDP per capita, PPP US$ (GDP Group)	10,585 (III)
Energy intensity (koe per US$)	0.08	Diversity of international energy suppliers	Low (HHI = 3,567)
Population with access to electricity (%)	50	Access to clean cooking in rural | urban areas (%)	15 | 92
Household electricity prices (US$/kWh)	0.12	Rate of transmission and distribution losses (%)	8.9
CO_2 intensity (kCO_2 per US$)	0.17	GHG emission growth rate 2000 – 2013 (%)	4.8

ENERGY PROFILE

Fossil fuel reserves: 53 Mtoe

Total primary energy supply composition

Diversity of electricity generation



NEPAL

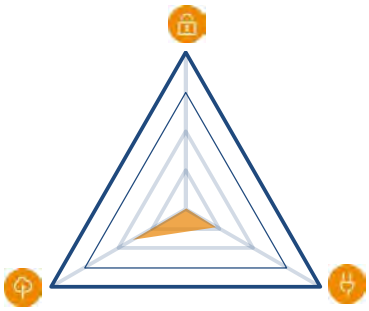
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

117

SCORE

DDC



	2015	2016	2017	Trend	Score
Overall rank and balance score	**123**	**123**	**117**	▶	**DDC**
Energy performance					
Energy security	125	125	125	▶	D
Energy equity	111	111	103	▶	D
Environmental sustainability	85	86	81	▶	C
Contextual performance	116	115	116	▶	

TRENDS AND OUTLOOK

- Nepal improves by 6 places in this year's Index, ranking 117. Energy security and equity scores are particularly poor, with environmental sustainability being the highest performing dimension, resulting in an overall score of DDC.
- The key energy challenges for Nepal are to improve access to modern energy in rural communities, and to increase electricity supply to provide reliable energy services to the population.
- Nepal has one of the lowest levels of electrification among South Asian countries and the rural population is highly dependent on traditional biofuel for heating and cooking. At the same time, energy demand is expected to increase at over 8% per year until 2027, according to the Nepal Electricity Authority (NEA).
- To provide reliable and sustainable energy, a 'Rural Energy Development Programme' was launched in 1996, supported by the United Nations Development Programme (UNDP). The National Rural and Renewable Energy Programme (2012−2017) is building on the Rural Energy Development Programme by building small hydropower and solar heating systems. The programme is expected to bring benefits of economic, environmental and social development to the country.

KEY METRICS

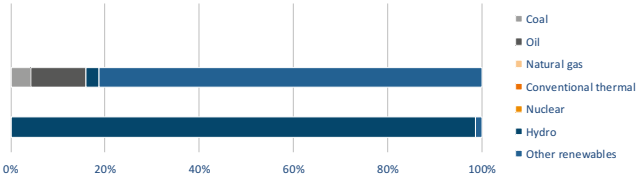
Industrial sector (% of GDP)	15.4	GDP per capita, PPP US$ (GDP Group)	2,468 (IV)
Energy intensity (koe per US$)	0.20	Diversity of international energy suppliers	Low (HHI = 8,407)
Population with access to electricity (%)	85	Access to clean cooking in rural | urban areas (%)	14 | 49
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	22.8
CO_2 intensity (kCO_2 per US$)	0.09	GHG emission growth rate 2000 – 2013 (%)	2.6

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



NETHERLANDS

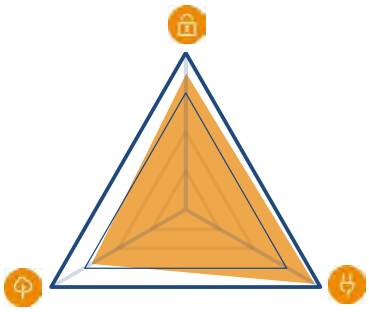
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

4

SCORE

AAB



	2015	2016	2017	Trend	Score
Overall rank and balance score	**8**	**4**	**4**	▶	**AAB**
Energy performance					
Energy security	20	9	10	▶	A
Energy equity	4	3	3	▶	A
Environmental sustainability	42	42	38	▶	B
Contextual performance	5	6	5	▶	

TRENDS AND OUTLOOK

- Netherlands maintains its rank at number 4 in this year's Index, performing strongly across the board with a balance score of AAB. Its energy equity score is particularly good, achieving 3rd place globally.
- The Netherlands is well-positioned in the Index, but still faces a number of challenges. These include: the public debate around installation of additional onshore wind capacity; high expectations of biomass and green gas in the face of challenging markets; ensuring solar surges and geothermal meet expectations given the low starting base; and a feed-in tariff scheme that is not sufficient to reach targets. Furthermore, energy efficiency progress is fairly slow.
- Key energy policy developments are: the green deals; energy innovation top sector approach designed to strengthen market steering, market involvement and market resources for energy; and the SDE+ (stimulation of sustainable/renewable energy) feed-in scheme that is fully operational and funded (over €1.5bn per annum).
- A key trend is the strong decentralisation of power generation. Policymakers have to create the framework to stimulate or facilitate this development, including the upgrade of the existing network such as smart grids. Finally, the Netherlands is expected to strengthen its position as a gas country, with an increased focus on the role of gas as a balancing fuel in a system that is moving towards sustainability.

KEY METRICS

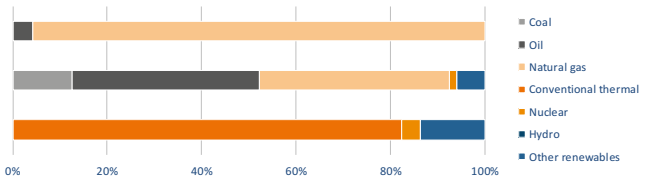
Industrial sector (% of GDP)	20.	GDP per capita, PPP US$ (GDP Group)	50,898 (I)
Energy intensity (koe per US$)	0.07	Diversity of international energy suppliers	High (HHI = 1,107)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	0.20	Rate of transmission and distribution losses (%)	4.3
CO_2 intensity (kCO_2 per US$)	0.26	GHG emission growth rate 2000 – 2013 (%)	-0.8

ENERGY PROFILE

Fossil fuel reserves: 715 Mtoe

Total primary energy supply composition

Diversity of electricity generation



NEW ZEALAND

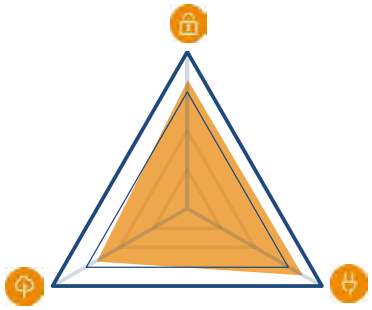
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

9

SCORE

AAB



	2015	2016	2017	Trend	Score
Overall rank and balance score	**7**	**9**	**9**	▶	**AAB**
Energy performance					
Energy security	16	13	15	▶	A
Energy equity	18	20	19	▶	A
Environmental sustainability	36	36	42	▶	B
Contextual performance	4	8	3	▶	

TRENDS AND OUTLOOK

- New Zealand maintains its rank at 9 in this year's Index, being the only representative from Asia, as well as the only non-European country to be placed in the global top ten. It continues to manage the energy trilemma well across all dimensions, resulting in a balance score of AAB.
- The New Zealand Energy Strategy (NZES) and the New Zealand Energy Efficiency and Conservation Strategy (NZEECS) set out the government's energy policy framework. The NZEECS's priority areas of renewable and efficient use of process heat, efficient and low-emissions transport, and innovative and efficient use of electricity nest within the broader NZES's four priorities (diverse resource development, environmental responsibility, efficient use of energy, and secure and affordable energy), and together shape New Zealand's trilemma performance.
- Discussions in the energy sector are currently focused around how to successfully leverage off New Zealand's already high proportion of renewable electricity (81% in 2015), and how to respond to the Paris Agreement imperative, all whilst ensuring a long-term economic transition to a low emissions economy.
- Trends to watch are: 1) the possible effects that a new government election in September may have on energy developments with a potential stronger focus on climate change targets and policies; 2) the implications of growing natural resource constraints, especially regarding water and its effects on electricity generation and agriculture and; 3) the shift of investment from hardware (e.g. pipes and wires) to software (e.g. blockchain and peer-to-peer trading) and its implications on energy demand, future competition, network regulation and prices.

KEY METRICS

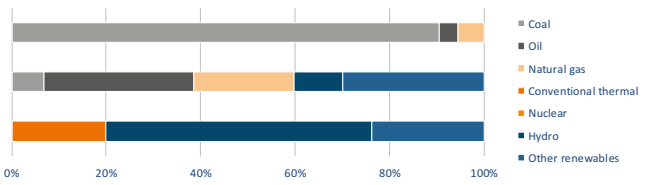
Industrial sector (% of GDP)	21.8	GDP per capita, PPP US$ (GDP Group)	39,059 (I)
Energy intensity (koe per US$)	0.10	Diversity of international energy suppliers	High (HHI = 1,073)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	0.10	Rate of transmission and distribution losses (%)	6.6
CO_2 intensity (kCO_2 per US$)	0.26	GHG emission growth rate 2000 – 2013 (%)	0.1

ENERGY PROFILE

Fossil fuel reserves: 440 Mtoe

Total primary energy supply composition

Diversity of electricity generation



NIGER

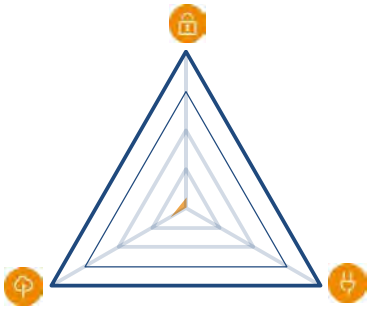
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

125

SCORE

DDD



	2015	2016	2017	Trend	Score
Overall rank and balance score	**124**	**124**	**125**	▶	**DDD**
Energy performance					
Energy security	117	119	124	▶	D
Energy equity	125	125	125	▶	D
Environmental sustainability	120	120	121	▶	D
Contextual performance	112	114	112	▶	

TRENDS AND OUTLOOK

- Niger drops a place in this year's Index, ranking last at 125. It performs poorly across all trilemma dimensions, resulting in an overall balance score of DDD.
- Despite the richness of Niger's resources, energy is still a challenge for the authorities. This is mainly a result of low economic productivity and investment, and also the limited access that the majority of the country has to energy.
- Niger has significant natural energy resources such as biomass, uranium, mineral coal, natural gas, hydro and solar. It is estimated that 90% of Niger's population accesses energy through the use of biomass, and 70% of energy supply comes from biomass. The second largest contributor is oil at 17%.
- National law and the liberalisation of the energy market result in Niger being an attractive investment opportunity, but infrastructure for delivering energy remains a key barrier.
- With regards to the renewable energy sector, there is still lack of sufficient legislation to attract incoming investment, specifically competitiveness, transparency and security of the market.

KEY METRICS

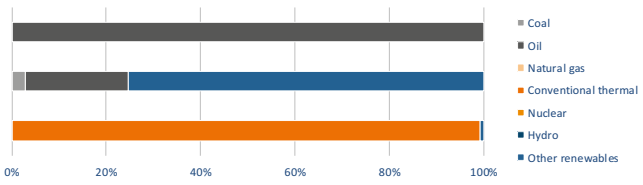
Industrial sector (% of GDP)	21.9	GDP per capita, PPP US$ (GDP Group)	978 (IV)
Energy intensity (koe per US$)	0.17	Diversity of international energy suppliers	Low (HHI = 3,449)
Population with access to electricity (%)	14	Access to clean cooking in rural | urban areas (%)	2 | 9
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	16.5
CO_2 intensity (kCO_2 per US$)	0.13	GHG emission growth rate 2000 – 2013 (%)	N.A.

ENERGY PROFILE

Fossil fuel reserves: 20 Mtoe

Total primary energy supply composition

Diversity of electricity generation



NIGERIA

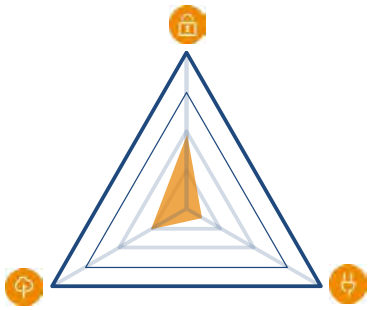
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

110

SCORE

CDC



	2015	2016	2017	Trend	Score
Overall rank and balance score	**101**	**104**	**110**	▶	**CDC**
Energy performance					
Energy security	5	8	67	▶	C
Energy equity	107	108	113	▶	D
Environmental sustainability	102	101	98	▶	C
Contextual performance	117	117	114	▶	

TRENDS AND OUTLOOK

- Nigeria drops 6 places in this year's Index to rank 110. Energy equity remains its weakest dimension, whilst energy security sees a noticeable drop, resulting in an overall balance score of CDC.
- The key priority challenge for Nigeria is to diversify energy sources. According to the Ministry of Power, Works and Housing of Nigeria, the country depends on gas-fired power plants for over 80% of its electricity while hydropower generates about 14%.
- However, the gas supply is frequently disrupted by militants. This situation drives the country to find other energy sources, i.e. renewable energy. In July 2016, the federal government signed the power purchase agreement with 12 firms for the construction of solar power plants. These are expected to give the country 975 MW of electricity capacity and bring the benefits of enhancement of energy security.
- The second challenge refers to the energy equity aspect of the Trilemma. Nigeria has one of the lowest shares of electrification, however is showing signs of progress, climbing from 48% of people having access in 2010 to 58% in 2014. Therefore, developing a new transmission and distribution network and improving existing lines will continue to feature as priorities for the country's energy agenda.

