1. Introduction of IRENA

2. Transitioning towards Renewable Power Generation

3. REmap 2030

4. Capacity Building

5. Renewable Readiness Assessment

6. The Role of IRENA
1

Introduction of IRENA
Renewable energy can:

- Meet our goals for secure, reliable and sustainable energy
- Provide electricity access to 1.3 billion people
- Promote economic development
- At an affordable cost
Structure and Membership

Headquarters:
Abu Dhabi,
United Arab Emirates

Three Programmes:
• Innovation and Technology Centre (IITC) in Bonn, Germany
• Knowledge, Finance and Policy Centre in Abu Dhabi
• Country Support and Partnerships in Abu Dhabi

Foundation
26 January 2009 in Bonn
International Agency since April 2011
The only international RE agency worldwide

Scope
Hub, voice and source of objective information for renewable energy

Mandate
Sustainable deployment of the six forms of renewable energy resources
(Biomass, Geothermal, Hydro, Ocean, Solar, Wind)
Thematic Areas of the Work Programme

- Planning for the global energy transition
- Gateway to knowledge on renewable energy
- Enabling RE investment and growth
- Renewable energy access for sustainable livelihoods
- Islands: lighthouses for renewable energy deployment
- Regional action agenda
Transitioning towards Renewable Power Generation
Renewables Dominate New Capacity Additions

- **Non-renewables** (Coal, Gas, Nuclear and Oil):
  - 2001: 81%
  - 2013: 58%

- **Renewables**:
  - 2001: 19%
  - 2013: 42%
Scaling-up all renewable energy sources

Total global RE use in REmap 2030: 132 EJ/yr
High levels of variable renewables are competitive
3
REmap 2030
REmap 2030 - A roadmap for doubling the RE share

- Originates from the United Nations global Sustainable Energy for All (SE4ALL) initiative
- Three objectives, all to be achieved by 2030:
  - Universal energy access (rural electrification, modern forms of renewables)
  - Doubling the rate of energy intensity improvements
  - Doubling the share of renewables in the global energy mix (compared to 2010 level)
- Each objective has its own hub; IRENA is the thematic hub for renewables
- 2014-2024: UN decade of Sustainable Energy for All
REmap 2030 - A roadmap for doubling the RE share

- REmap explores the potential, cost and benefits of doubling the renewables share in the global energy mix

- **Technology options**
  - No target setting; options characterised by their cost and potentials
  - Technology options can be combined into scenarios and translated into policy action

- Focuses on power, district heat and end-use sectors

- Coverage: **40 countries**; 80% of the global energy use

- Developed together with & validated by country experts
Dark green: Completed country analysis in June 2014 (26 countries)
Light green: Ongoing country analysis end of 2015 (14 countries)
Breakdown of Global Renewable Energy Use in 2010

Globally 18% RE in Total Final Energy Consumption (TFEC)
Half is traditional biomass, 8.4% modern renewables

Source: IRENA (2014); SE4ALL Global Tracking Framework (2013)
Global RE Use in 2030 including REmap Options

Remap 2030 – 132 EJ (final energy) 60% is biomass

- Power: 36% (40% of modern renewable energy)
- Heat: 51%
- Transport Fuels: 13%
- Solar Thermal Heat: 9%
- Modern biomass replacing traditional biomass: 11%
- Geothermal Power: <1%
- CSP: <1%
- Other: <1%
- Biogas Power: 1%
- Biogas Industry / Buildings: 2%
- Biomass Heat: 17%
- Heat for District Heat Buildings: 11%
- Biomass Heat for Buildings: 11%
- Hydropower: 14%
- Wind: 11%
- Biomass Power: 6%
- Biofuels Transport: 13%

*including combined heat and power (CHP) and district heat
Mapping Out the Renewable Energy Transition

Breakdown of Total Global Renewable Energy Use in 2030 (%)

- 26 countries – 75% of global energy consumption
- China is the largest single market for global renewable energy use
REmap 2030 key findings

• Doubling the RE share from 18% in 2010 to 36% in 2030 is technically achievable with existing technologies
  ▪ Higher shares in power generation
  ▪ More attention needed for heating and transportation fuels

• Doubling is affordable when externalities are accounted for
  ▪ However these are not reflected in today’s prices and markets are distorted because of energy subsidies
  ▪ Macro-economic benefits include more jobs; economic activity; health benefits; a cleaner environment; a higher level of energy security

• Biomass is key resource

• Potential exists in all countries, and differentiated action
Benefits for Health, Environment and the Economy

- **$200bn**: Global health-related costs can be reduced up to $200 billion annually.
- **900,000 jobs**: Doubling the global share of renewable energy would create a net gain of 900,000 jobs in the energy sector in 2030.
- **15%**: Demand for oil and natural gas can be reduced by around 15%, creating more energy security for fossil-fuel importing countries.
- **26%**: Demand for coal can decline by 26%, resulting in reduced carbon emissions and cleaner air.
Comprehensive REmap country reports

