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2017 Energy Trilemma Index

Benchmarking the Sustainability of National Energy Systems

Name of presenter | date and name of event

Navigating the Energy Trilemma

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ENERGY SECURITY

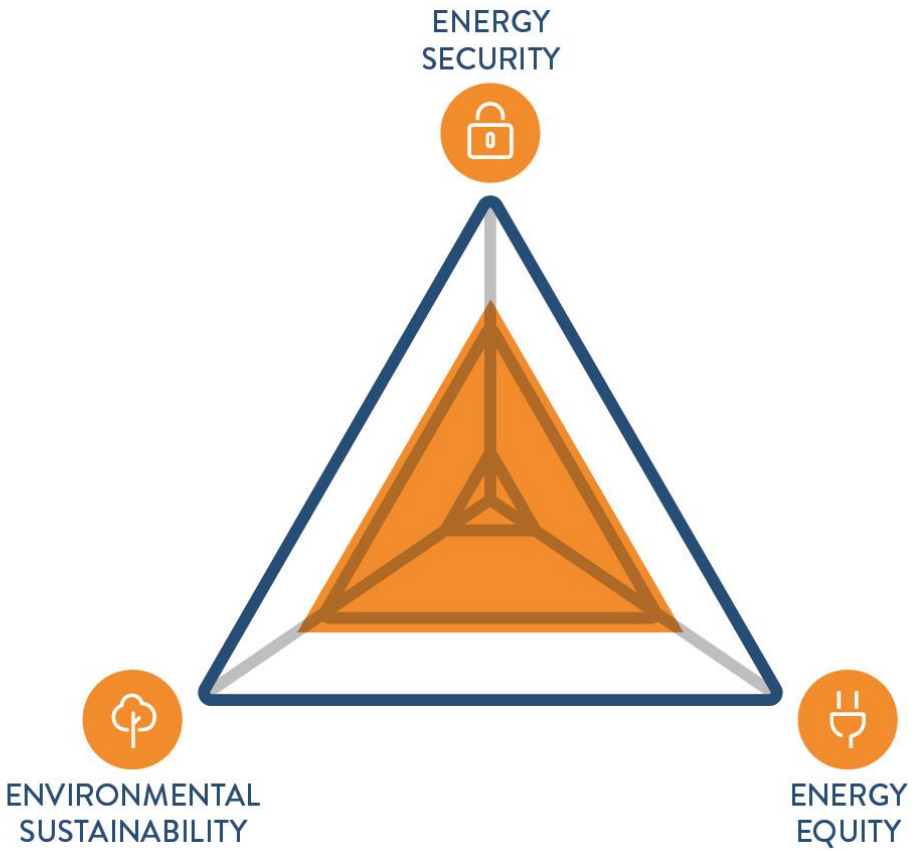
Effective management of primary energy supply from domestic and external sources, reliability of energy infrastructure, and ability of energy providers to meet current and future demand.

ENERGY EQUITY

Accessibility and affordability of energy supply across the population.

ENVIRONMENTAL SUSTAINABILITY

Encompasses achievement of supply- and demand-side energy efficiencies and development of energy supply from renewable and other low-carbon sources.



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2017 Trilemma Index Rankings - Overall Top Ten