KEY METRICS

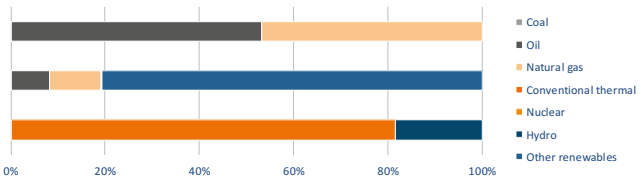
Industrial sector (% of GDP)	20.4	GDP per capita, PPP US$ (GDP Group)	5,867 (IV)
Energy intensity (koe per US$)	0.08	Diversity of international energy suppliers	Medium (HHI = 1,885)
Population with access to electricity (%)	58	Access to clean cooking in rural | urban areas (%)	11 | 39
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	16.6
CO_2 intensity (kCO_2 per US$)	0.04	GHG emission growth rate 2000 – 2013 (%)	1.4

ENERGY PROFILE

Fossil fuel reserves: 9,384 Mtoe

Total primary energy supply composition

Diversity of electricity generation



PAKISTAN

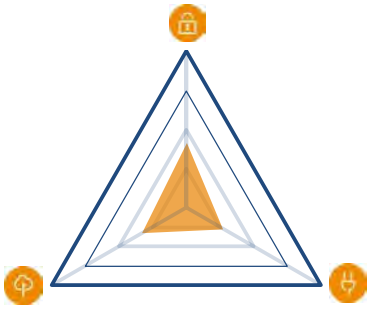
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

102

SCORE

CCC



	2015	2016	2017	Trend	Score
Overall rank and balance score	**102**	**102**	**102**	▶	**CCC**
Energy performance					
Energy security	69	76	78	▶	C
Energy equity	99	99	98	▶	C
Environmental sustainability	94	93	90	▶	C
Contextual performance	119	120	118	▶	

TRENDS AND OUTLOOK

- Pakistan remains unmoved this year at rank 102. Receiving relatively low scores across all dimensions, the country has a balance score of CCC.
- Pakistan's energy sector is faced with a triple challenge posed by a large supply−demand gap, an ageing and inefficient power transmission system, and expensive thermal power generation. To remedy this situation, in 2013, the government launched the National Power Plan (NPP). A key aspect of the NPP is to step up efforts to exploit the country's potential for renewable energy generation.
- In addition, projects are being developed under the auspices of the China−Pakistan Economic Corridor (CPEC) to achieve a higher share of renewables. One of the projects, the Quaid-e-Azam Solar Park, started operating in 2015 and plans exist to expand its capacity to 1,000 MW. This would make it the world's largest solar power plant. Other projects include several wind farms and hydroelectric power plants such as the Suki Kinari project currently under construction in the North East of the country.
- Pakistan will also have to make sure that the country's transmission infrastructure can keep up with the rapid development of renewable energy capacity to ensure the reliable supply of energy.

KEY METRICS

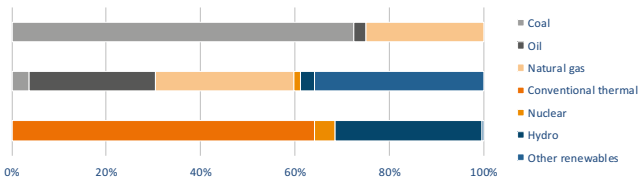
Industrial sector (% of GDP)	20.	GDP per capita, PPP US$ (GDP Group)	5,249 (IV)
Energy intensity (koe per US$)	0.10	Diversity of international energy suppliers	Low (HHI = 2,708)
Population with access to electricity (%)	98	Access to clean cooking in rural | urban areas (%)	14 | 88
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	17.4
CO_2 intensity (kCO_2 per US$)	0.19	GHG emission growth rate 2000 – 2013 (%)	2.7

ENERGY PROFILE

Fossil fuel reserves: 1,990 Mtoe

Total primary energy supply composition

Diversity of electricity generation



PANAMA

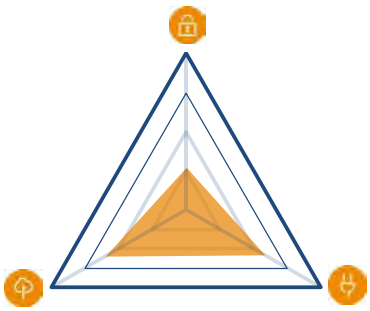
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

67

SCORE

CBB



	2015	2016	2017	Trend	Score
Overall rank and balance score	**77**	**79**	**67**	▶	**CBB**
Energy performance					
Energy security	111	118	94	▶	C
Energy equity	74	76	69	▶	B
Environmental sustainability	46	47	51	▶	B
Contextual performance	41	39	39	▶	

TRENDS AND OUTLOOK

- Panama improves by 12 places in this year's Index to rank 67. Performing well in energy equity and environmental sustainability, it lags behind in energy security, resulting in a balance score of CBB.
- Vulnerabilities in Panama's electricity system, caused by investment complications in Panama's electricity transmission infrastructure in recent years, have led to blackouts and overloads that have affected not just Panama, but other countries connected directly to the SIEPAC grid. In response to this, the state-owned transmission company is planning to construct and extend several transmission lines in the east-west and north-south directions. Discussions are still ongoing regarding a proposed Panama-Colombia Interconnection Line.
- In 2016, 92.4% of Panamanian households had access to electricity, and efforts have been made by the Office for Rural Electrification to increase electricity access to indigenous zones and areas of difficult access through the use of renewable energy technologies. In addition, in efforts to curb the impact of price variations on the transportation sector, Panama is slowly electrifying its transportation network by installing a substantial electric transport system that will connect the suburbs and city through eight lines.
- Panama has recently sought to diversify its energy matrix through the installation of a wind park and photovoltaic plants that together make up 10% of total installed capacity. The expansion of the Panama Canal also provides opportunities to integrate non-conventional fuels and to replace conventional fuels that have a higher polluting-ratio. A 381 MW LNG power plant is currently under construction and is expected to start operations in 2018, and two other LNG plants with over 750 MW total capacity are also being planned.
- The National Energy Plan for 2015-2050, enforced by Panama's Secretary of Energy, aims to produce at least 67% of Panama's energy requirements for the domestic market using conventional and non-conventional renewable energy sources. Its implementation requires further discussion.

KEY METRICS

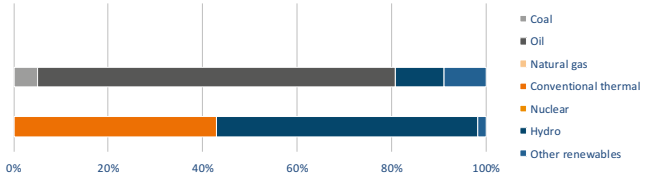
Industrial sector (% of GDP)	27.7	GDP per capita, PPP US$ (GDP Group)	23,015 (II)
Energy intensity (koe per US$)	0.05	Diversity of international energy suppliers	Medium (HHI = 2,461)
Population with access to electricity (%)	92	Access to clean cooking in rural | urban areas (%)	70 | 90
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	14.1
CO_2 intensity (kCO_2 per US$)	0.14	GHG emission growth rate 2000 – 2013 (%)	5.8

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



PARAGUAY

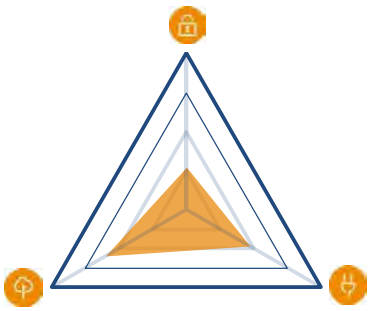
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

84

SCORE

CCB



	2015	2016	2017	Trend	Score
Overall rank and balance score	**89**	**89**	**84**	▶	**CCB**
Energy performance					
Energy security	97	96	95	▶	C
Energy equity	86	86	85	▶	C
Environmental sustainability	59	57	52	▶	B
Contextual performance	100	96	96	▶	

TRENDS AND OUTLOOK

- Paraguay improves by 5 places this year to rank 84. Whilst scoring well in environmental sustainability, energy security and energy equity remain its weakest dimensions, resulting in a balance score of CCB.
- Nearly 99% of Paraguay's energy demand is met by hydropower. Therefore, there is little to no incentive for Paraguay to develop a policy framework promoting the use of other renewables.
- The only clean energy policy incentive in Paraguay is a biofuel mandate for gasoline and diesel. The mandate states that diesel sold commercially in the country must contain 5% biodiesel and gasoline must contain between 18% and 24% ethanol. It is hoped that the policy will introduce greater diversification of supply and less reliance on hydropower in the future.
- The abundant supply of energy results in low energy costs for the retail and commercial consumer, and is a good basis for social and economic development in the future.

KEY METRICS

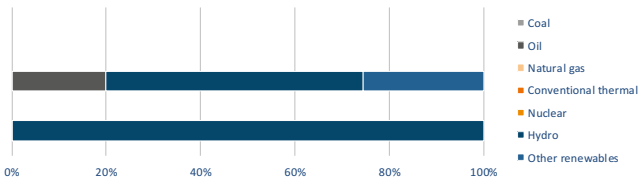
Industrial sector (% of GDP)	29.6	GDP per capita, PPP US$ (GDP Group)	9,577 (III)
Energy intensity (koe per US$)	0.10	Diversity of international energy suppliers	Low (HHI = 2,518)
Population with access to electricity (%)	99	Access to clean cooking in rural | urban areas (%)	30 | 74
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	27.1
CO_2 intensity (kCO_2 per US$)	0.11	GHG emission growth rate 2000 – 2013 (%)	3.1

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



PERU

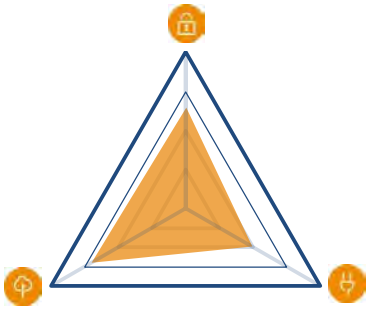
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

55

SCORE

BCB



	2015	2016	2017	Trend	Score
Overall rank and balance score	**63**	**64**	**55**	▶	**BCB**
Energy performance					
Energy security	61	54	38	▲	B
Energy equity	85	84	80	▶	C
Environmental sustainability	32	38	39	▶	B
Contextual performance	62	60	67	▶	

TRENDS AND OUTLOOK

- Peru improves by 9 places this year to rank 55. Achieving good results in energy security and environmental sustainability dimensions, energy equity remains relatively low, resulting in a balance score of BCB.
- Peru's National Energy Policy 2010−2040 was approved at the end of 2010, with the goal to encourage and protect private investment in the sector; and to minimise the social and environmental impacts by promoting the development of energy markets, encouraging efficiency and the development of renewable energies at the local, regional, and national level.
- Schemes to support these goals are already in place and include: a law, passed in April 2012, to promote energy security in hydrocarbons; a scheme to promote the modernisation of oil refineries; a universal energy access plan for the 2013−2022 period, implemented in May 2013, with clearly defined targets for different sub-components; and auctions and calls for tenders to secure the implementation of hydro projects. Additional fiscal incentives are in place for small-scale hydro, solar, wind, biomass, and geothermal.

KEY METRICS

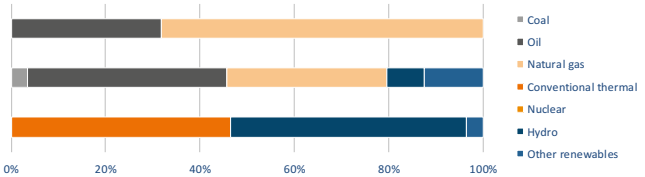
Industrial sector (% of GDP)	32.8	GDP per capita, PPP US$ (GDP Group)	13,022 (III)
Energy intensity (koe per US$)	0.05	Diversity of international energy suppliers	Low (HHI = 3,317)
Population with access to electricity (%)	93	Access to clean cooking in rural | urban areas (%)	14 | 80
Household electricity prices (US$/kWh)	0.17	Rate of transmission and distribution losses (%)	11.2
CO_2 intensity (kCO_2 per US$)	0.15	GHG emission growth rate 2000 – 2013 (%)	4.3

ENERGY PROFILE

Fossil fuel reserves: 536 Mtoe

Total primary energy supply composition

Diversity of electricity generation



POLAND

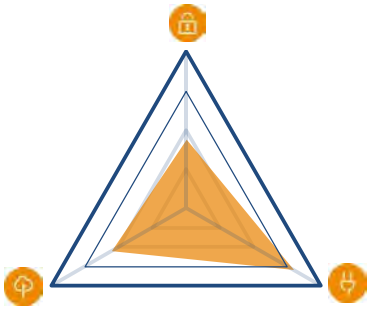
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

37

SCORE

CAB



	2015	2016	2017	Trend	Score
Overall rank and balance score	**32**	**36**	**37**	▶	**CAB**
Energy performance					
Energy security	47	60	73	▶	C
Energy equity	30	28	30	▶	A
Environmental sustainability	68	64	60	▲	B
Contextual performance	34	36	35	▶	

TRENDS AND OUTLOOK

- Poland drops 1 place this year, to rank 37. Performing very well in energy equity, a drop in energy security results in a balance score of CAB.
- Recent energy policy developments include the diversification of the energy mix through additional nuclear plants; incentives to diversify gas supply and development of renewables; reducing energy intensity and increasing energy efficiency; increasing the competitiveness of fuels and energy by liberalisation of the markets; improving the legal framework for exploration works for domestic primary energy fuels; and limiting the energy sector impact on the environment by the development of clean coal technologies.
- Expected future trends affecting Poland's energy sustainability and issues for policymakers to focus on are: 1) development of the country's energy network infrastructure; 2) further diversification of energy sources; 3) modernisation of the electricity generation sector; 4) increase security of primary fuel supply through investments in more efficient coal mining exploitation and exploration for conventional and unconventional gas; 5) increase transport biofuels production and use; 6) continued efforts to improve energy efficiency and energy savings; 7) transition to a low-carbon economy, while enabling an improvement of lifestyles over the next 20 years, by deploying low-emission technologies to achieve lower emissions growth.

KEY METRICS

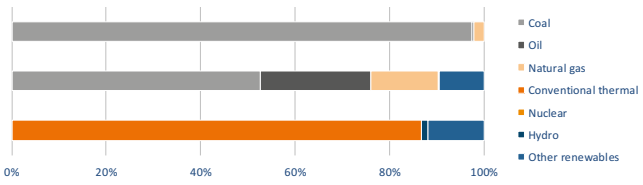
Industrial sector (% of GDP)	34.1	GDP per capita, PPP US$ (GDP Group)	27,811 (II)
Energy intensity (koe per US$)	0.08	Diversity of international energy suppliers	Low (HHI = 4,365)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	0.17	Rate of transmission and distribution losses (%)	7.1
CO_2 intensity (kCO_2 per US$)	0.37	GHG emission growth rate 2000 – 2013 (%)	0.0

ENERGY PROFILE

Fossil fuel reserves: 3,912 Mtoe

Total primary energy supply composition

Diversity of electricity generation



PORTUGAL

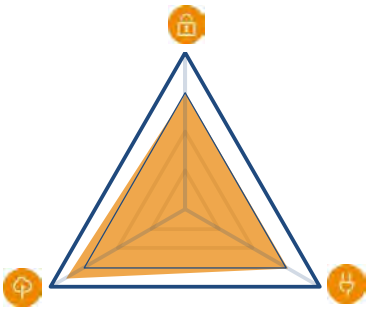
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

18

SCORE

BAA



	2015	2016	2017	Trend	Score
Overall rank and balance score	**17**	**18**	**18**	▶	**BAA**
Energy performance					
Energy security	39	31	30	▶	B
Energy equity	31	33	34	▶	A
Environmental sustainability	11	12	17	▶	A
Contextual performance	27	32	24	▶	

TRENDS AND OUTLOOK

- Portugal maintains its position at rank 18 in this year's Index. A well-balanced energy trilemma profile results in a score of BAA, with environmental sustainability being a particular strength.
- The implementation of the reinforcement of the electricity and gas interconnections between the Iberian Peninsula and central Europe, a product of the Madrid Declaration held in 2015, continues to be a central policy aim for Portugal. The initiative seeks to promote market integration, and increase the energy security of Europe, by taking advantage of the high capacity of LNG terminals and excess renewable electricity capacity in the Iberian Peninsula In efforts to diversify electricity import and exports, a viability study for a cable interconnection between Portugal and Morocco was commissioned in January 2017, with a decision expected by the end of 2017..
- Due to the increasing cost competitiveness of renewables compared to fossil fuel sources, new renewable energy projects no longer gain such a large benefit from the feed-in tariff regime, except from household and development projects. Several licensing requests, amounting to 500 MW for PV projects under the new market regime, have been submitted to the government administration responsible for renewable development projects, highlighting the remarkable jump in competitiveness seen in renewables in recent years.

