International Renewable Energy Agency

*Brief introduction*
About IRENA

Established in 2011.

158 Members
24 States in accession.

Mandate: to promote the widespread adoption and sustainable use of all forms of renewable energy

IRENA serves as:
• Centre of excellence for knowledge and innovation
• Global voice of renewables
• Network hub
• Source of advice and support

Headquarters in Masdar City, Abu Dhabi, UAE; Innovation and Technology Centre – Bonn, Germany; Permanent Observer to the United Nations – New York, USA
IRENA Programmatic Divisions

Country Support and Partnership - CSP
RRA, Capacity building, Regional Agendas...

Knowledge, Policy and Finance Centre - KPFC
Policies, Access to Finance, Knowledge Repository, Data and Statistics...

IRENA Innovation and Technology Centre- IITC
Centre of Excellence in RE Technology and Innovation

Biennium Work Programme
Some of IRENA’s Regional and country engagement

Regional Engagements

Renewable Energy Roadmaps (REmap)
- 70 countries – G20, EU, ASEAN, select countries in LAC and Africa
- Three regional analyses: EU, Africa, and ASEAN
- 13 Country roadmaps and outlooks

Renewable Readiness Assessments (RRA)
- 22 complete or in progress

Renewable Market Analysis
- GCC, LA, SEA, SEE
IRENA in ASEAN and APEC

In-Country Collaboration

Regional Initiatives

ASEAN-IRENA MOU at 36th AMEM (October 2018)
A long-term pathway to energy system decarbonization:

• In line with the Paris Agreement goal of keeping global warming well-below 2°C.
• Based on high energy efficiency and renewable energy
• Renewable shares, EI improvement
• Combines IRENA REmap techno-economic analysis and macroeconomic model analysis
• G20 country focus

Second edition released in April, 2018 at the Berlin Energy Transition Dialogue.
Two technical papers focused on synergies between renewable energy and energy efficiency

- Joint-paper with C2E2 (2015) focused on larger context of 2030 targets
- IRENA paper (2017) diving into more depth on joint synergies for China, India, Germany, Japan and USA
Thank you!

Nicholas Wagner

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Global Energy Transformation
Presentation focus

i. Global view to 2050

ii. APEC view 2030 (2050)

iii. ASEAN view to 2030

iv. Renewable energy and energy efficiency synergies
REmap engagement process

- **Global Reports**
  - Design of technology pathways and RE options in all sectors
  - Assessment of economic, social, environmental metrics at a global level
  - 4 global reports

- **Regional Reports**
  - Assessment of technology options and regional disaggregation
  - Identification of key technologies and trends, and cross-country opportunities
  - 3 regional reports (EU, ASEAN and Africa) and one under development (South-East Europe)

- **Country Reports**
  - Insights to policy and decision makers for areas in which action is needed at a country level
  - 12 country reports for major economies

- **Thematic reports**
  - Provide detailed technical and economic analysis on specific topics (i.e. RE investments, stranded assets, subsidies, etc.)
  - 9 thematic/technical reports
The case for an energy transformation

**ENVIRONMENTAL CASE**

- Meeting the global objective to limit global temperature rise below 2 degrees Celsius
- Renewable energy & energy efficiency can provide over 90% of the reduction in energy-related CO₂
- Energy-related CO2 budget exceeded in under 20 years

**BUSINESS CASE**

- Costs of global renewable power generation are dropping
- Increasing RE power is least-cost option
Renewable energy and energy efficiency can provide over 90% of the reduction in energy-related CO₂.

Annual energy-related CO₂ emissions and reductions, 2015-2050

Annual energy-related emissions are expected to remain flat (under current policies in the Reference Case) but must be reduced by over 70% to bring temperature rise to below the 2°C goal.

Renewable energy and energy efficiency measures provide over 90% of the reduction required.

An upper limit of 2 degrees with a 2/3 chance of success:

790 Gt energy CO₂ emissions budget 2015-2100
The global share of renewable energy in energy supply would need to increase to two-thirds.