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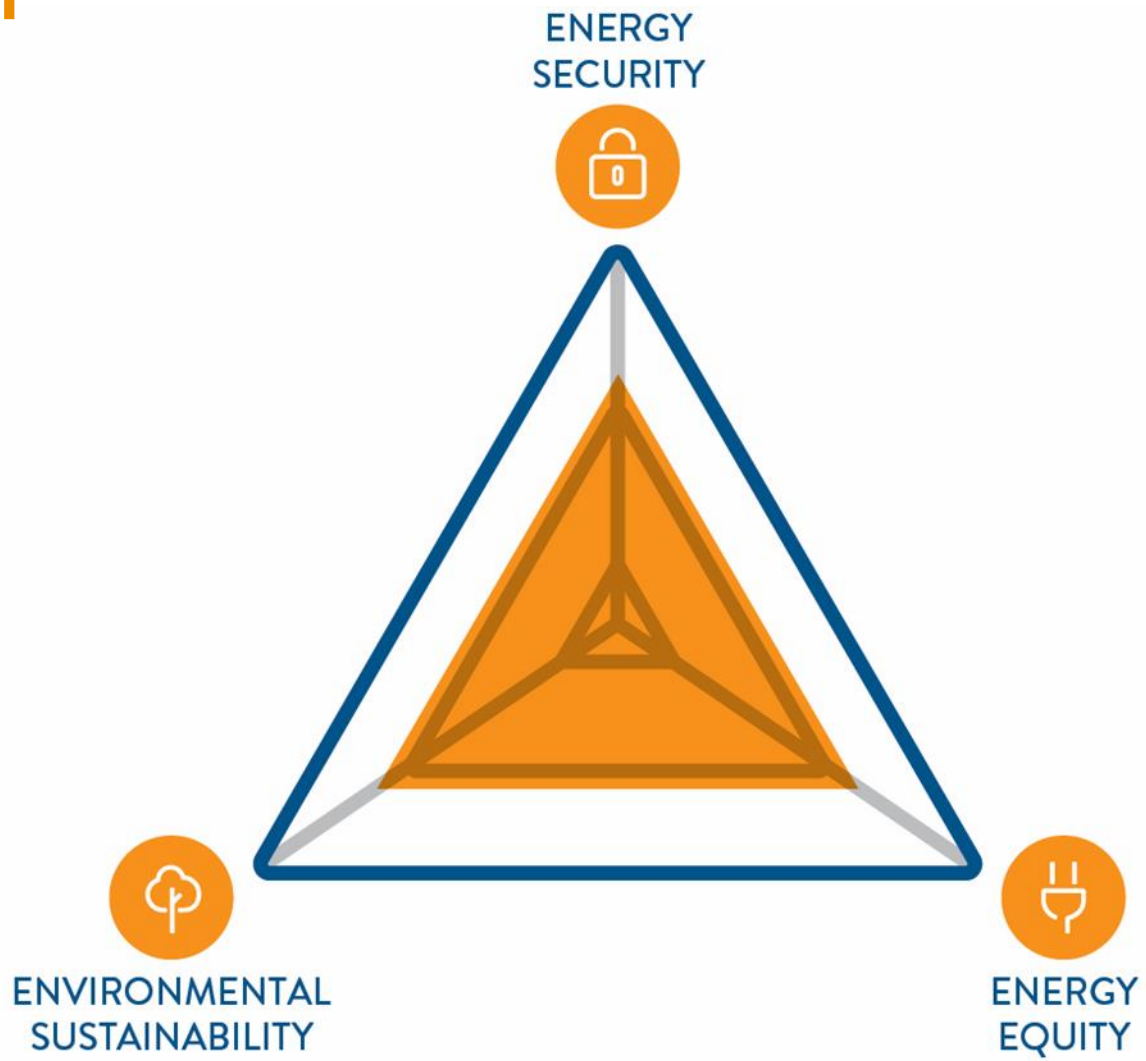
1. Denmark
2. Sweden
3. Switzerland
4. Netherlands
5. United Kingdom
6. Germany
7. Norway
8. France
9. New Zealand
10. Slovenia



2017 Trilemma Index – Top 10 Rankings for Dimensions

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TOP 10 ENERGY SECURITY

1. Denmark
2. Slovenia
3. Finland
4. Canada
5. Latvia
6. Venezuela
7. Romania
8. United States
9. Sweden
10. Netherlands

TOP 10 ENVIRONMENTAL SUSTAINABILITY

1. Philippines
2. Ireland
3. Switzerland
4. Denmark
5. Sweden
6. France
7. Costa Rica
8. Norway
9. United Kingdom
10. Uruguay

TOP 10 ENERGY EQUITY

1. Luxembourg
2. Qatar
3. Netherlands
4. Switzerland
5. Bahrain
6. Kuwait
7. Czech Republic
8. Austria
9. Oman
10. Ireland

2017 Positive Watch List

Country	Rank	Score	Developments to Watch
Chile	36	BBB	• Rapid growth of solar energy production • Planned infrastructure improvements
Ecuador	64	BBC	• Rapid expansion of hydroelectric power sector
Japan	30	CAB	• Efforts to diversify energy sources away from fossil fuels • Reactivation of old nuclear facilities after 2011 shutdown • Integration of distributed renewable generation
Mexico	52	BBB	• Liberalisation of oil and gas markets • Transition to low-carbon economy
United Arab Emirates	40	AAD	• First nuclear power plant to come online in 2017 • Green growth strategy • Phasing out gas and electricity subsidies

2016 Negative Watch List

Country	Rank	Score	Developments to Watch
Germany	6	AAA	• Continuing high cost of the energy transition • Reform in renewables support scheme
South Africa	82	BCD	• Continuing struggle with power shortages • Maintenance efforts by main utility is creating difficulties for independently produced renewable energy to enter the market
United Kingdom	11	AAA	• Energy security concerns created by an uncertain regulatory regime impacting investments in nuclear and gas sector • Political events create uncertainty around climate and energy policy
United States	14	AAC	• Ageing transmission infrastructure and impending coal-fired power plant retirements • Increasing frequency of extreme weather events • Departure from Paris Climate Agreement creates new uncertainty