KEY METRICS

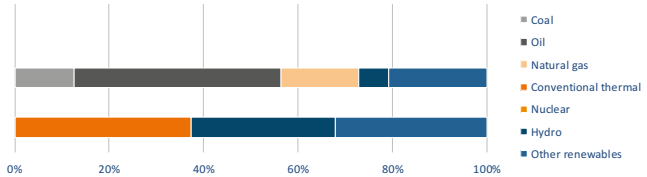
Industrial sector (% of GDP)	22.3	GDP per capita, PPP US$ (GDP Group)	30,624 (II)
Energy intensity (koe per US$)	0.07	Diversity of international energy suppliers	High (HHI = 1,049)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	0.25	Rate of transmission and distribution losses (%)	9.7
CO_2 intensity (kCO_2 per US$)	0.21	GHG emission growth rate 2000 – 2013 (%)	-2.4

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



ROMANIA

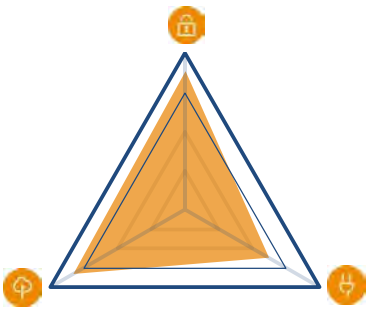
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

25

SCORE

ABA



	2015	2016	2017	Trend	Score
Overall rank and balance score	**31**	**32**	**25**	▶	**ABA**
Energy performance					
Energy security	17	24	7	▶	A
Energy equity	63	63	64	▶	B
Environmental sustainability	39	28	23	▲	A
Contextual performance	58	53	44	▲	

TRENDS AND OUTLOOK

- An improvement of 7 places sees Romania rank 25 in this year's Index. Once again the country scores well across the board, with energy security being particularly strong at 7th globally. This results in a balance score of ABA.
- Romania's renewable energy sector, which is mainly comprised of wind energy, reached a capacity of 4690 MW in June 2016. In addition, the country has already reached and exceeded its EU-mandated target of a 24% share of renewables in gross final energy consumption. However, the future of further investments in renewable energy is uncertain due to recent changes to the country's green certificate scheme and the fact that a feed-in tariff system for small renewable energy producers, having been passed into law in 2015, has still not been effectively implemented.
- Although plans to construct a submarine cable connection with Turkey have been abandoned, the integration of the power markets of the Czech Republic, Slovakia, Hungary and Romania, along with the already high share of renewable energy, is expected to maintain Romania's strong energy security score.
- Going forward, Romanian policymakers will have to find ways to design more effective and coherent systems to support the further development of renewable energy, as well as focus on the maintenance and improvement of the existing energy supply and transmission structure, which will need large investments to raise the country's energy equity score.

KEY METRICS

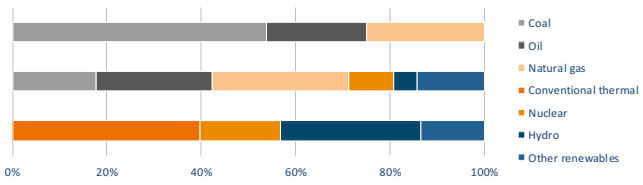
Industrial sector (% of GDP)	33.7	GDP per capita, PPP US$ (GDP Group)	23,626 (II)
Energy intensity (koe per US$)	0.08	Diversity of international energy suppliers	Medium (HHI = 2,440)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	56 | 100
Household electricity prices (US$/kWh)	0.16	Rate of transmission and distribution losses (%)	13.4
CO_2 intensity (kCO_2 per US$)	0.27	GHG emission growth rate 2000 – 2013 (%)	-1.7

ENERGY PROFILE

Fossil fuel reserves: 377 Mtoe

Total primary energy supply composition

Diversity of electricity generation



RUSSIA

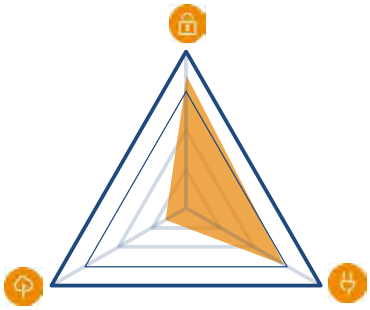
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

44

SCORE

ABD



	2015	2016	2017	Trend	Score
Overall rank and balance score	**48**	**45**	**44**	▶	**ABD**
Energy performance					
Energy security	8	6	13	▶	A
Energy equity	42	42	38	▶	B
Environmental sustainability	117	116	113	▶	D
Contextual performance	51	48	56	▶	

TRENDS AND OUTLOOK

- Russia improves by 1 place this year to rank 44. The country shows excellent performance regarding energy security, where it is placed 13th globally; its weakest dimension is environmental sustainability, resulting in a balance score of ABD.
- Russia is endowed with natural resources, and exports natural gas and oil to countries in Eastern and Western Europe, Turkey, Japan, as well as other Asian countries. The high dependence of the economy on energy exports and the vulnerability to the fluctuations in energy prices, the development of shale gas in other regions of the world, and Europe's efforts to decrease dependence on Russian gas imports following disputes with key transit countries such as Ukraine, led to the development of new transportation routes and plans to tap new gas markets in the east ('Pivot to the East'). However, competition with other gas suppliers, as well as economic turmoil in China, is raising concerns over the profitability of these plans. With four nuclear reactors under construction as of 2017, and an average of one large reactor per year due to come on line by 2028, Russia is working to further improve its security of supply while reducing its dependence on fossil fuels.
- Energy efficiency is a key issue for Russia. To this end, in 2014 the government published an updated version of the State Program on Energy Efficiency and Energy Development, which envisages a 40% decrease in energy intensity of the economy by 2020. Another key part of this strategy is the further development of renewables, which, by 2020, are to account for 2.5% of electricity generation, excluding large hydroelectric power plants.

KEY METRICS

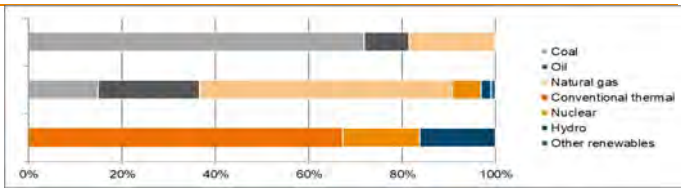
Industrial sector (% of GDP)	32.8	GDP per capita, PPP US$ (GDP Group)	23,163 (II)
Energy intensity (koe per US$)	0.17	Diversity of international energy suppliers	Medium (HHI = 1,915)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	91 | 100
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	10.9
CO_2 intensity (kCO_2 per US$)	0.72	GHG emission growth rate 2000 – 2013 (%)	0.5

ENERGY PROFILE

Fossil fuel reserves: 156,299 Mtoe

Total primary energy supply composition

Diversity of electricity generation



SAUDI ARABIA

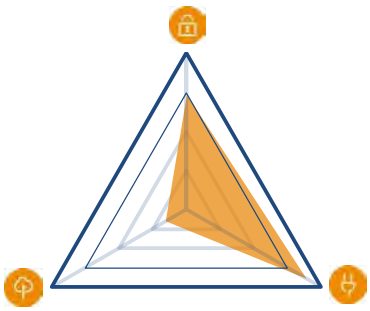
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

53

SCORE

BAD



	2015	2016	2017	Trend	Score
Overall rank and balance score	**47**	**47**	**53**	▶	**BAD**
Energy performance					
Energy security	41	39	31	▶	B
Energy equity	11	12	11	▶	A
Environmental sustainability	110	112	114	▶	D
Contextual performance	54	51	71	▶	

TRENDS AND OUTLOOK

- Saudi Arabia drops 6 places this year to rank 53. Performing strongly in energy security, where it ranks 11th globally, its weakest dimension is environmental sustainability. A good score in energy security completes the profile to give a balance score of BAD.
- The Saudi energy sector is fully dependent on oil and gas for electricity generation and transportation. In order to diversify its energy supply, in April 2016, the government launched its long-term development roadmap, 'Saudi Arabia's Vision 2030', which sets a goal of building 9.5 GW of renewable energy generation capacity by 2030.
- In June 2016, the country published the National Transformation Program 2020, which specifies more detailed short-term targets for the country. This includes a goal of generating 4% of energy supply through renewable energy by 2020, which is to be met chiefly through solar energy. This has been rendered more attractive by the recent drop in prices for solar PV technology. The National Transformation Program also calls for full compliance with security standards for the introduction of nuclear power generation.
- Saudi Arabian policymakers must now focus on realising these ambitious goals and attracting the necessary investment, while also continuing to improve energy efficiency in the country. Although fossil fuels will continue to make up the vast majority of Saudi Arabia's energy supply, successful implementation could improve the country's environmental sustainability as well as energy security scores in future rankings.

KEY METRICS

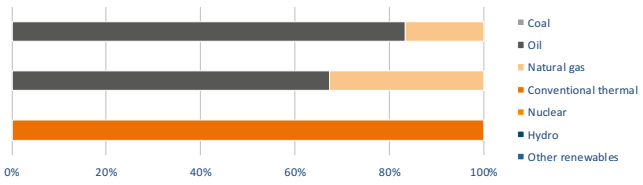
Industrial sector (% of GDP)	45.3	GDP per capita, PPP US$ (GDP Group)	54,431 (I)
Energy intensity (koe per US$)	0.08	Diversity of international energy suppliers	High (HHI = 767)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	7.1
CO_2 intensity (kCO_2 per US$)	0.39	GHG emission growth rate 2000 – 2013 (%)	5.8

ENERGY PROFILE

Fossil fuel reserves: 43,894 Mtoe

Total primary energy supply composition

Diversity of electricity generation



SENEGAL

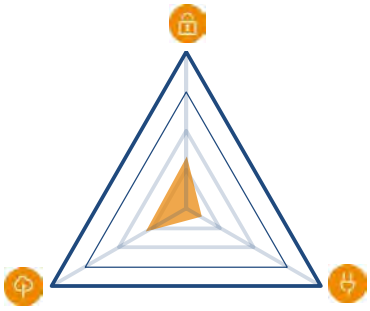
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

111

SCORE

CDC



	2015	2016	2017	Trend	Score
Overall rank and balance score	**109**	**109**	**111**	▶	**CDC**
Energy performance					
Energy security	82	92	88	▶	C
Energy equity	108	107	114	▶	D
Environmental sustainability	88	91	96	▶	C
Contextual performance	101	99	91	▶	

TRENDS AND OUTLOOK

- Senegal drops 2 places to rank 111 in this year's Index. With relatively low scores across the board, especially regarding energy equity where it receives a D grade, Senegal receives an overall balance score of CDC.
- Senegal's energy sector is currently faced with a number of challenges, including ageing infrastructure that is not being properly maintained, nor planned to be replaced. Water issues are also at the top of the agenda, as droughts have a strong impact on households, especially those located in rural areas.
- The 2012 Energy Strategy for Senegal sets out a sustainable development plan for the country's energy sector. Targets include achieving a 50% rural electrification rate by 2017, and a 20% renewables share of the electricity generation mix by 2017. To support the deployment of renewables, Senegal has joined the 'Scaling Solar' initiative in early 2016 to develop up to 200 MW of solar power.
- The Senegalese government has also signed up to the World Bank's Electricity Sector Support Project, running from 2012 to 2020. The aim of the Senegal Electricity Sector Support Project is to reduce the national utility company's technical and commercial losses and to improve the reliability of electricity supply in certain areas of the country, mainly in Greater Dakar. While improving the reliability of electricity supply will help to improve the country's energy equity, improving access to electricity in rural areas will be required to achieve significant energy equity gains.

KEY METRICS

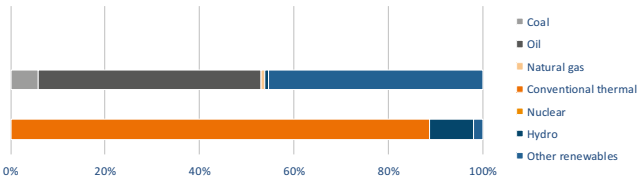
Industrial sector (% of GDP)	23.4	GDP per capita, PPP US$ (GDP Group)	2,568 (IV)
Energy intensity (koe per US$)	0.10	Diversity of international energy suppliers	Medium (HHI = 1,894)
Population with access to electricity (%)	61	Access to clean cooking in rural | urban areas (%)	8 | 80
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	13.0
CO_2 intensity (kCO_2 per US$)	0.28	GHG emission growth rate 2000 – 2013 (%)	4.0

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



SERBIA

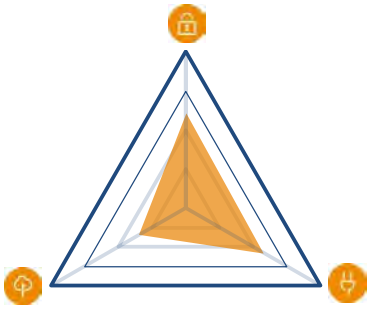
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

68

SCORE

BBC



	2015	2016	2017	Trend	Score
Overall rank and balance score	**68**	**73**	**68**	▶	**BBC**
Energy performance					
Energy security	46	61	51	▶	B
Energy equity	73	73	70	▶	B
Environmental sustainability	90	89	88	▶	C
Contextual performance	89	84	72	▲	

TRENDS AND OUTLOOK

- An improvement of 5 places sees Serbia rank 68 in this year's Index. With good scores received for both energy security and energy equity dimensions, it lags behind slightly in environmental sustainability, resulting in a letter grade BBC.
- Considerable investments have been made in the energy sector to meet environmental goals. Several wind farms are ready for construction to meet the target of 500 MW, set by the National Action Plan, which calls for 27% of gross final energy consumption in 2020 to be from renewables. This is expected to improve the country's energy security.
- The new Energy Sector Development Strategy to 2030 (ESDS) has been adopted in line with the EU policy, enforced by the Energy Community Treaty and action plans to implement energy efficiency and renewables. The existing feed-in tariff (FIT) scheme has been modified for solar power plants. These developments will have a positive impact on the energy security and environmental sustainability dimension. At the same time, construction of a new coal-fired power generation unit has started. Existing units are also being refurbished, with the intention that they will remain in operation beyond 2023, while those that do not meet environmental regulations will be shut down.
- Policymakers need to focus on: 1) adopting the program for the implementation of the ESDS until 2023; 2) meeting the obligation from the Energy Community Treaty to implement flue gas desulphurisation in all existing power plants that will remain in operation after 2023; 3) meeting the 27% target of renewables, including a 10% target for biofuels in the transport sector; and 4) enforcing the incentives for energy efficiency through the new budget fund.