Under current and planned policies (the Reference Case) TPES is expected to increase almost 40% by 2050. To achieve a pathway to energy transition (the REmap Case), energy efficiency would need to reduce TPES slightly below 2015 levels, and renewable energy would need to provide two-thirds of the energy supply.

Note: values in figure exclude non-energy use.
Significant improvements in energy intensity are needed and the share of renewable energy must rise

Both renewable energy and energy efficiency are at the heart of the energy transition and climate goals. By 2050 action in both areas must be scaled up considerably.

Source: Historical energy intensity improvement values from (SE4ALL, 2016), projections based on IRENA analysis
RE power capacity additions constantly exceed conventional power

➢ Wind and solar PV led the uptake of RES.
➢ Solar PV accounted for more than 56% of total RES additional installed capacity in 2017.
Electrification of end-use sectors: key enabler for the energy transformation

Gross power generation will almost double between 2015 and 2050, due to electrification of end-use sectors, with renewables generating 85%

Transport sector will see a major growth in electrification; buildings and industry will also have an incremental electrification rate

Breakdown of electricity generation by source

- **2015**
  - **BUILDINGS**: 31%
  - **INDUSTRY**: 27%
  - **TRANSPORT**: 1%

- **2050**
  - **BUILDINGS**: 56%
  - **INDUSTRY**: 42%
  - **TRANSPORT**: 33%

Source: IRENA (2018), Global Energy Transformation: A roadmap to 2050
RE penetration in heating and transport requires boosted efforts

Progress in the power sector is not being matched in transport and heating – which together account for 80% of global energy consumption.
RE should scale up to meet power, heat and transport needs
40% electrification of end use

Electricity consumption (TWh)

Industry and buildings final energy consumption (PJ/yr)

Transport final energy consumption (PJ/yr)

- Others (incl. marine and hybrid)
- Geothermal
- Bioenergy
- Hydro power
- Solar PV (incl. CSP)
- Non-Renewables
- District heat: Renewables
- Electricity: Renewables
- Modern biomass
- Traditional biomass
- Geothermal heat
- Solar thermal
- Hydrogen
- Liquid biofuels/biogas
- Non-Renewables
- District heat: Non-Renewables
- Electricity: Non-Renewables
The importance of fossil fuels is declining
Investment will need to shift to renewable energy and energy efficiency

Under the REmap Case, cumulative investment of USD 120 trillion must be made between 2015 and 2050 in low-carbon technologies, averaging around 2% of the period average global GDP per year. This is USD 27 trillion more than the Reference Case.
Reduced negative externalities far outweigh the costs needed to achieve a global energy transformation

Macroeconomic impacts
USD 27 trln cumulative additional energy investments
1% GDP increase by 2050
11 mln additional jobs by 2050
Socio-economic benefits of renewable energy

- GDP: + 1.0 %
- Jobs: + 0.14 %
- Welfare: + 15 %
- + 2.06 USD trillion in the energy sector

28 million jobs in 2050
Emerging Innovations in Power Sector – Landscape report

A Combination of Affordable RE Technologies, Digitalisation and Climate Change Policies is driving change – IRENA Innovation Landscape Assessment ongoing

- Massive expansion of interconnections and creation of regional markets
- Electrification of end use sectors
- Electric Vehicles
- Battery Storage
- Artificial Intelligence
- Internet of Things
- Blockchain
- Aggregators-VPP
- Decentralized system through distributed generation
- Value complementarities in RES
- Encourage Flexibility, pricing that supports DSM/DSR
- RE Tech
- System Operation
- Enabling technologies
- Market regulation
- Business Models
- Platform business model
Presentation focus

i. Global view to 2050

ii. APEC view 2030 (2050)

iii. ASEAN view to 2030

iv. Renewable energy and energy efficiency synergies
Modern renewable energy share in TFEC

In APEC region:

- Modern renewable energy share in TFEC would increase by 75% in the Reference Case, and by 200% in REmap
- Total renewable energy share in TFEC would increase by 40% in the Reference Case, and 140% in REmap
In APEC region renewable shares in power generation increase by 2030 to
- Reference Case to around 20-30%
- REmap Case with many in the 40-50+% range
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ASEAN – in a glance

- GDP US$ 2.5 Trillion
- US$ 3,882 per capita
- Population 644 million
- Growth ~4.7%
- Electricity consumption ~1,502 kWh/cap
- Total trade US$ 2.37 Trillion
- ~ 14% TPES by renewables
- ~ 60 million have no grid-quality electricity
- Population 644 million
- Total trade US$ 2.37 Trillion
- ~ 14% TPES by renewables
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Regional Commitment on Clean Energy

Increase RE to 23% by 2025 in TPES

Reduce EI by 20% in 2020, 30% in 2025 based on 2005 level.
Renewable Energy Outlook for ASEAN (2016)

Aspirational target of 23% renewable energy share in total primary energy supply (TPES) by 2025

- 2014 – 9.4%
- 2025 Reference Case – 16.9%
- A 6% point gap to the 23% target
- REmap Options identified how to close this gap in consultation with the ten ASEAN Member States: notably solar PV, solar thermal, bioenergy
- Significant health, climate benefits
- Findings used for the 5th AEO
Renewable Energy Outlook for ASEAN - investments

- Average annual investment would total USD 27 billion to 2025
- This is split equally between the Reference Case and REmap Options for closing the gap
- One-third of the additional investment needed for REmap Options will be redirected from fossil fuels
- Three-quarters of all renewable energy investment is for power sector
- The region will need to invest on average around 1% per year of GDP
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Renewable energy and energy efficiency synergy

<table>
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<tr>
<th>Table 1: Effect of RE/EE on energy intensity and renewable energy share in 2030 and associated costs and savings</th>
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<td><strong>In 2030</strong></td>
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<td><strong>MJ/USD</strong></td>
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<td>United States</td>
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Thank you!

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Key focus areas to foster the Global Energy Transformation

1. Tap into the strong synergies between energy efficiency and renewables
2. Plan a power system with high shares of renewable energy
3. Increase the use of electricity in transport, buildings and industry
4. Foster system-wide innovation
5. Align socio-economic structures and investment with the transition
6. Ensure that transition costs and benefits are fairly distributed
Leading destinations **2006-16**:  
1. Thailand ($10bn, 40%)  
2. Indonesia and Philippines (~20% of total each).

Leading destinations in **2016**:  
1. Thailand ($1.3bn, >50%)  
2. Indonesia ($577m)  
3. Singapore ($575m).

- Decreases recorded in Malaysia, Viet Nam; 
  dramatic increases recorded in Philippines.

- Malaysia attracted $400m in 2016 in solar manufacturing.

Note: Based on power sector asset finance data for Indonesia, Malaysia, the Philippines, 
Singapore, Thailand and Viet Nam.
Further cost decline expected in solar and wind

IRENA costing database of 15000 large scale RE power projects and 1.5 million rooftop PV systems

Covering half of all existing and planned RE capacity
Cost trends in wind power
Reduced turbine costs & higher capacity factors → lower LCOE

➢ Wind turbine costs halved by 2017 compared to 2009
➢ Capacity factors increased by 45% from 1983 to 2017 and by 10% from 2010 to 2016
➢ LCOE of onshore wind declined by 85% from 1983 to 2017 and by 25% from 2010 to 2017
Large variation between countries

- **Wide range of economic and capital market development** ➔ Different capital mix and renewable investment landscape.

- More advanced economic & capital markets development: Indonesia, Malaysia, Philippines, Singapore and Thailand.

- More reliant on traditional donor and development banks: Cambodia, Lao PDR, Myanmar and Viet Nam.

- Next growth market?

**Total stock market capitalization and levels of GDP in Southeast Asian countries**

![Graph showing total stock market capitalization and levels of GDP in Southeast Asian countries](image-url)