Regional Profiles: Trilemma Performance

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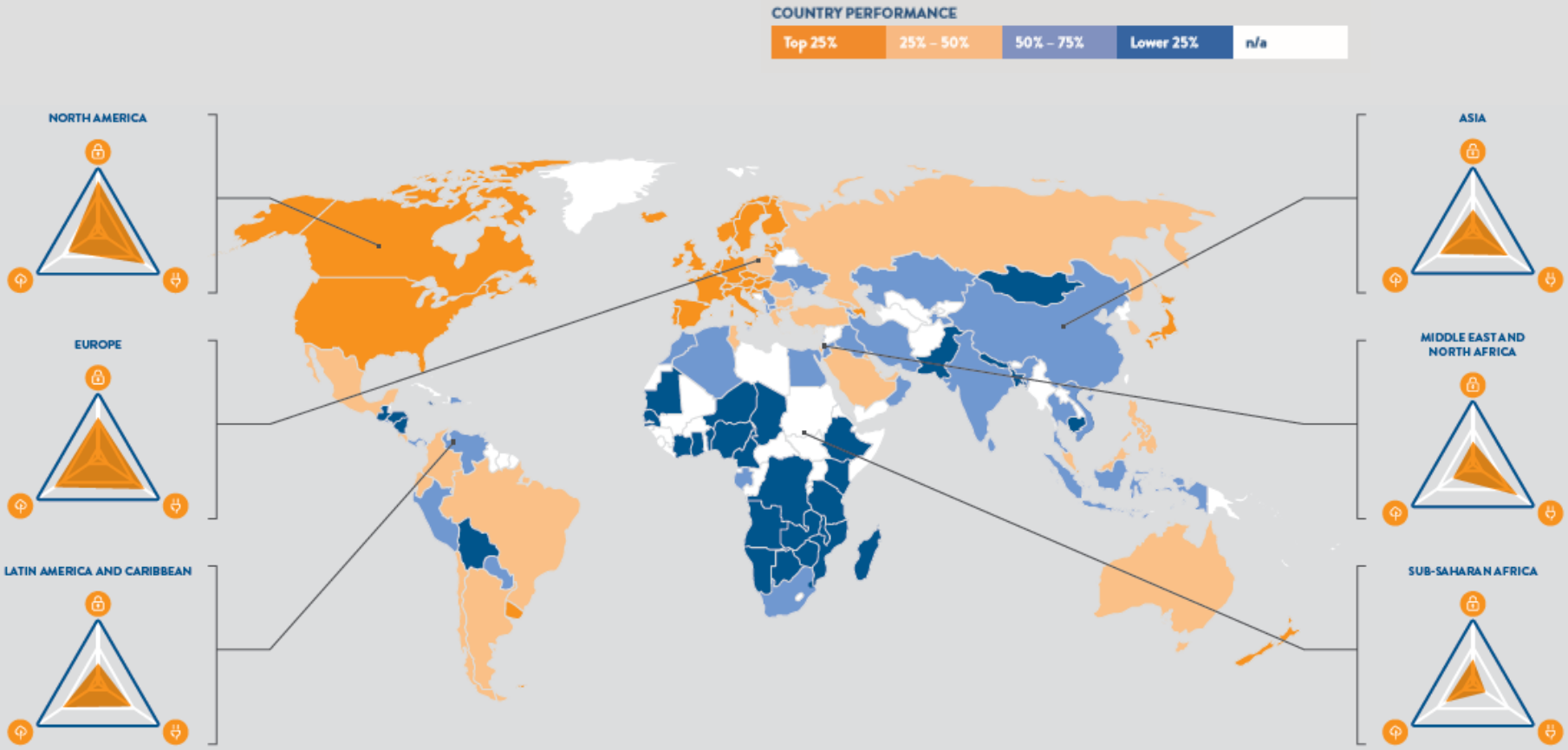

[Insert Country] 2017 Trilemma Index

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RANK

59

SCORE

BBB

	2014	2015	2016	Trend	Score
Overall rank and balance score	61	61	59		B
Energy performance					
Energy security	58				
Energy equity					B
Environme… sustai…				▶	B
Cont…			93	▶	

Download Your Country Profile At
www.worldenergy.org/data/trilemma-index

TRENDS AND OUTLOOK

- Argentina improves by 2 place… in 2016. Overall, the country performs well and the energy performance is bal… all three trilemma dimensions.
- If the current ener… …rs and high subsidies to consumers continues, there is little chance to rev… …oduction declined by 30% since 1998, while natural gas production declined b… …nce, Argentina, previously a net energy exporter in 2006 with a surplus of US$6… …orter in 2011 with a deficit of US$3 billion.
- …ed in 2012 (by expropriation of Repsol shares in Argentina's biggest oil company), is …estors, which are necessary to exploit the large reserves of unconventional oil and natural …overnment programmes to incentivise investment have so far not been successful.
- …ment, elected in November 2015, aims to remedy this situation by phasing out subsidies to return to r… …ted prices for supply and incentivising investment through a focus on renewables and clearer regulations. Th… …llenge for policymakers will be to implement these reforms to attract new investment while not compromising the Trilemma's equity of access dimension.

Find Out More

- Trilemma Tool
  - Regional profiles
  - Interactive Map and Pathway Calculator
  - Optimised version for mobile devices
  - Accessible at www.worldenergy.org/data

- Access the full report as well as the companion report **World Energy Trilemma 2017: Changing Dynamics – Using Distributed Energy Resources to Meet the Trilemma Challenge** at www.worldenergy.org/publications/