KEY METRICS

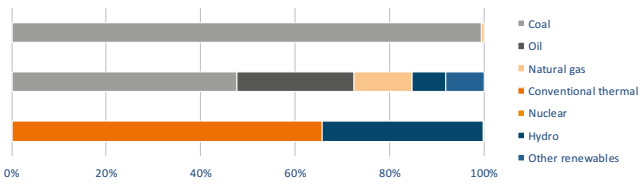
Industrial sector (% of GDP)	31.4	GDP per capita, PPP US$ (GDP Group)	14,512 (II)
Energy intensity (koe per US$)	0.11	Diversity of international energy suppliers	Low (HHI = 3,931)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	46 | 86
Household electricity prices (US$/kWh)	0.10	Rate of transmission and distribution losses (%)	15.4
CO_2 intensity (kCO_2 per US$)	0.58	GHG emission growth rate 2000 – 2013 (%)	0.8

ENERGY PROFILE

Fossil fuel reserves: 9,404 Mtoe

Total primary energy supply composition

Diversity of electricity generation



SINGAPORE

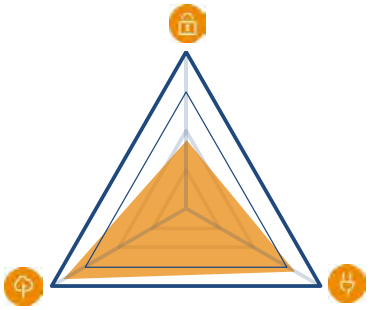
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

22

SCORE

CAA



	2015	2016	2017	Trend	Score
Overall rank and balance score	**25**	**24**	**22**	▶	**CAA**
Energy performance					
Energy security	80	70	74	▶	C
Energy equity	56	56	28	▶	A
Environmental sustainability	7	9	11	▶	A
Contextual performance	1	1	1	▶	

TRENDS AND OUTLOOK

- An improvement of 2 places sees Singapore rise to rank 22 in this year's Index. Performing strongly in environmental sustainability, where it ranks 11th globally, as well as 1st for contextual performance, energy security remains weak. This results in a grade of CAA.
- The country has been investing heavily in R&D projects, particularly in the electricity grid infrastructure. The country has recently launched a Grid 2.0 initiative, that would consolidate the country's gas, solar and thermal energy into a single intelligent network. The government is committing about S$1 billion from the National Research Foundation into this initiative to address Singapore's future energy challenges.
- Smart grids are the other key part of the new energy industry in Singapore. The smart grid and data analytics projects were launched in August 2016, and these are expected to be completed by 2021. The projects can allow the country to enhance energy supply stability and sustainability by monitoring electricity disruptions and facilitating the use of renewable energy.

KEY METRICS

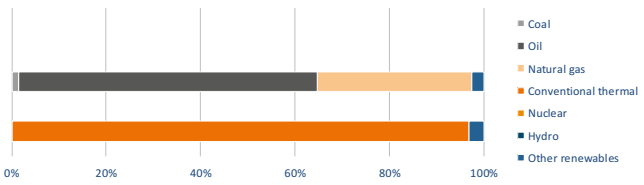
Industrial sector (% of GDP)	26.2	GDP per capita, PPP US$ (GDP Group)	87,856 (I)
Energy intensity (koe per US$)	0.03	Diversity of international energy suppliers	High (HHI = 591)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	1.7
CO_2 intensity (kCO_2 per US$)	0.13	GHG emission growth rate 2000 – 2013 (%)	0.4

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



SLOVAKIA

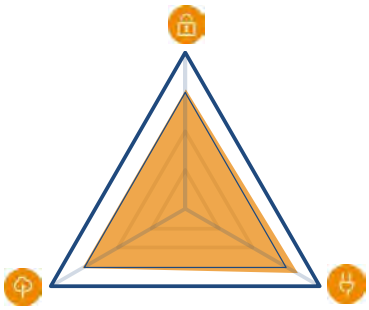
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

24

SCORE

AAA



	2015	2016	2017	Trend	Score
Overall rank and balance score	**14**	**16**	**24**	▶	**AAA**
Energy performance					
Energy security	9	15	23	▶	A
Energy equity	20	18	25	▶	A
Environmental sustainability	33	30	29	▶	A
Contextual performance	38	37	36	▶	

TRENDS AND OUTLOOK

- Slovakia drops by 8 places this year to rank 24. Showing excellent performance across all trilemma dimensions, Slovakia balances the trilemma very well, resulting in an overall balance score of AAA.
- Recent policy developments are mainly driven by EU energy and climate targets and implementation of EU policy and regulation continues, including market liberalisation and promotion of environmentally-friendly energy technologies. The removal of cross subsidies is challenging, as it conflicts with the support of the availability of cheap energy for low-income households and for the manufacturing sector.
- Policymakers need to focus on dealing with the challenge for the distribution system as a result of decentralised production and e-mobility. Increasing energy efficiency in all sectors of the economy remains a challenge and requires structural changes in the economy to move from heavy industry to sophisticated production, but also measures to reduce energy consumption of buildings. The role of nuclear energy needs to be discussed because the technology allows an increase of electricity generation without increasing carbon emissions. Furthermore, policymakers need to focus on decreasing the dependence on natural gas and oil imports.

KEY METRICS

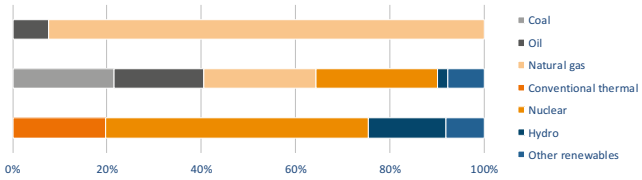
Industrial sector (% of GDP)	34.8	GDP per capita, PPP US$ (GDP Group)	30,632 (II)
Energy intensity (koe per US$)	0.08	Diversity of international energy suppliers	Low (HHI = 4,068)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	0.18	Rate of transmission and distribution losses (%)	2.5
CO_2 intensity (kCO_2 per US$)	0.25	GHG emission growth rate 2000 – 2013 (%)	-1.3

ENERGY PROFILE

Fossil fuel reserves: 13 Mtoe

Total primary energy supply composition

Diversity of electricity generation



SLOVENIA

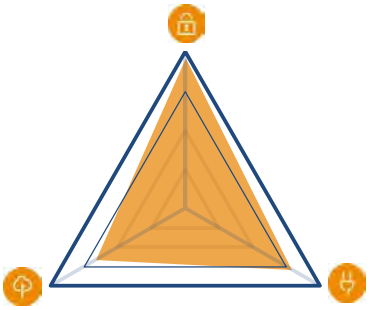
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

10

SCORE

AAB



	2015	2016	2017	Trend	Score
Overall rank and balance score	**13**	**12**	**10**	▶	**AAB**
Energy performance					
Energy security	3	2	2	▶	A
Energy equity	26	25	31	▶	A
Environmental sustainability	47	44	43	▶	B
Contextual performance	35	35	31	▶	

TRENDS AND OUTLOOK

- Slovenia makes it into the top 10 this year, improving by 2 places to rank 10. A strong performance in energy security, where it ranks 2nd globally, is matched by an excellent performance in energy equity. Overall Slovenia balances the energy trilemma very well, receiving a balance score of AAB.
- The Energy Act increases competition in the electricity market, especially in the gas market, and significantly stimulates investment in renewables and energy efficiency. The National Energy Concept, which sets energy-related environmental goals, is still in constructive public discussion and should be adopted by 2018. The main discussion is focusing on the future energy mix.
- Construction of a series of hydroelectric power plants on the Sava River is in progress, which will increase the share of renewables in the energy mix. The construction of electricity and gas interconnections with Hungary are in progress, which will benefit the regional energy market. Multiple technologically advanced smart grid projects on distribution levels are also being realised, including the SINCRO.GRID project, initiated by a Slovenian transmission operator along with a Croatian operator.
- To improve Slovenia's environmental performance additional financial investments are needed for energy efficiency measures, particularly in the energy consumption of buildings (thermal insulation, window replacement and replacement of obsolete heating systems), and in supporting schemes for the use of renewable energy sources for energy supply of buildings. National environmental legislation and permit granting are still crucial obstacles for investments in the energy sector and in renewable energy sources.

KEY METRICS

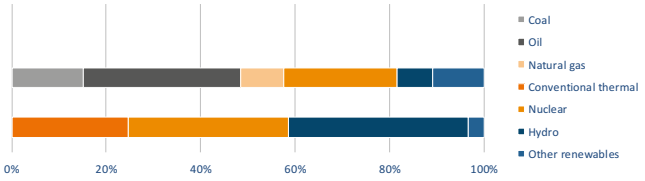
Industrial sector (% of GDP)	32.7	GDP per capita, PPP US$ (GDP Group)	32,885 (II)
Energy intensity (koe per US$)	0.09	Diversity of international energy suppliers	High (HHI = 1,396)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 92
Household electricity prices (US$/kWh)	0.18	Rate of transmission and distribution losses (%)	6.1
CO_2 intensity (kCO_2 per US$)	0.25	GHG emission growth rate 2000 – 2013 (%)	0.1

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



SOUTH AFRICA

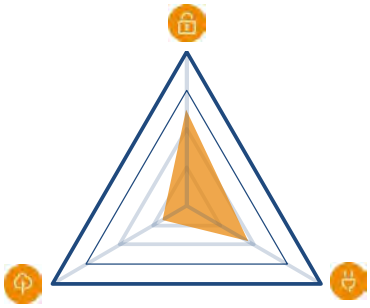
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

82

SCORE

BCD



	2015	2016	2017	Trend	Score
Overall rank and balance score	**81**	**84**	**82**	▶	**BCD**
Energy performance					
Energy security	68	66	47	▶	B
Energy equity	80	82	87	▶	C
Environmental sustainability	105	105	109	▶	D
Contextual performance	49	47	46	▶	

TRENDS AND OUTLOOK

- South Africa improves by 2 places to rank 82 in this year's Index, mainly due to a noticeable improvement in energy security. However, environmental sustainability remains its weakest dimension, resulting in an overall balance score of BCD.
- Energy security has improved due to a number of factors – additional power has become available from the Renewable Energy programme that was launched in 2011; the National Utility has improved the operation of its coal-fired fleet and the demand growth has not been as strong as anticipated due to the slow-down in the economy. In fact, the National Utility now has excess power relative to the demand it is serving.
- Environmental sustainability continues to be South Africa's weakest trilemma dimension as a result of coal-based electricity generation. Although the contribution from renewable energy sources is increasing, it is still small (<14%). Coal-based generation of electricity will continue to dominate even as renewable energy programmes are completed.
- South Africa continues to explore ways to establish a natural gas infrastructure based on LNG as one way of addressing the environmental sustainability dimension, which has become an imperative following the Paris agreement, and also since the country has no indigenous natural gas supplies of its own.

KEY METRICS

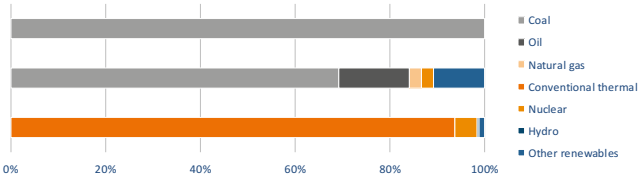
Industrial sector (% of GDP)	29.2	GDP per capita, PPP US$ (GDP Group)	13,225 (III)
Energy intensity (koe per US$)	0.12	Diversity of international energy suppliers	Medium (HHI = 1,532)
Population with access to electricity (%)	86	Access to clean cooking in rural | urban areas (%)	67 | 99
Household electricity prices (US$/kWh)	0.09	Rate of transmission and distribution losses (%)	9.0
CO_2 intensity (kCO_2 per US$)	0.71	GHG emission growth rate 2000 – 2013 (%)	2.9

ENERGY PROFILE

Fossil fuel reserves: 21,039 Mtoe

Total primary energy supply composition

Diversity of electricity generation



SPAIN

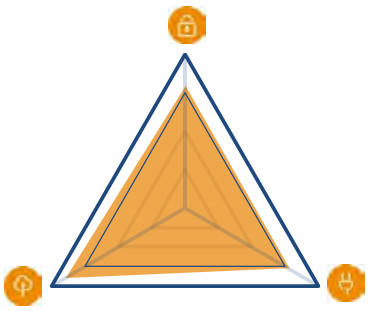
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

13

SCORE

AAA



	2015	2016	2017	Trend	Score
Overall rank and balance score	**16**	**13**	**13**	▶	**AAA**
Energy performance					
Energy security	22	26	20	▶	A
Energy equity	28	30	33	▶	A
Environmental sustainability	15	17	15	▶	A
Contextual performance	31	31	27	▶	

TRENDS AND OUTLOOK

- Spain maintains its position at rank 13 in this year's Index. Being able to manage the trade-offs of the energy trilemma excellently, Spain once again exhibits a balance score of AAA.
- Spain, in the context of the EU, has set a target of a 20% share of renewable energy in gross final energy consumption by 2020. In 2015, the share of renewables in final energy consumption reached 17.3%. In January 2016, the government launched 700 MW of renewable auctions, with two more taking place during 2017. This amounts to a total of 8,000 MW of renewable energy that will be available by 2020. However, regional integration may pose an obstacle towards the further growth of renewables. While the current level of electricity interconnections with Europe progressed significantly in 2015, it is still well below the EU target of 10%.
- The deployment of the Iberian Natural Gas Hub in December 2015 was a milestone for the development and maturity of the gas wholesale market in Spain, allowing the generation of price signals, increased transparency and flexibility as well as other advantages.
- Further progress to reduce energy poverty was made at the end of last year, with a new Royal Decree Law (RDL 7-2016) proposing the establishment of a new social bond financing mechanism. Most recently, energy utility suppliers have also signed numerous agreements with local and regional public authorities to protect vulnerable customers.
- The government has started the approval process for a comprehensive Climate Change and Energy Transition Act, with the objective of facilitating compliance with international and European commitments. This new act should pave the way for a sustainable development model that provides resilience to the effects of climate change.

KEY METRICS

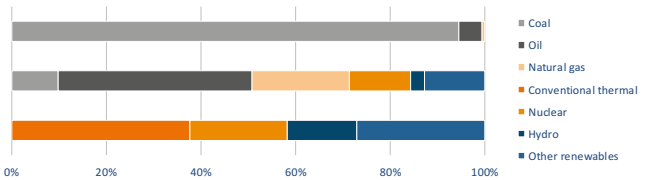
Industrial sector (% of GDP)	23.6	GDP per capita, PPP US$ (GDP Group)	36,310 (I)
Energy intensity (koe per US$)	0.06	Diversity of international energy suppliers	High (HHI = 672)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	0.26	Rate of transmission and distribution losses (%)	10.1
CO_2 intensity (kCO_2 per US$)	0.20	GHG emission growth rate 2000 – 2013 (%)	-1.5

ENERGY PROFILE

Fossil fuel reserves: 391 Mtoe

Total primary energy supply composition

Diversity of electricity generation



SRI LANKA

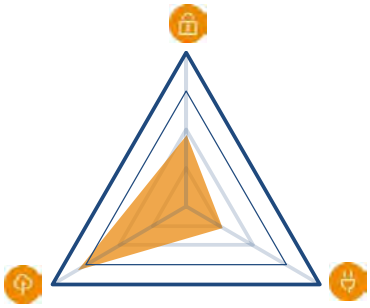
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

83

SCORE

CCA



	2015	2016	2017	Trend	Score
Overall rank and balance score	**83**	**81**	**83**	▶	**CCA**
Energy performance					
Energy security	84	74	69	▲	C
Energy equity	96	96	99	▶	C
Environmental sustainability	21	24	24	▶	A
Contextual performance	88	85	93	▶	

TRENDS AND OUTLOOK

- Dropping by 2 places, Sri Lanka moves down to rank 83 in this year's Index. A strong performance in environmental sustainability results in a letter grade A; however, energy security and equity remain relatively low. This results in an imbalanced energy trilemma profile of CCA.
- Avoiding the expected energy shortage will be an urgent and important challenge for the country. According to the Public Utilities Commission's analysis, Sri Lanka could face energy and capacity shortages in 2018−2019 and beyond under drought conditions, even with planned plant additions.
- In July 2016, the Asian Development Bank (ADB) approved a loan of US$115m and US$3.8m in grants to improve the reliability and quality of electricity supply. This includes electrification of remote islands with renewable hybrid energy systems. The country currently has an electrification rate of around 99.3%, the only South Asian nation to have near 100% grid connectivity.

KEY METRICS

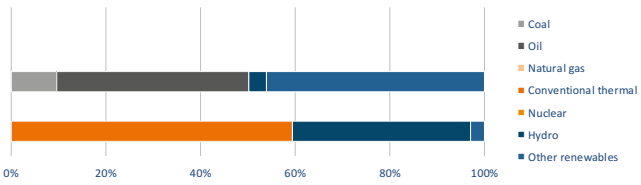
Industrial sector (% of GDP)	29.5	GDP per capita, PPP US$ (GDP Group)	12,316 (III)
Energy intensity (koe per US$)	0.05	Diversity of international energy suppliers	Medium (HHI = 2,182)
Population with access to electricity (%)	99.3	Access to clean cooking in rural | urban areas (%)	15 | 86
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	9.63
CO_2 intensity (kCO_2 per US$)	0.09	GHG emission growth rate 2000 – 2013 (%)	2.2

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



SWAZILAND

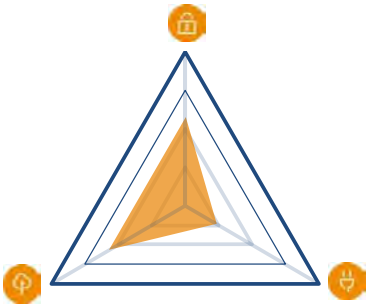
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

90

SCORE

BDB



	2015	2016	2017	Trend	Score
Overall rank and balance score	**95**	**95**	**90**	▶	**BDB**
Energy performance					
Energy security	48	45	54	▶	B
Energy equity	103	103	102	▶	D
Environmental sustainability	66	70	58	▶	B
Contextual performance	90	98	97	▶	

TRENDS AND OUTLOOK

- A rise of 5 places sees Swaziland placed at 90 in this year's Index. Whilst performing well in the energy security and environmental sustainability dimensions, energy equity remains its weakest dimension, resulting in a balance score of BDB.
- Coal will continue to play an important role in the energy mix of Swaziland. The country has vast reserves and is considering building a 300 MW coal-fired thermal power station using clean coal technologies, which is expected to supply the country and allow export to the Southern African Power Pool. However, companies are investing in cogeneration to replace coal. These efforts are expected to improve the country's energy independence by reducing the heavy reliance on imported energy. In addition, the development of a renewable energy strategy for both power (off- and on-grid) and fuel (biofuels), an independent power producer policy, and feed-in tariffs are underway.
- In addition, the country is looking to increase its strategic fuel reserves, enhance bulk purchasing (better prices), explore the possibility of setting up a petroleum products refinery, and tap into the natural gas market in Mozambique.
- Policymakers need to: 1) support the deployment of renewables; and 2) increase the budget for the energy sector to enable economic development and poverty reduction, through increased rural electrification, energy access, research and development, development of skills, and capacity building.

KEY METRICS

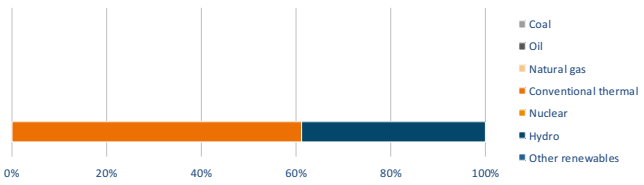
Industrial sector (% of GDP)	37.9	GDP per capita, PPP US$ (GDP Group)	8,343 (III)
Energy intensity (koe per US$)	0.10	Diversity of international energy suppliers	Low (HHI = 9,596)
Population with access to electricity (%)	65	Access to clean cooking in rural | urban areas (%)	20 | 100
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	13.0
CO_2 intensity (kCO_2 per US$)	0.11	GHG emission growth rate 2000 – 2013 (%)	N.A.

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



SWEDEN

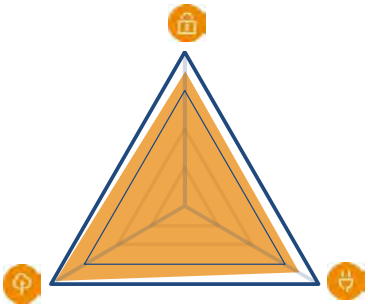
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

2

SCORE

AAA



	2015	2016	2017	Trend	Score
Overall rank and balance score	**4**	**3**	**2**	▶	**AAA**
Energy performance					
Energy security	13	10	9	▶	A
Energy equity	32	27	21	▶	A
Environmental sustainability	9	8	5	▶	A
Contextual performance	10	4	2	▶	

TRENDS AND OUTLOOK

- An impressive performance means Sweden rises by 1 place to rank 2 in this year's Index. The country continues to manage the energy trilemma excellently, with improvement seen in all trilemma dimensions, resulting in a balance score of AAA.
- Currently, the transport sector (except trains, metro and trams) relies on fossil fuels. Special policies and financial support to incentivise the purchase of electric cars are in place, but results are not yet meeting expectations. The EU target to increase the share of biofuels used in transport to 10% by 2020 will be exceeded, with the share having already reached 31% in 2016. This is primarily due to a rapid increase in the blending of HVO-biodiesel and other biofuels in gasoline and diesel, and an increased number of cars running on biogas.
- Policymakers need to focus on finding a solution to replace the existing ten nuclear reactors that will be taken out of operation to meet future electricity demand. The first reactors are expected to close between 2017 and 2020. Vattenfall has taken a policy decision to close the two smallest reactors in Ringhals, and Uniper (formerly E.ON) has already closed the two smallest reactors in Oskarshamn in 2017. While the application to build new reactors has not been formally withdrawn, Vattenfall has currently stopped any further work on the application. In addition to finding measures to meet the EU CO_2 reduction and RES targets, energy efficiency needs to be a top priority.

KEY METRICS

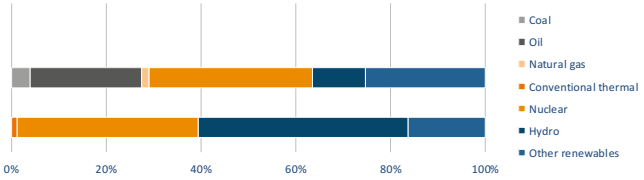
Industrial sector (% of GDP)	26.3	GDP per capita, PPP US$ (GDP Group)	49,175 (I)
Energy intensity (koe per US$)	0.08	Diversity of international energy suppliers	High (HHI = 1,499)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	0.22	Rate of transmission and distribution losses (%)	5.5
CO_2 intensity (kCO_2 per US$)	0.10	GHG emission growth rate 2000 – 2013 (%)	-2.6

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



SWITZERLAND

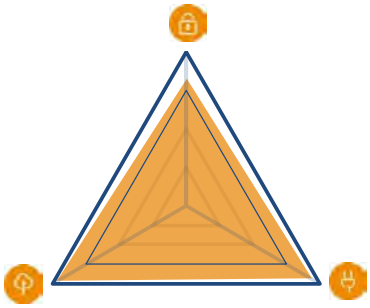
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

3

SCORE

AAA



	2015	2016	2017	Trend	Score
Overall rank and balance score	**2**	**2**	**3**	▶	**AAA**
Energy performance					
Energy security	12	12	16	▶	A
Energy equity	3	2	4	▶	A
Environmental sustainability	3	3	3	▶	A
Contextual performance	7	3	13	▶	

TRENDS AND OUTLOOK

- Switzerland drops by 1 place to rank 3 in this year's Index. Excellent scores in both energy equity and environmental sustainability, where it is ranked 4th and 3rd respectively, result in a well-balanced energy trilemma profile of AAA.
- Switzerland's leading position in the Index reflects the country's past energy and energy-related policy decisions. Recent policy decisions, however, are likely to have a strong impact on the country's energy sustainability balance.
- Recent energy policy developments include the decision to refrain from building new nuclear power plants, to reduce energy consumption, increase energy efficiency and to promote renewable energies. In a popular vote in May 2017, the Swiss people approved these initial measures. The entire energy strategy is expected to be implemented fully by 2050. The measures and next steps to phase out nuclear are not yet known, and will be a matter of political discussions in the next few months (a public referendum is probable). To achieve the transition to a low-carbon energy system in the long term, in the mid-term Switzerland is likely to become more dependent on electricity imports.
- Policymakers need to focus on: 1) construction of new electricity grids; 2) completing the liberalisation of the electricity market; 3) securing energy supply after the phase-out of nuclear power plants; and 4) coming to a bilateral agreement with the EU in order to participate in the European internal energy market and the EU-ETS. Furthermore, there is the need to be ambitious and increase the renovation rate of buildings as part of the transition to a low-carbon energy system.

KEY METRICS

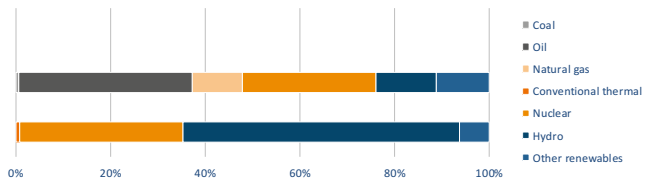
Industrial sector (% of GDP)	25.5	GDP per capita, PPP US$ (GDP Group)	62,881 (I)
Energy intensity (koe per US$)	0.05	Diversity of international energy suppliers	Medium (HHI = 2,270)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	0.16	Rate of transmission and distribution losses (%)	7.6
CO_2 intensity (kCO_2 per US$)	0.10	GHG emission growth rate 2000 – 2013 (%)	-0.2

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



TANZANIA

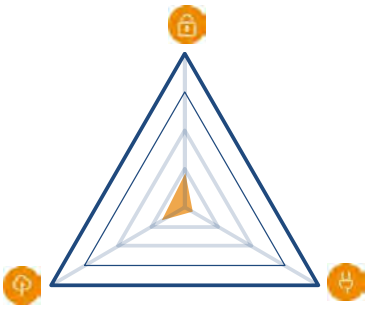
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

123

SCORE

DDD



	2015	2016	2017	Trend	Score
Overall rank and balance score	**121**	**122**	**123**	▶	**DDD**
Energy performance					
Energy security	64	83	107	▶	D
Energy equity	122	121	119	▶	D
Environmental sustainability	113	114	112	▶	D
Contextual performance	94	94	94	▶	

TRENDS AND OUTLOOK

- A drop of 1 place sees Tanzania slip into rank 123 in this year's Index. A drop in energy security this year means a letter grade change from C to D, resulting in an overall balance score of DDD.
- Tanzania faces a shortage of energy services. Power generation capacities are still insufficient, transmission and distribution networks are inadequate, and there is a huge lack of investment, human capital and technology. The government is implementing a number of projects under Big Results Now (BRN) to increase power generation, access to electricity and to bring reliable power to citizens, to drive economic growth and social development. The government is engaging in the development of the country's solar energy capacity, pursuing off-grid or micro-grid options, for example, thought the 'One Million Solar Homes' initiative launched in 2015, as well as larger-scale projects such as the commissioning of a 55 MW solar park in Dodoma, also in 2015.
- Targets set by the government include: 1) increasing electricity access to 50% by 2025 and reaching 75% by 2033; 2) increasing electricity generation up to 3,000 MW in 2018 and 10,000 MW by 2025; and 3) reducing transmission and distribution losses to 12% by 2018. The government has also developed a number of initiatives, such as the Petroleum Policy, the PPP Act and participation in the Southern African Power Pool, to create an attractive environment for private investors and increase competitiveness and transparency in the energy sector

KEY METRICS

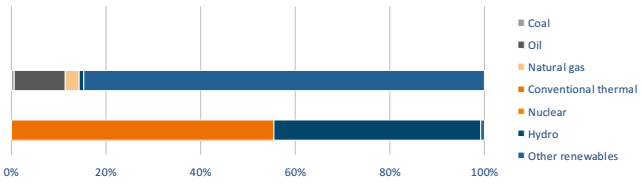
Industrial sector (% of GDP)	26.1	GDP per capita, PPP US$ (GDP Group)	2,787 (II)
Energy intensity (koe per US$)	0.19	Diversity of international energy suppliers	Low (HHI = 5,906)
Population with access to electricity (%)	16	Access to clean cooking in rural | urban areas (%)	2 | 10
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	17.5
CO_2 intensity (kCO_2 per US$)	0.10	GHG emission growth rate 2000 – 2013 (%)	6.1

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



THAILAND

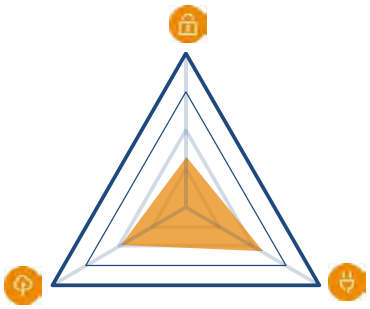
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

74

SCORE

CBC



	2015	2016	2017	Trend	Score
Overall rank and balance score	**76**	**76**	**74**	▶	**CBC**
Energy performance					
Energy security	96	94	89	▶	C
Energy equity	68	67	71	▶	B
Environmental sustainability	77	76	73	▶	C
Contextual performance	72	71	62	▶	

TRENDS AND OUTLOOK

- Thailand improves by 2 places to rank 74 in this year's Index. A good performance in the energy equity dimension is offset by relatively low scores in energy security and environmental sustainability dimensions, resulting in a balance score of CBC.
- Increasing energy production to enhance energy security and reduce reliance on energy imports is a key challenge for Thailand. To address this challenge, the government aims to advance the exploration and production of energy resources at domestic and international levels; explore the joint development of energy resources with neighbouring economies; develop a more diversified energy mix; and encourage electricity production from renewable and other alternative energy sources. In addition, the government aims to increase competition and investment in the energy industry by creating a business-friendly, transparent environment through the Investor Relation Office, which will be responsible for investment procedures and processes in the energy industry.
- The government has developed policies to encourage the production and use of alternative energy, in particular biofuels, biomass, solid waste and animal manure. These measures are expected to enhance energy security, reduce pollution, and support farmers by encouraging the production and use of renewable energy at the community level.