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Thank you

Back up slides

Regional Index Results

Regional Profiles: Key Challenges

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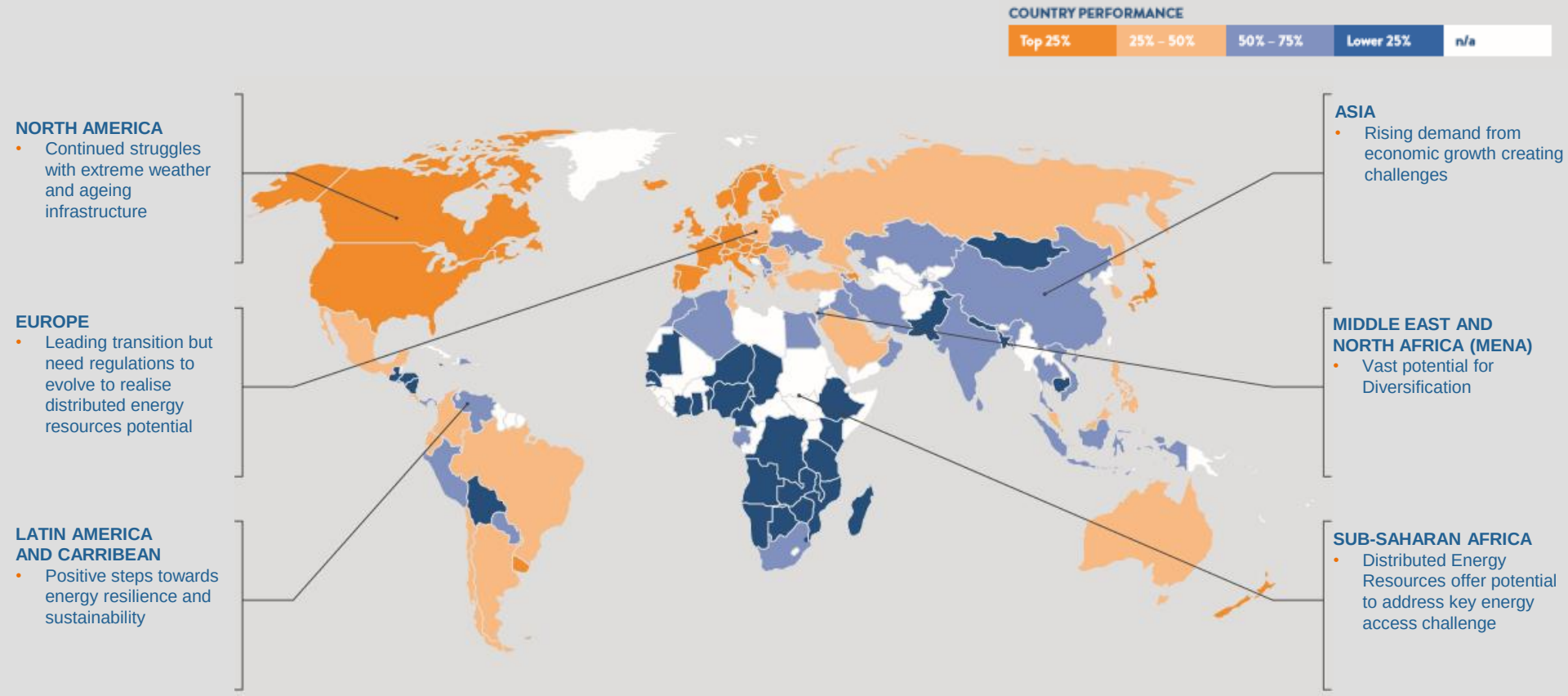

NORTH AMERICA
- Continued struggles with extreme weather and ageing infrastructure

EUROPE
- Leading transition but need regulations to evolve to realise distributed energy resources potential

LATIN AMERICA AND CARRIBEAN
- Positive steps towards energy resilience and sustainability

ASIA
- Rising demand from economic growth creating challenges

MIDDLE EAST AND NORTH AFRICA (MENA)
- Vast potential for Diversification

SUB-SAHARAN AFRICA
- Distributed Energy Resources offer potential to address key energy access challenge