KEY METRICS

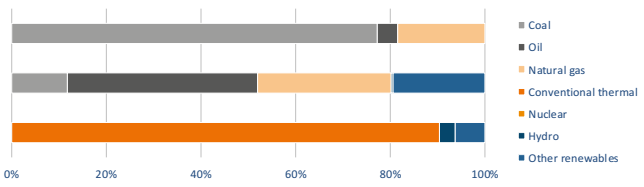
Industrial sector (% of GDP)	36.4	GDP per capita, PPP US$ (GDP Group)	16,916 (II)
Energy intensity (koe per US$)	0.08	Diversity of international energy suppliers	High (HHI = 1,195)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	62 | 100
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	5.9
CO_2 intensity (kCO_2 per US$)	0.28	GHG emission growth rate 2000 – 2013 (%)	4.0

ENERGY PROFILE

Fossil fuel reserves: 1,118 Mtoe

Total primary energy supply composition

Diversity of electricity generation



TRINIDAD & TOBAGO

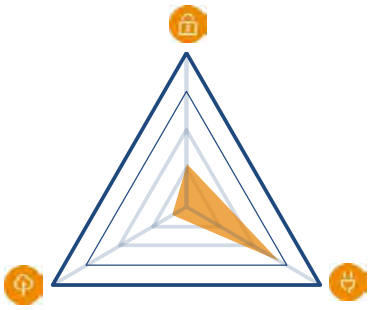
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

88

SCORE

CBD



	2015	2016	2017	Trend	Score
Overall rank and balance score	**90**	**90**	**88**	▶	**CBD**
Energy performance					
Energy security	102	99	92	▶	C
Energy equity	48	48	55	▶	B
Environmental sustainability	124	123	122	▶	D
Contextual performance	61	64	75	▶	

TRENDS AND OUTLOOK

- An improvement of 2 places sees Trinidad and Tobago rise to rank 88 in this year's Index. Whilst scoring low on environmental sustainability, it performs well in terms of energy equity, receiving a balance score of CBD overall.
- Trinidad and Tobago's electricity rates are among the lowest in the Caribbean region at approximately US$0.04 to US$0.06 per kWh, well below the regional average of US$0.33 per kWh, contributing towards the country's energy equity performance. Trinidad and Tobago has significant oil and natural gas reserves and is a net exporter of these fuels. The country is the world's 6th largest exporter of LNG. Liquid fuels subsidies are removed on a step-by-step basis. There have been two price increases since 2015 in order to bring prices in-line with the international market, in an effort to decrease the fiscal burden on the government.
- The government has set a renewable energy goal of 135 MW (10% of 2016 peak capacity) by 2021. There is a strong recognition for the need to increase energy security through promotion of energy efficiency and energy conservation in the production and utilisation of energy sources. Key issues the government will continue to address include: 1) increasing current production levels while reducing the rate of depletion of energy sources; 2) diversifying energy sources to include renewable energy and contributing to global efforts to address climate change and global warming; and 3) maximising the benefits that accrue to the citizens from the exploitation of energy resources.

KEY METRICS

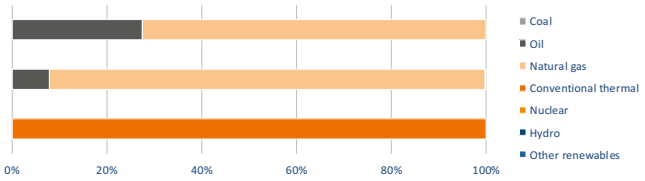
Industrial sector (% of GDP)	40.4	GDP per capita, PPP US$ (GDP Group)	31,908 (III)
Energy intensity (koe per US$)	0.11	Diversity of international energy suppliers	Low (HHI = 3,622)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	2.4
CO_2 intensity (kCO_2 per US$)	0.99	GHG emission growth rate 2000 – 2013 (%)	0.5

ENERGY PROFILE

Fossil fuel reserves: 410 Mtoe

Total primary energy supply composition

Diversity of electricity generation



TUNISIA

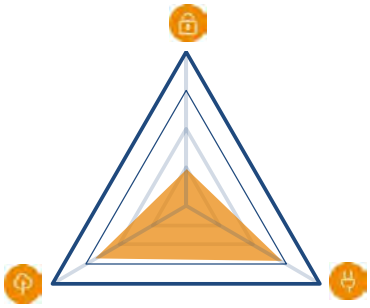
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

59

SCORE

DBB



	2015	2016	2017	Trend	Score
Overall rank and balance score	**54**	**54**	**59**	▶	**DBB**
Energy performance					
Energy security	101	101	100	▶	D
Energy equity	45	49	47	▶	B
Environmental sustainability	35	43	41	▶	B
Contextual performance	80	80	78	▶	

TRENDS AND OUTLOOK

- Tunisia drops by 5 places to rank 59 in this year's Index. Energy security remains its weakest dimension; however, this is offset by good scores in energy equity and environmental sustainability, resulting in a balance score of DBB.
- Over the past few years, Tunisia has made continued efforts to sustain its economic development and improve the energy sustainability balance. To achieve the latter, policies have been implemented to manage the exploration and production of hydrocarbons that will allow Tunisia to accelerate its economic development and to establish its position on the world market. Furthermore, programmes for the promotion of energy efficiency, renewable energy and energy substitution have been initiated.
- Key issues policymakers need to focus on are: 1) increasing the share of renewable energy in electricity generation (including wind, solar and a new concentrated solar power (CSP) scheme) and households (solar water heat, micro generation); and 2) extending the natural gas network in the south and central parts of the country.

KEY METRICS

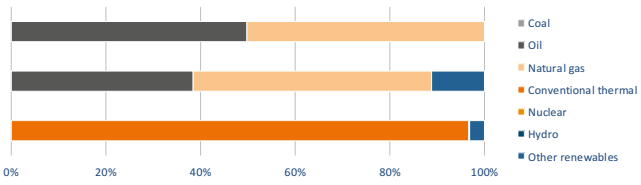
Industrial sector (% of GDP)	28.2	GDP per capita, PPP US$ (GDP Group)	11,599 (II)
Energy intensity (koe per US$)	0.07	Diversity of international energy suppliers	Medium (HHI = 1,518)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	15.7
CO_2 intensity (kCO_2 per US$)	0.24	GHG emission growth rate 2000 – 2013 (%)	2.0

ENERGY PROFILE

Fossil fuel reserves: 111 Mtoe

Total primary energy supply composition

Diversity of electricity generation



TURKEY

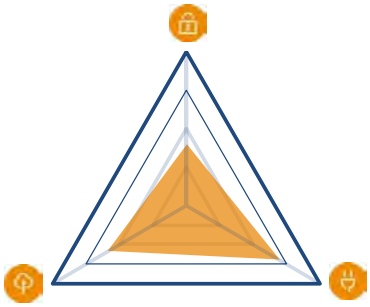
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

50

SCORE

CBB



	2015	2016	2017	Trend	Score
Overall rank and balance score	**45**	**46**	**50**	▶	**CBB**
Energy performance					
Energy security	67	69	82	▶	C
Energy equity	43	45	52	▶	B
Environmental sustainability	56	53	55	▶	B
Contextual performance	53	57	52	▶	

TRENDS AND OUTLOOK

- Turkey drops 4 places this year to rank 50. Good scores are achieved in the energy equity and environmental sustainability dimensions, but a drop in energy security, results in a balance score of CBB.
- Turkey must accommodate a fast-growing demand for energy. The country broke its all-time energy consumption record on July 3rd 2017 with approximately 928 million kWh, and enormous investment volumes are required to meet the country's continuing growth. At the moment, 25% of primary energy consumption and 49% of power generation – a record high – is met by domestic resources.
- Several initiatives are underway to improve energy security in the country: 1) A competitive tender of 1000 MW solar was completed in March, with the Kalyon-Hanwha Group consortium submitting the lowest offer of $6.99 cents/kWh. It is one of the largest single solar projects in the world; 2) 1387 MW wind power generation was added to installed capacity in 2016, followed by a massive US$1 billion tender in August 2017 for 1000 MW, setting a new world record feed-in tariff price of $3.48 cents/kWh. An average of 1.5 million tons of CO_2 emissions will be reduced; 3) Geothermal power has achieved a 70% growth in the past eight months. This puts Turkey at 4th place globally in terms of geothermal electricity generation; 4) The Trans-Anatolian Natural Gas Pipeline (TANAP), which began construction in 2015, is expected to make its first contribution to the Turkish grid by June 2018. Export to Europe is expected in 2020 once the construction of the Trans Adriatic Pipeline (TAP) is completed; 5) TurkStream Natural Gas Pipeline (TANAP) is expected to become operational by the end of 2019. The Intergovernmental Agreement of the project was signed during WEC2016; 6) Construction of Turkey's first nuclear power plant, Akkuyu, is underway with an additional one planned in Sinop. When completed, both reactors are expected to make up a 10% share of total electricity supply.

KEY METRICS

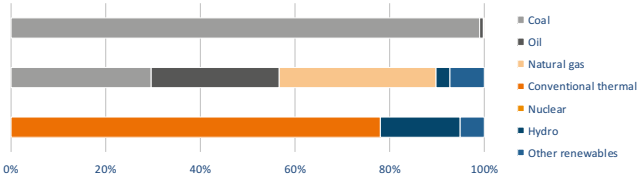
Industrial sector (% of GDP)	31.7	GDP per capita, PPP US$ (GDP Group)	24,244 (III)
Energy intensity (koe per US$)	0.08	Diversity of international energy suppliers	High (HHI = 1,176)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 94
Household electricity prices (US$/kWh)	0.10	Rate of transmission and distribution losses (%)	13.8
CO_2 intensity (kCO_2 per US$)	0.29	GHG emission growth rate 2000 – 2013 (%)	2.8

ENERGY PROFILE

Fossil fuel reserves: 6,123 Mtoe

Total primary energy supply composition

Diversity of electricity generation



UKRAINE

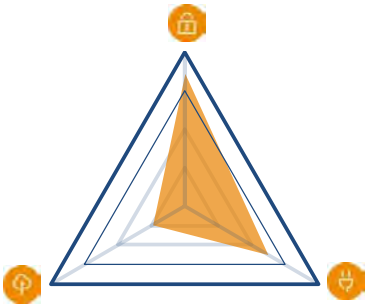
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

48

SCORE

ABD



	2015	2016	2017	Trend	Score
Overall rank and balance score	**65**	**63**	**48**	▶	**ABD**
Energy performance					
Energy security	28	28	11	▶	A
Energy equity	60	61	63	▶	B
Environmental sustainability	111	108	102	▶	D
Contextual performance	95	97	87	▶	

TRENDS AND OUTLOOK

- Ukraine jumps 15 places this year to rank 48. An excellent improvement in energy security this year, where it is ranked 11th globally, combined with a good score in energy equity result in letter grades of A and B, respectively. A low score in the environmental sustainability dimension results in an imbalanced trilemma profile of ABD.
- Ukraine's energy sector faces great challenges, from a high dependence on expensive fossil fuel imports such as oil and gas, to inefficient infrastructure and markets. Recent energy policy developments to address those challenges include the decision to replace Russian gas with Ukrainian coal, increase oil and gas production (for example, from the Black Sea shelf), and develop nuclear power capacity.
- Furthermore, there is a need to strengthen energy efficiency policies, make full use of the country's renewable energy potential such as biogas and municipal waste for heat and power generation, and lower gas consumption in the district heating sector to ensure heat supply and lower energy bills.

KEY METRICS

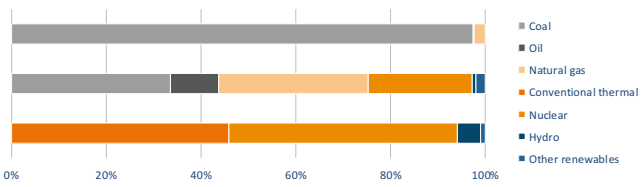
Industrial sector (% of GDP)	25.6	GDP per capita, PPP US$ (GDP Group)	8,272 (I)
Energy intensity (koe per US$)	0.18	Diversity of international energy suppliers	Medium (HHI = 1,690)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	89 | 99
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	12.3
CO_2 intensity (kCO_2 per US$)	0.65	GHG emission growth rate 2000 – 2013 (%)	-0.6

ENERGY PROFILE

Fossil fuel reserves: 24,231 Mtoe

Total primary energy supply composition

Diversity of electricity generation



UNITED ARAB EMIRATES

TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

40

SCORE

AAD

	2015	2016	2017	Trend	Score
Overall rank and balance score	**42**	**43**	**40**	▶	**AAD**
Energy performance					
Energy security	34	42	21	▶	A
Energy equity	19	22	14	▶	A
Environmental sustainability	114	113	116	▶	D
Contextual performance	25	25	29	▶	

TRENDS AND OUTLOOK

- The United Arab Emirates improves by 3 places to rank 40 in this year's Index. Strong performances in both energy security and energy equity dimensions are in contrast to a particularly low score in environmental sustainability, resulting in an imbalanced trilemma profile of AAD.
- The UAE relies significantly on conventional hydrocarbon resources for electricity and transport. However, there are opportunities for renewable energy and energy efficiency solutions. For example, the UAE has launched initiatives such as Vision 2021, Dubai Plan 2021, and Abu Dhabi Vision 2030, which include the establishment of renewable energy (7% and 5% generation capacity in Abu Dhabi and Dubai, respectively by 2030), and energy efficiency targets (30% demand reduction target by 2030 in Dubai). The UAE is also working on a comprehensive energy policy plan to coordinate all federal initiatives.
- Diversification of the energy mix, energy efficiency and conservation, as well as a deep understanding of the water-energy nexus in a water-scarce environment, are all issues policymakers need to focus on in the coming years. The leading oil producer in the UAE has scrapped subsidies on petrol and diesel from August 2015 to support state finances, rationalise fuel consumption, and protect natural resources and the environment.

KEY METRICS

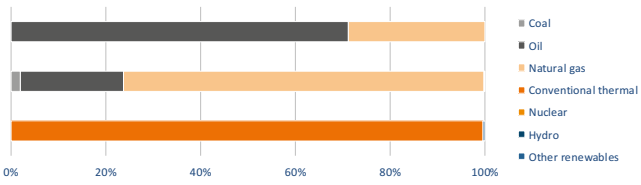
Industrial sector (% of GDP)	55.3	GDP per capita, PPP US$ (GDP Group)	72,419 (I)
Energy intensity (koe per US$)	0.09	Diversity of international energy suppliers	Medium (HHI = 1,727)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	7.7
CO_2 intensity (kCO_2 per US$)	0.42	GHG emission growth rate 2000 – 2013 (%)	5.4

ENERGY PROFILE

Fossil fuel reserves: 18,197 Mtoe

Total primary energy supply composition

Diversity of electricity generation



UNITED KINGDOM

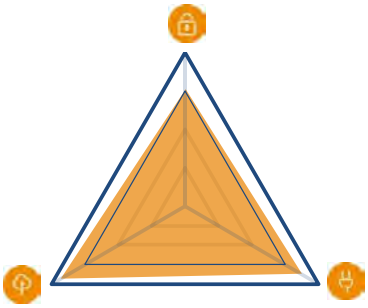
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

5

SCORE

AAA



	2015	2016	2017	Trend	Score
Overall rank and balance score	**10**	**11**	**5**	▶	**AAA**
Energy performance					
Energy security	38	32	26	▲	A
Energy equity	7	8	15	▶	A
Environmental sustainability	16	15	9	▶	A
Contextual performance	13	13	7	▶	

TRENDS AND OUTLOOK

- The United Kingdom improves by 6 places this year to rank in the top 10 list once again. Excellent performance in all trilemma dimensions results in a very well-balanced profile of AAA.
- Challenges in securing energy supply, however, remain. Overall domestic production of fossil fuels continues to decline, and the plans to expand production of unconventional oil and gas still have to overcome technical challenges and gain public support. In the power sector, an ageing nuclear plant is being decommissioned, while planned new nuclear was approved by the new government in mid-2016. In addition, the planned closure of all coal plants under UK legislation by 2025 (as well as existing EU regulation driving closure at present) is resulting in a decline in electricity generation from coal, and was at a record low in the first quarter of 2016. Electricity generation from renewables is showing steady increase year-on-year, but does not match the decline in generation from conventional sources.
- Regarding energy affordability, policy changes continue to impact. In June 2016, the UK Competition and Markets Authority published its final review into the supply and acquisition of energy in the UK and, while acknowledging that the sector has made significant progress in reducing emissions and ensuring security of supply, concerns were raised in relation to energy affordability. Proposed regulatory changes in light of the report are yet to come into effect. In addition, the consequences of the UK's decision to leave the EU and subsequent changes in government leadership and restructuring of government departments are yet to be realised.

KEY METRICS

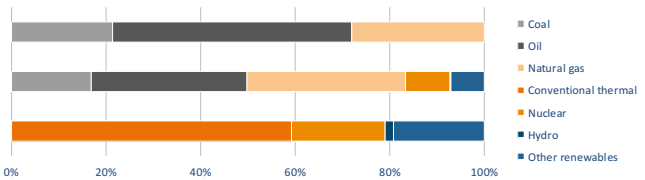
Industrial sector (% of GDP)	19.4	GDP per capita, PPP US$ (GDP Group)	42,609 (I)
Energy intensity (koe per US$)	0.05	Diversity of international energy suppliers	High (HHI = 1,308)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	0.24	Rate of transmission and distribution losses (%)	8.0
CO_2 intensity (kCO_2 per US$)	0.17	GHG emission growth rate 2000 – 2013 (%)	-1.4

ENERGY PROFILE

Fossil fuel reserves: 740 Mtoe

Total primary energy supply composition

Diversity of electricity generation



UNITED STATES

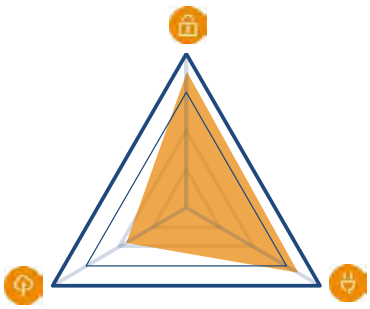
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

15

SCORE

AAC



	2015	2016	2017	Trend	Score
Overall rank and balance score	**22**	**14**	**15**	▶	**AAC**
Energy performance					
Energy security	11	4	8	▶	A
Energy equity	15	13	24	▶	A
Environmental sustainability	80	73	75	▶	C
Contextual performance	19	18	14	▶	

TRENDS AND OUTLOOK

- The United States drops by 1 place this year to rank 15. Whilst exhibiting strong performances in both energy security, where it ranks 8th globally, and energy equity, this is offset by a relatively weak score in terms of environmental sustainability. This results in a balance score of AAC.
- Due to advances in horizontal drilling and hydraulic fracturing, shale gas production has become economically viable in recent years. The Energy Information Administration (EIA) estimates that the country has more than 1,744 trn cubic feet (tcf) of technically recoverable natural gas, including 211 tcf of proved reserves (the discovered, economically recoverable fraction of the original gas-in-place). Production of shale gas is expected to increase from a 2007 US total of 1.4 tcf to 4.8 tcf in 2020. The significant increases in domestic oil and gas production will greatly reduce oil imports over the next 10 years, and lead to increased exports of refined products and possibly natural gas.
- The recent decision by the Trump administration to withdraw from the Paris Agreement has added uncertainty to the US energy sector. Nevertheless, commitment among Americans remains high in supporting renewables development, with some cities pledging to stick by earlier commitments to target emissions decreases and increase shares of renewables.

KEY METRICS

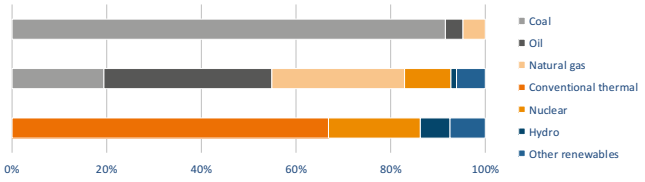
Industrial sector (% of GDP)	20.0	GDP per capita, PPP US$ (GDP Group)	57,467 (II)
Energy intensity (koe per US$)	0.09	Diversity of international energy suppliers	Medium (HHI = 1,675)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	100 | 100
Household electricity prices (US$/kWh)	0.21	Rate of transmission and distribution losses (%)	6.2
CO_2 intensity (kCO_2 per US$)	0.34	GHG emission growth rate 2000 – 2013 (%)	-0.8

ENERGY PROFILE

Fossil fuel reserves: 180,609 Mtoe

Total primary energy supply composition

Diversity of electricity generation



URUGUAY

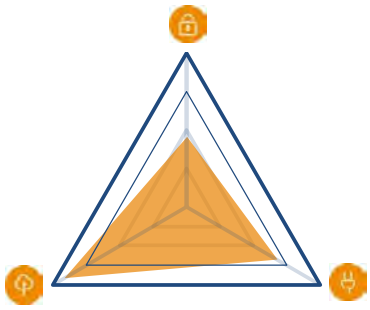
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

35

SCORE

CBA



	2015	2016	2017	Trend	Score
Overall rank and balance score	**27**	**27**	**35**	▶	**CBA**
Energy performance					
Energy security	29	40	70	▶	C
Energy equity	51	51	57	▶	B
Environmental sustainability	14	16	10	▶	A
Contextual performance	45	44	43	▶	

TRENDS AND OUTLOOK

- A drop of 8 places sees Uruguay rank 35 in this year's Index. Whilst a drop in energy security results in a change from B to C, the country excels in environmental sustainability, ranking 10th globally. This results in a balance score of CBA.
- The country has no proven oil, natural gas or coal reserves, but a high availability of renewable energy sources. By carefully choosing renewable energy sources and technologies such as hydropower, wind energy, biomass cogeneration, and biofuels, it was possible, without subsidies, to reach a 57% share of renewable energy in the 2015 energy mix (up from 37% in 2005). At the end of 2015, Uruguay had 26 wind farms (857 MW installed capacity), of which 19 were installed in the past two years. This represents a 15% share of wind energy in the electricity generation mix. In addition, during 2015, the country increased the use of biomass waste as an energy source by 30%. This, among other measures, contributes towards the country's strong energy trilemma performance.
- The country is evaluating the construction of a regasification LNG plant and 70% of the Uruguayan offshore area is being explored for natural gas and oil. Between 2010 and 2015 US$7bn has been invested in the energy sector (15% of annual GDP). As a result of this process, during the past two years, Uruguay has moved from being an energy importer to being an energy exporter. Moreover, since 2015 Uruguay did not have to import electricity.

KEY METRICS

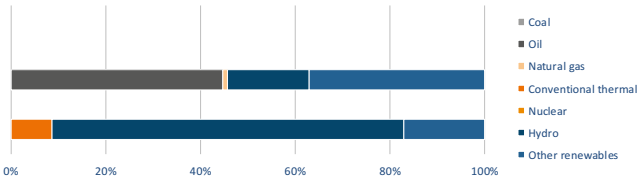
Industrial sector (% of GDP)	28.9	GDP per capita, PPP US$ (GDP Group)	21,625 (I)
Energy intensity (koe per US$)	0.07	Diversity of international energy suppliers	Medium (HHI = 2,191)
Population with access to electricity (%)	100	Access to clean cooking in rural | urban areas (%)	81 | 100
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	12.4
CO_2 intensity (kCO_2 per US$)	0.10	GHG emission growth rate 2000 – 2013 (%)	2.5

ENERGY PROFILE

Fossil fuel reserves: 0 Mtoe

Total primary energy supply composition

Diversity of electricity generation



ZIMBABWE

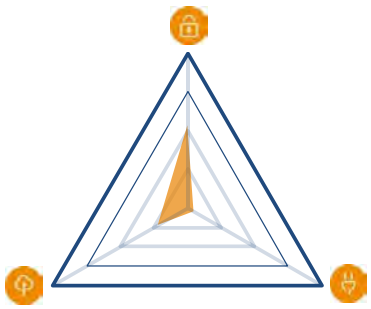
TRILEMMA INDEX RANKINGS AND BALANCE SCORE

RANK

120

SCORE

BDD



	2015	2016	2017	Trend	Score
Overall rank and balance score	**118**	**113**	**120**	▶	**BDD**
Energy performance					
Energy security	50	27	60	▶	B
Energy equity	120	120	121	▶	D
Environmental sustainability	109	109	105	▶	D
Contextual performance	115	116	119	▶	

TRENDS AND OUTLOOK

- Zimbabwe drops 7 places in this year's Index to rank 120. Whilst exhibiting a good performance in the energy security dimension, energy equity and environmental sustainability scores remain low, resulting in a balance score of BDD.
- Over the past few years Zimbabwe has made continued efforts to improve its energy security, energy access and environmental footprint. The installation of a 100 MW project and increased energy imports have resulted in improved energy security and reliability, with tangible impacts for consumers. Since December 2015 there has not been any load shedding in Zimbabwe. Energy equity is addressed through the rural energy master plan, which is being implemented. Moreover, after signing the Paris Agreement, the government has committed to reducing the country's carbon footprint by 33% by 2020. This has already seen a marked shift of power projects to hydro and solar, which is expected to improve the country's environmental sustainability in the future. In addition, the use of biofuels is further promoted, with an increase in the blending ratio from 15% today to 20% by 2018.
- Additional policy developments include: establishment of an independent energy regulator; amendment of the Electricity Act to promote energy efficiency in the public utility; promotion of public-private partnerships to spur development in the petroleum and power sector and the adoption of a long-term, government-driven renewable energy technologies programme.

KEY METRICS

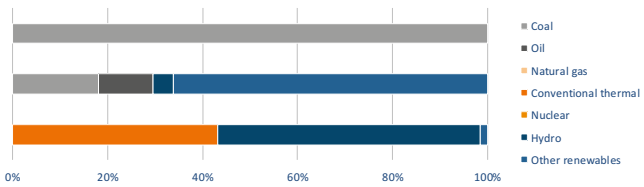
Industrial sector (% of GDP)	24.4	GDP per capita, PPP US$ (GDP Group)	2,006 (IV)
Energy intensity (koe per US$)	0.40	Diversity of international energy suppliers	Medium (HHI = 2,000)
Population with access to electricity (%)	32	Access to clean cooking in rural | urban areas (%)	6 | 67
Household electricity prices (US$/kWh)	N.A.	Rate of transmission and distribution losses (%)	17.2
CO_2 intensity (kCO_2 per US$)	0.48	GHG emission growth rate 2000 – 2013 (%)	-1.0

ENERGY PROFILE

Fossil fuel reserves: 350 Mtoe

Total primary energy supply composition

Diversity of electricity generation



Frequently asked questions

A. GENERAL INTRODUCTION

WHAT IS THE WORLD ENERGY TRILEMMA INDEX?

The World Energy Trilemma Index is a quantification of the Energy Trilemma, which is defined by the World Energy Council as the triple challenge of providing secure, affordable, and environmentally sustainable energy. Balancing these trade-offs is challenging but is also the foundation for the prosperity and competitiveness of countries.

The World Energy Trilemma Index looks at indicators of energy performance across the three dimensions as well as the country's context.

1. **Energy security** measures the ability to meet current and future energy demand.
2. **Energy equity** measures the ability to provide access to reliable and affordable energy for domestic and commercial use.
3. **Environmental sustainability** measures the ability to mitigate natural resource depletion and environmental degradation.

Country context focuses on elements that enable countries to effectively develop and implement energy policy and achieve energy goals. This component examines factors such as the capacity to support a coherent and predictable policy framework, a stable regulatory environment, and overall attractiveness of the country to investors.