Regional Overviews

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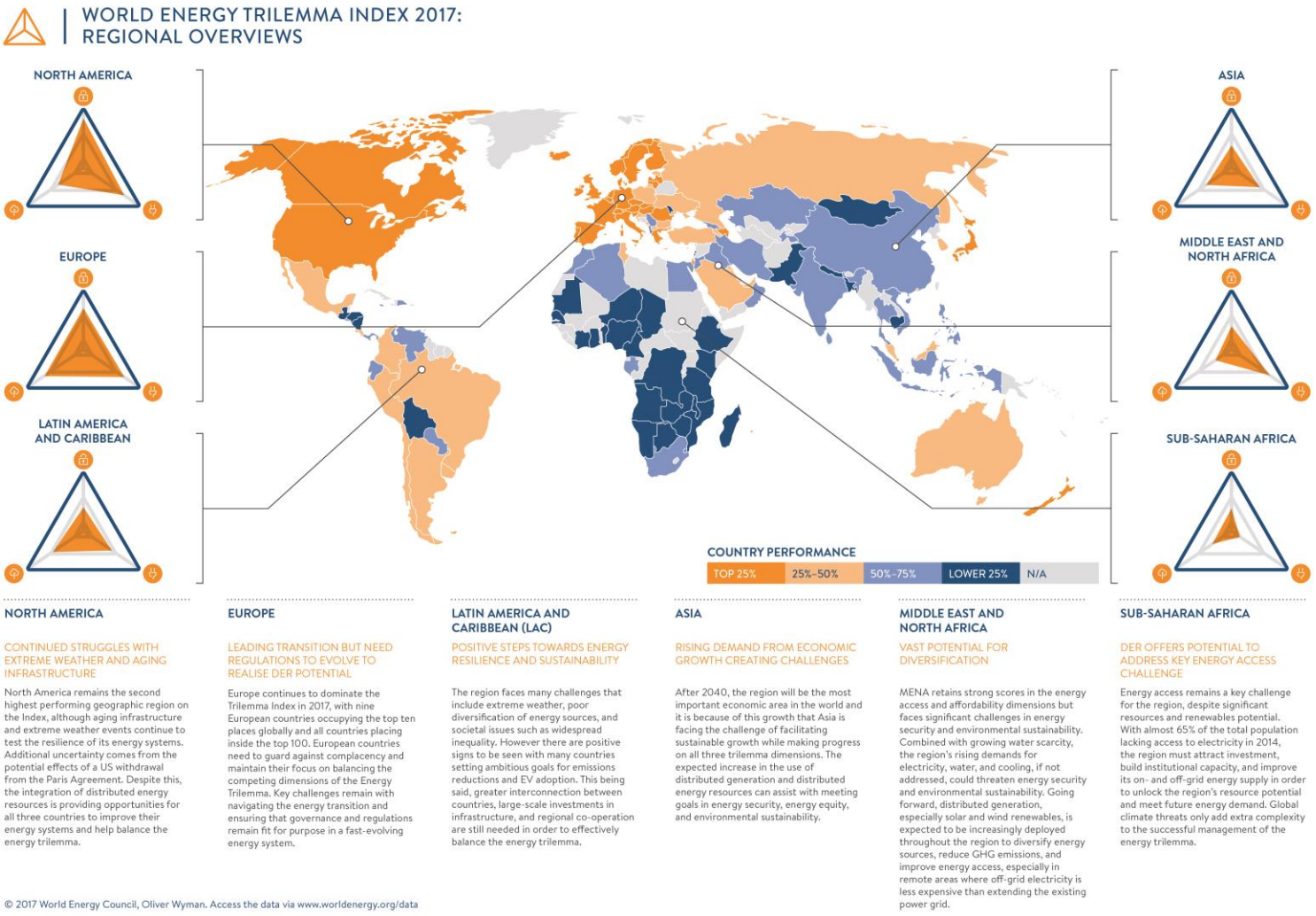

NORTH AMERICA

CONTINUED STRUGGLES WITH EXTREME WEATHER AND AGING INFRASTRUCTURE

North America remains the second highest performing geographic region on the Index, although aging infrastructure and extreme weather events continue to test the resilience of its energy systems. Additional uncertainty comes from the potential effects of a US withdrawal from the Paris Agreement. Despite this, the integration of distributed energy resources is providing opportunities for all three countries to improve their energy systems and help balance the energy trilemma.

EUROPE

LEADING TRANSITION BUT NEED REGULATIONS TO EVOLVE TO REALISE DER POTENTIAL

Europe continues to dominate the Trilemma Index in 2017, with nine European countries occupying the top ten places globally and all countries placing inside the top 100. European countries need to guard against complacency and maintain their focus on balancing the competing dimensions of the Energy Trilemma. Key challenges remain with navigating the energy transition and ensuring that governance and regulations remain fit for purpose in a fast-evolving energy system.

LATIN AMERICA AND CARIBBEAN (LAC)

POSITIVE STEPS TOWARDS ENERGY RESILIENCE AND SUSTAINABILITY

The region faces many challenges that include extreme weather, poor diversification of energy sources, and societal issues such as widespread inequality. However there are positive signs to be seen with many countries setting ambitious goals for emissions reductions and EV adoption. This being said, greater interconnection between countries, large-scale investments in infrastructure, and regional co-operation are still needed in order to effectively balance the energy trilemma.

ASIA

RISING DEMAND FROM ECONOMIC GROWTH CREATING CHALLENGES

After 2040, the region will be the most important economic area in the world and it is because of this growth that Asia is facing the challenge of facilitating sustainable growth while making progress on all three trilemma dimensions. The expected increase in the use of distributed generation and distributed energy resources can assist with meeting goals in energy security, energy equity, and environmental sustainability.

MIDDLE EAST AND NORTH AFRICA

VAST POTENTIAL FOR DIVERSIFICATION

MENA retains strong scores in the energy access and affordability dimensions but faces significant challenges in energy security and environmental sustainability. Combined with growing water scarcity, the region's rising demands for electricity, water, and cooling, if not addressed, could threaten energy security and environmental sustainability. Going forward, distributed generation, especially solar and wind renewables, is expected to be increasingly deployed throughout the region to diversify energy sources, reduce GHG emissions, and improve energy access, especially in remote areas where off-grid electricity is less expensive than extending the existing power grid.

SUB-SAHARAN AFRICA

DER OFFERS POTENTIAL TO ADDRESS KEY ENERGY ACCESS CHALLENGE

Energy access remains a key challenge for the region, despite significant resources and renewables potential. With almost 65% of the total population lacking access to electricity in 2014, the region must attract investment, build institutional capacity, and improve its on- and off-grid energy supply in order to unlock the region's resource potential and meet future energy demand. Global climate threats only add extra complexity to the successful management of the energy trilemma.

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Trilemma Profile: Asia

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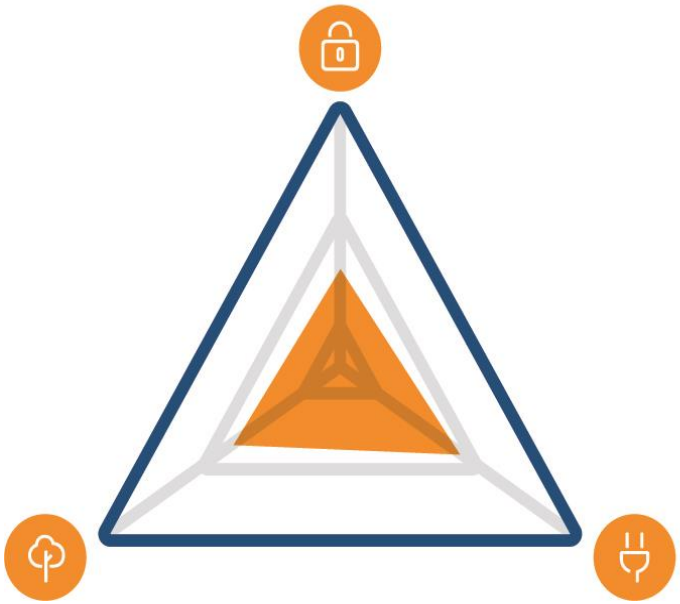
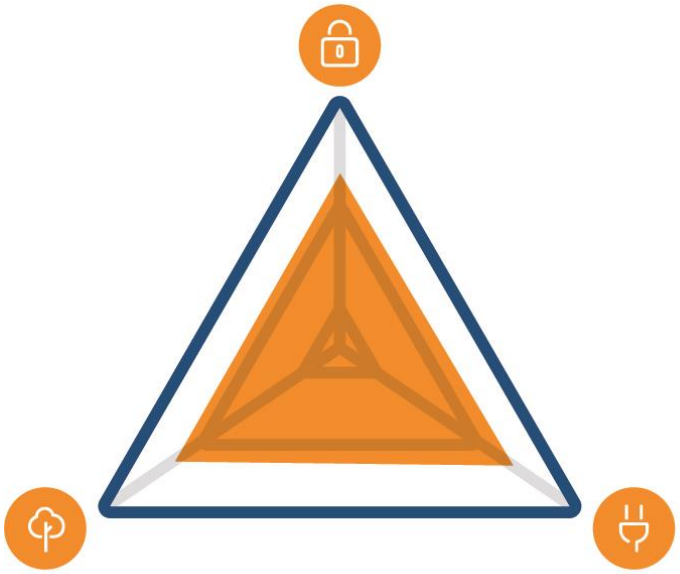


ASIAN COUNTRIES

Armenia	India	New Zealand
Australia	Indonesia	Pakistan
Azerbaijan	Japan	Philippines
Bangladesh	Kazakhstan	Singapore
Cambodia	Korea (Rep.)	Sri Lanka
China	Malaysia	Tajikistan
Georgia	Mongolia	Thailand
Hong Kong, China	Nepal	Vietnam

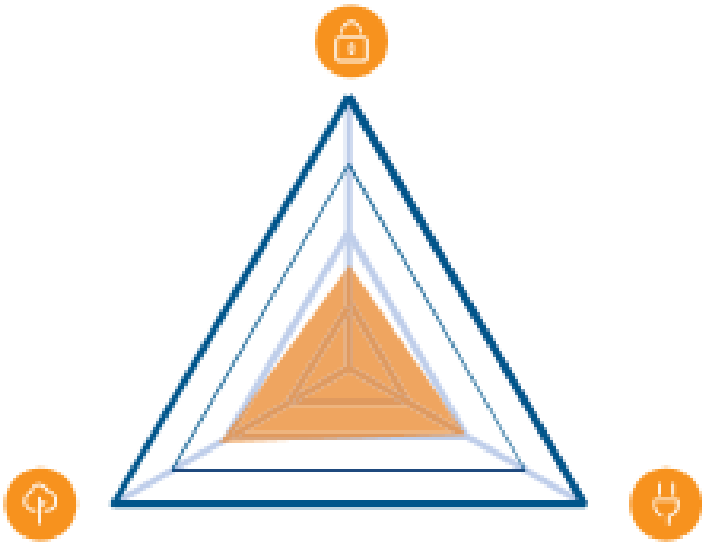
Trilemma Profile: Europe



European Countries

Albania	Greece	Poland
Armenia	Hungary	Portugal
Austria	Iceland	Romania
Belgium	Ireland	Russian Federation
Bulgaria	Italy	Serbia
Croatia	Latvia	Slovakia
Cyprus	Lithuania	Slovenia
Czech Republic	Luxembourg	Spain
Denmark	Macedonia (Rep.)	Sweden
Estonia	Malta	Switzerland
Finland	Moldova	Turkey
France	Montenegro	Ukraine
Georgia	Netherlands	United Kingdom
Germany	Norway	