The Energy Trilemma Index is prepared annually by the World Energy Council in partnership with global consultancy Oliver Wyman, along with the Global Risk Centre of its parent Marsh & McLennan Companies since 2010.

WHAT IS THE GOAL OF THE INDEX?

The goal of the Index is to provide insights into a country's relative energy performance with regards to energy security, energy equity and environmental sustainability. In doing so, the Index highlights a country's challenges in balancing the energy 'Trilemma' and opportunities for improvements in meeting energy goals now and in the future. The Index thus informs policy makers, energy leaders, and the investment and financial sector.

WHAT IS THE SCOPE OF THE INDEX?

The Index includes 130 countries, 94 of which are member countries of the World Energy Council. However, in 2017, rankings have only been produced for 125 countries due to data limitations. Countries that are tracked but not ranked are: Chinese Taipei, Libya, Barbados, Syria (Arab Republic) and Yemen.

The Index aggregates 72 datasets into 35 indicators to create a snapshot energy profile for each country.

WHAT TIME PERIOD DOES THE 2017 INDEX CAPTURE?

The 2017 Index generally reflects data from 2014-2016, although selected datasets may date from earlier if more recent data is not available. Recent world events that could affect the Index's outcomes may therefore not be fully captured (e.g., the sharp drop in oil prices through 2015 or the geopolitical unrest in the Middle East).

To address this limitation, the World Energy Trilemma Index Report identifies a 'watch list' that seeks to identify countries that are likely to experience significant changes – positive or negative – in their trilemma Index performance in the near future. The goal of the watch list is to reflect developments in a country's energy sector that are currently ongoing but not yet captured in the data that is available.

HOW ARE THE INDEX RESULTS PRESENTED?

Countries are provided with an overall Index rank (1-125), as well as rankings for each dimension of energy security, energy equity and energy sustainability. The top performing country is awarded a #1 ranking, while the lowest ranking country is assigned rank # 125.

In addition, each country is also given a 'balance score' that allocates a 'letter grade' to a country's ranking in each dimension and countries are provided with a three-letter score. The scores are calculated by splitting the normalised results in each dimension into four groups (A, B, C, D). High performance across all three dimensions is s awarded 'AAA'. Letter scores such as BBC, CCD, highlight the balance or imbalance across a country's energy performance. An imbalance in energy performance suggests current or future challenge in the country's energy policy. Each letter reflects one dimension of the Energy Trilemma: the first letter refers to energy security; the second letter to energy equity and the third letter to environmental sustainability.

Index results and analysis are also complemented by regional overviews as well as individual country profiles of World Energy Council member countries only. The country profiles provide trends in energy trilemma performance as well as performance on specific indicators assessed in the overall Index.

WHERE CAN I FIND THE FULL RESULTS?

The results are published once a year. Results can be downloaded for free from the Council's webpage.

Index data is available at: https://www.worldenergy.org/data/.

The full report with country rankings and profiles is available at: https://www.worldenergy.org/publications/

As part of the world energy Trilemma work programme of the World Energy Council, an analysis report is published once a year, which draws on the findings of the Index and puts these into regional, economic and energy trilemma profile context. The 2017 World Energy Trilemma report, TITLE, can be found at: https://www.worldenergy.org/work-programme/.

B. INDEX RANKINGS & POLICIES

WHAT DOES THE INDEX TELL US ABOUT THE COUNTRY'S ENERGY PERFORMANCE AND POLICY?

The Index shows how well each country is performing on the Energy Trilemma and in effect, captures the aggregate effect of energy policies applied over time. Because the Index shows aggregate policy effects, it does not identify the effectiveness of a particular policy; each policy interacts with a unique set of policies specific to that country over different periods. Nonetheless, the Index broadly measures the aggregate outcome of country policies, such as the level of country CO_2 emissions or the overall use of electricity per capita relative to other countries.

It is important to note that the Index is a comparative ranking and shows the performance of a country in the context of the relative to the performance of all the countries. To move up in the Index ranking requires a country to improve its performance relative to peer countries. Thus, if a country's energy performance remains stable but those of other countries improve, a country will decrease in rankings.

WHAT WILL AFFECT A COUNTRY'S RANKING IN THE INDEX?

The Index is weighted in favour of energy performance versus contextual performance. Therefore, changes in energy performance will have a greater effect on a country's ranking than contextual dimensions.

A country's overall position in the Index is affected by the degree of balance between the three energy performance dimensions. Given the equal weighting of these dimensions, countries that exhibit broadly similar and relatively higher scores in these will typically rank higher on the Index and have a higher letter grade.

Few countries manage to perform well across all three energy dimensions. Currently, many countries achieve stronger performance in two dimensions, suggesting trade-offs between energy dimensions. For example, some energy exporting countries may lead in social equity (highly affordable and accessible energy) and also in energy security (high energy exports) but obtain lower scores in environmental impact mitigation (due to intense energy use). A trade-off between strong affordability and low energy intensity becomes evident as low prices limit incentives to reduce energy consumption and to engage in energy efficiency programs.

HOW CAN A COUNTRY MOVE UP OR DOWN THE INDEX?

Country position can change due to changes in a county's performance or due to the relative changes in other countries' performances. For example, a country with broadly unchanged data could move lower in Index rankings if other countries make improvements.

For example, a country's ranking on the indicator 'Diversity of electricity production' will depend on how its diversity (e.g., hydroelectric, nuclear, wind, conventional thermal) ranks against other countries. Put differently, a country's underlying indicator data can remain the same year-on-year but its Index position can move due to changes within other countries. Thus, performance stagnation could impact the Index position in the same way as retrograde motion of the energy performance data.

WHAT POLICIES WILL AFFECT A COUNTRY'S POSITION ON THE INDEX?

The Index aggregates many different data points and it is thus often very difficult to pinpoint how any single policy affects a country's performance against a particular indicator or in an overall dimension. For example, 'GHG emissions' could change due to multiple policies implemented over time aimed at reducing GHG and CO_2 emissions. Technological factors within specific industries (e.g., changes in automotive technology) can also have an impact, and are not directly measured by the Index.

Those factors noted, countries which implement a range of clear and predictable energy policies resulting in an overall framework that addresses the three aspects of energy trilemma typically rank higher in the Index.

C. INDEX METHODOLOGY

WHY WAS THE INDEX METHODOLOGY REVISED IN 2016?

The Index was launched in 2010 and the methodology was revised in 2016. There were three broad goals in revising the Index methodology:

1. To broaden the focus of indicators to provide a more comprehensive view of energy performance:
    - The earlier version of the Index had a heavy focus on the electricity sector. Model updates allowed the focus to expand to the wider energy sector (including renewables and nuclear), primarily by including additional indicators for diversity of primary energy supply as well as diversity of electricity generation.
    - The understanding of energy equity was also enhanced, primarily by broadening the scope of energy access measures (clean cooking) and, including measures for the quality of supply and affordability of a wider number of energy resources (natural gas and diesel).

2. To enable a forward-looking view of energy performance by capturing resilience of the energy system:
    - Countries must increasingly consider the resilience of their energy system to emerging risks (including extreme weather, economic shocks, or geopolitical factors) as a critical aspect of energy security. The Index updates include measures specifically aimed at assessing the resilience of a country's energy system; this is assessed by both utilizing a broader understanding of energy storage and also measuring the preparedness (human factor) of a country – that is the ability of a country to prepare for and repair energy infrastructure following shocks.

3. To try to reduce a potential bias to wealthier countries:
    - In the earlier version of the Index, country context accounted for 25% of overall Index performance; this has been reduced to 10% in the current Index. While recognising the importance of country context to energy performance, in many instances, there are few energy-specific indicators available (e.g., foreign direct investment and technology transfer indicators relate to all sectors and not just energy) and the indicators thus may not effectively

reveal energy policymaking performance. To address this data challenge and not unduly favour wealthier countries, the context weighting has been reduced.

HOW ARE INDICATORS SELECTED FOR THE INDEX?

Each indicator category is composed of a set of carefully selected indicators that meet the selection criteria and are highly relevant to the World Energy Council's understanding of the Energy Trilemma.

It was also critical that the indicators could be consistently and readily derived from reputable sources and cover a high proportion of member countries; some potential indicators were excluded from the Index due to low Council's country coverage. Indicator data sources include the International Energy Agency, the U.S. Energy Information Administration, the World Bank, the International Monetary Fund, the World Economic Forum, and others.

Data selection criteria included:

- Country coverage / data availability and timeliness;
- Comparability of data: Data to calculate an indicator is derived from as single and common a unique source as possible;
- Relevance: Indicators are chosen or developed to provide insight into country situations;
- Distinctiveness and balance: Each indicator focuses on a different aspect of the issue being explored;
- Contextual sensitivity: Indicators capture different country situations (e.g., wealth, size);
- Robustness: Indicators are captured from reputable sources with the most current information available;
- Balance: Indicators within each dimension (and dimensions across the Index) exhibit coverage of different issues.

WHAT IS THE 2017 INDEX BASED ON?

Each country's overall Index ranking is based on underlying indicators across 13 categories in 4 dimensions – some of which are supported by multiple datasets. For example, "Affordability and competitiveness" is measured using three indicators, each of which is supported by multiple datasets. Figure 1 provides an overview of underlying indicators and weighting regimes.

FIGURE 1: 2017 ENERGY TRILEMMA INDEX STRUCTURE AND WEIGHTING

Dimension	%		Indicator category	%		Indicator	%
Energy security	30%	1	Security of supply and energy delivery	15%	a	Diversity of primary energy supply	5.0%
					b	Energy consumption in relation to GDP growth	5.0%
					c	Import dependence	5.0%
		2	Resilience	15%	a	Diversity of electricity generation	5.0%
					b	Energy storage	5.0%
					c	Preparedness (human factor)	5.0%
Energy equity	30%	1	Access	10%	a	Access to electricity	5.0%
					b	Access to clean cooking	5.0%
		2	Quality of supply	10%	a	Quality of electricity supply	5.0%
					b	Quality of supply in urban vs. rural areas	5.0%
		3	Affordability and competitiveness	10%	a	Electricity prices	3.3%
					b	Gasoline and diesel prices	3.3%
					c	Natural gas prices	3.3%
Environmental sustainability	30%	1	Energy resource productivity	10%	a	Final energy intensity	5.0%
					b	Efficiency of power generation and T&D	5.0%
		2	GHG emissions	10%	a	GHG emission trend	5.0%
					b	Change in forest area	5.0%
		3	CO2 emissions	10%	a	CO2 intensity	3.3%
					b	CO2 emission per capita	3.3%
					c	CO2 from electricity generation	3.3%
Country context	10%	1	Coherent and predictable policy framework	2.0%	a	Macroeconomic environment	0.5%
					b	Effectiveness of government	0.5%
					c	Political stability	0.5%
					d	Perception of corruption	0.5%
		2	Stable regulatory environment	2.0%	a	Transparency of policy making	0.7%
					b	Rule of law	0.7%
					c	Regulatory quality	0.7%
		3	Initiatives that enable RD&D and innovation	2.0%	a	Intellectual property protection	0.5%
					b	FDI & technology transfer	0.5%
					c	Capacity for innovation	0.5%
					d	Number of patents issued by residents	0.5%
		4	Investability	2.0%	a	Foreign direct investment net inflows	1.0%
					b	Ease of doing business	1.0%
		5	Air pollution, land and water impact	2.0%	a	Wastewater treatment	1.0%
					b	Air pollution	1.0%

ARE MORE DETAILS ON THE METHODOLOGY AVAILABLE?

Full details on the Index methodology, including the sources of all datasets and how each indicator is calculated and treated, are provided in the comprehensive 'Methodology' document available at: www.worldenergy.org.

WHY ARE GRADES ASSIGNED USING ACTUAL DISTRIBUTION?

Assigning grades using the actual distribution is more representative of the data. It presents the absolute difference between the countries' performance in the different dimensions and avoids artificially dividing countries into different categories with a fixed number of countries within each category (e.g. AAA ranking), as would occur with an even distribution approach.

WHY ARE GATE CRITERIA USED?

Gate criteria were introduced to address heavily skewed data, such as access to energy – there are a large number of countries that have a 100% access rate. A gate criterion helps group similar countries (e.g., those with a 100% access rate) and thereby prevents the skewed data from excessively influencing outcomes.

WHICH (SUB)-INDICATORS ARE SUBJECT TO A GATE CRITERION?

The following indicators and sub-indicators are subject to a gate criterion:

Diversity of primary energy supply:

1. Import dependence;
2. Energy storage (oil stocks and infrastructure);
3. Access to electricity;
4. Access to clean cooking;
5. Number of patents issued by residents.

Please refer to full Index Methodology document for a detailed explanation of the gate criteria and the rationale behind the gate criteria for each of the sub-indicators.

WHY IS MISSING DATA REPLACED BY THE GROUP MEAN?

The group mean is more representative of the specific countries in terms of economic development, social situation, etc. This representativeness renders missing values less likely to distort country outcomes.

The groups are established based (jointly) on economic groups and geographic region

- GDP Group I: GDP per capita greater than USD 33,500;
- GDP Group II: GDP per capita between USD14,300 and USD 33,500;
- GDP Group III: GDP per capita between USD 6,000 and USD 14,300;
- GDP Group IV: GDP per capita lower than USD 6,000.

The indicator mean is the average of a specific indicator across all countries. For example, the indicator mean would average CO_2 emissions data between the United States and South Sudan, which have very different figures.

Using group means ensures that, for example, CO_2 emissions data would be averaged between South Sudan and countries with a similar GDP and geographic location, which could be more reflective of the economy and energy profile of South Sudan.

WHAT ARE THE LIMITATIONS OF THE INDEX?

- The Index cannot capture real-time energy trilemma performance due to the challenges of capturing large volumes of reliable data for a wide range of countries.
- The Index cannot isolate the impact of a particular single policy.
- The Index uses nearly 100 data sets. In a number of instances data for specific countries is not available (i.e. the data set has missing data), in which case missing data is replaced by the group mean.

WHAT QUESTIONS/ DISCUSSION ARE REVEALED BY THE INDEX?

The Index prompts an analysis of statistical groupings of countries to better understand why some are performing better than others. The grouping of countries is sometimes obvious, but other times requires additional analysis to understand. This leads to further dialogue:

- What is the country's perspective/priority on the 'right balance' on the energy trilemma?
- How does the country want to achieve its energy trilemma goals?
- What is the role of government policies (national, regional, local) in supporting these energy goals?
- What policies are appropriate to drive energy goals (e.g., raising fuel taxes to encourage energy efficiency or encouraging greater use of electric cars?). How do these policies need to evolve over time?
- What are the situational and/or contextual barriers the country faces in terms of energy performance, and how might these barriers be overcome?
- How do situational and contextual barriers differ across countries in different stages of their development? How can emerging countries combine social and economic development with balancing the energy trilemma?

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