Trilemma Profile: Latin America and Caribbean

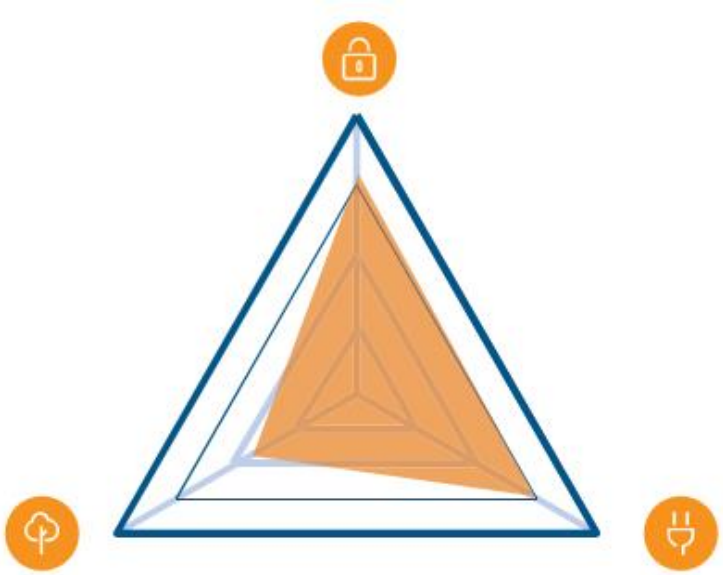


LAC Countries		
Argentina	Ecuador	Panama
Bolivia	El Salvador	Paraguay
Brazil	Guatemala	Peru
Chile	Honduras	Trinidad & Tobago
Colombia	Jamaica	Uruguay
Costa Rica	Nicaragua	Venezuela
Dominican Republic		

Trilemma Profile: Middle East and North Africa

MENA Countries		
Algeria	Israel	Oman
Bahrain	Jordan	Qatar
Egypt	Kuwait	Saudi Arabia
Iran (Islamic Rep.)	Lebanon	Tunisia
Iraq	Morocco	United Arab Emirates

Trilemma Profile: North America

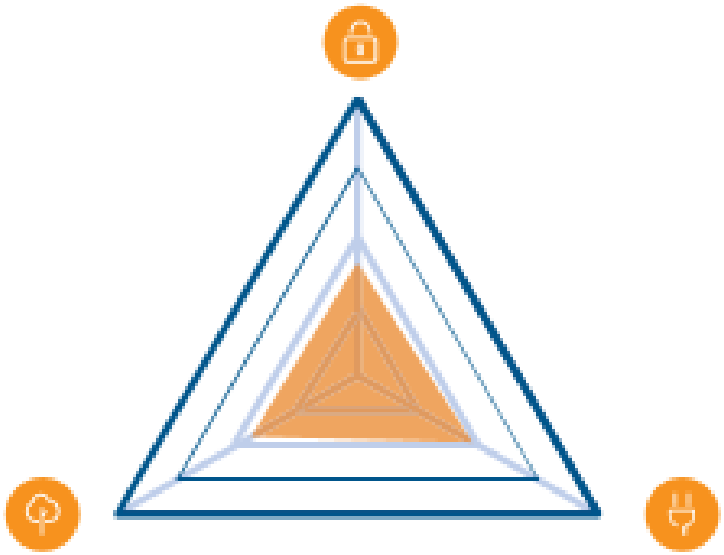


North American Countries
Canada
Mexico
United States

Trilemma Profile: Sub-Saharan Africa

Sub-Saharan African Countries		
Angola	Ghana	Senegal
Benin	Kenya	South Africa
Botswana	Madagascar	Swaziland
Cameroon	Malawi	Tanzania
Chad	Mauritania	Zambia
Congo (Dem. Rep.)	Mauritius	Zimbabwe
Côte d'Ivoire	Mozambique	
Ethiopia	Namibia	
Gabon	Niger	

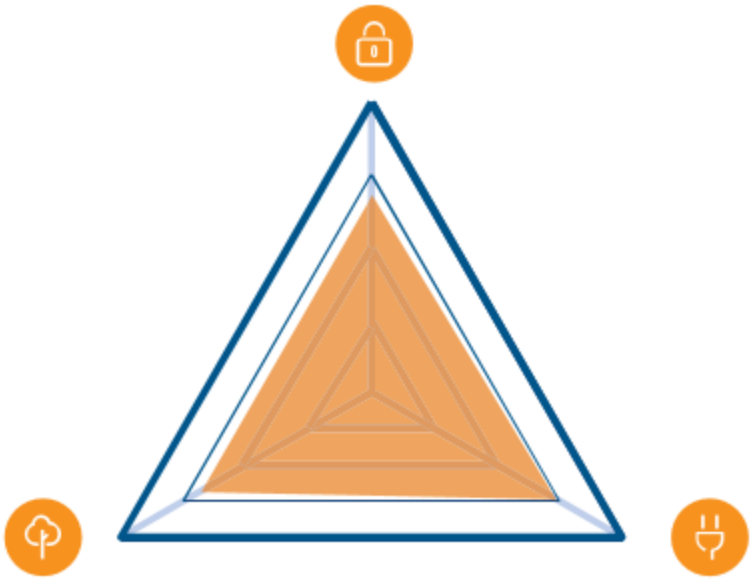
ASIA
Rising Demand from Economic Growth Creating Challenges



- Will be most important economic area in the world after 2040, but this growth means that Asia is facing the challenge of making progress on all 3 trilemma dimensions
- Expected increase in use of distributed generation and distributed energy resources can assist with meeting Energy Trilemma goals, and reduce reliance on energy imports

EUROPE

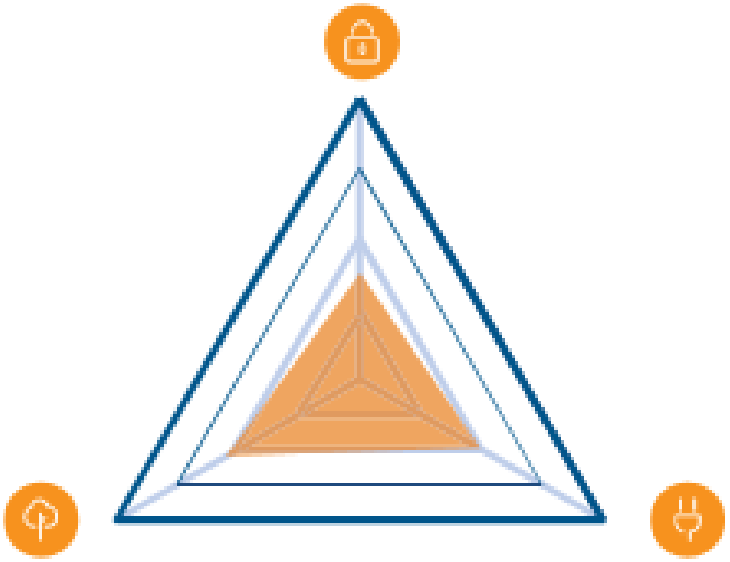
Leading Transition but need regulations to evolve



- Europe continues to dominate 2017 Trilemma Index with 9 European countries in overall top 10 and all countries placing inside top 100
- Need to guard against complacency and maintain focus on balancing competing dimensions of Energy Trilemma
- Key challenges remain with navigating energy transition and ensuring that governance and regulations remain fit for purpose in fast-evolving energy system

LATIN AMERICA AND THE CARIBBEAN

Positive Steps to Energy Resilience and Sustainability



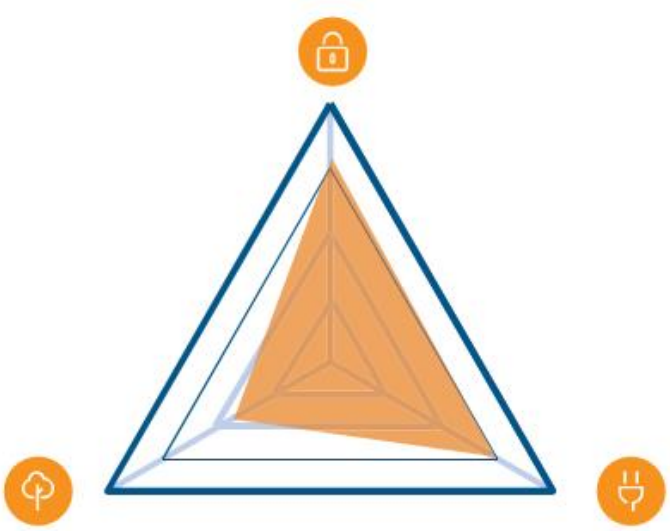
- Faces many challenges that include extreme weather, poor diversification of energy sources, and societal issues such as widespread inequality
- But positive signs seen with many countries setting ambitious goals for emissions, reductions and EV adoption
- Greater interconnection between countries, large-scale investments in infrastructure, and regional co-operation still needed to effectively balance the Energy Trilemma.

MIDDLE EAST AND NORTH AFRICA
Vast Potential for Diversification

- Retains strong scores for access and affordability but faces significant challenges in energy security and environmental sustainability
- With growing water scarcity, rising demands for electricity, water, and cooling, if not addressed, could threaten energy security and environmental sustainability
- Distributed generation, especially solar and wind renewables, expected to be increasingly deployed to diversify sources, reduce GHG emissions, and improve energy access, especially in remote areas

NORTH AMERICA

Continued Struggles with Extreme Weather and Ageing Infrastructure



- Remains the second highest performing geographic region on the Index
- resilience of its energy systems being tested by ageing infrastructure and extreme weather events
- Additional uncertainty with US decision to redraw from the Paris Agreement
- Integration of distributed energy resources providing opportunities for all three countries to improve their energy systems and help balance the Energy Trilemma

SUB-SAHARAN AFRICA

Distributed Energy Resources offer scope to address key Energy Access challenge

- Energy access remains key challenge, despite significant resources and renewables potential
- Almost 65% of population lacked access to electricity in 2014
- Need to attract investment, build institutional capacity, and improve on-and-off grid energy supply to unlock resource potential and meet future energy demand
- Global climate threats add extra complexity to successful navigation of Energy Trilemma

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Thank you

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