- Purpose: Translate analysis into actionable options
  - Areas for joint action to accelerate RE deployment
- China, Mexico, UAE, United States, Ukraine completed
- India, Poland, South Africa reports in preparation
- Discussion on-going with other countries
Capacity Building
Technical Capacities for RE

- **RE on Power Grids (implementing):**
  - Certify installers to properly install PV
  - Train island utilities and regulators to understand grid stability analyses and potential for reliable RE integration
  - Train island utilities to operate grids with higher RE shares.

- **RE in Buildings (envisioned):**
  - Certify installers to properly install PV and SWH
  - Train auditors to conduct EERE audits

- **RE Systems (envisioned):**
  - Training in proper installation, operation and maintenance of renewable desalination and waste-to-energy systems.
Entrepreneurial Capacities

• **RE in Electricity Markets:**
  - Training on how to follow wind measurement guidelines in developing bankable wind power projects (proposed)
  - Training to set up and operate PV businesses (ProSPER: Promoting a Sustainable Market for Photovoltaic Systems in the ECOWAS [Economic Community of West African States] Region) – focus on enterprise development and linkages with financial institutions.

• **RE in Buildings:**
  - Training to set up and operate ESCOs (proposed)
Policy and Regulatory Capacities

- **RE in Electricity Markets (activities envisioned):**
  - Train policy-makers on how to set targets and meet them
  - Train regulators on setting rates for the power utility.
    - Appropriate Rate of Return (ROR)
  - Train regulators on market opening to IPPs
    - Design of Power Purchase Agreements
  - Train regulators on market opening to prosumers
    - Net billing to share rents between prosumers and utility
Possible Areas for IRENA-APEC Cooperation on Capacity Building

• **Training for PV Installers:**
  - IRENA training seminars in cooperation with SPREP (Secretariat of the Pacific Regional Environment Program)
  - APEC EGNRET [NRE142-6] APEC Building Mounted PV Best Practices and Latest Development Comparative Study (Proposed)

• **Business Models for PV Entrepreneurs:**
  - IRENA work on business models for mini-grids, in cooperation with Mini Grids High Impact Opportunity (HIO) of UN Sustainable Energy for All (SE4All) initiative.
  - APEC EGNRET [NRE142-2]: Innovative business models for scale-up application of solar photovoltaic technology in APEC (Proposed)
5 Renewable Readiness Assessment
RRA Approach

“Problems cannot be solved by the same level of thinking that created them.”

---Albert Einstein

RRA Approach

- Taking a holistic and system approach
- But, focusing on key issues
- Formulating actionable activities/programs with multi-stakeholder participations
Recommendations:

Conduct Institutional capacity Analysis

1. A thorough map-out of *who is doing what* against *who is supposed to do*

2. Emerging issues are calling for additional skills and manpower: *are we there?*

3. Multi-stakeholders are offering multiple perspectives as well as various demands

4. What institutional capacity should be in place from a national and long-term perspective?
Recommendations:

Effective use of GIZ PV Guidebook for the Philippines

1. The guiding should be viewed as a dynamic process as the administrative procedures are evolving

2. Effective dissemination and communication may be helpful for investors/developers to better use the resources provided in the Guidebook

3. Feedbacks are always welcome and timely addressed
Recommendations:

Conduct country study on rural minigrids

**Contexts** of the study

a. **Energy supply by renewable resources providing more than just sources of energy**

b. **Improved electrification rate is not enough**
Conduct country study on rural minigrids

Objective:

to facilitate the Philippines to create enabling environment for renewable energy-based mini-grid deployment to shift the paradigm for universal energy access as well as for enhanced energy security

Scope:

covering the issues from estimation of physical potentials, policy and regulatory framework, technological options/guidelines, business models, to evaluation of long-term social and economic benefits that such systems can generate for the society as a whole

Focus:

islands and remote/unelectrified regions where RE-powered mini-grids can be economic viable and also used for promoting rural development
RE Minigrids for off grid island states and remote areas in Philippines

• Off grid power generation dominated by diesel operated minigrids
  ▪ NPC-SPUG under their Missionary Electrification programme serves 213 islands and isolated grids (Feb, 2012)

• Hybridization of diesel minigrids reduces generation costs
  ▪ Techno-Economic studies of the 3.57 MW diesel power plant at Busuanga Island show that hybridization with a 3 MW solar PV system can reduce the LCOE from 34.7 to 29.8 USDc/KWh
  ▪ Annual diesel consumption reduces by more than 1.2 million liters

• Study on the potential of Minigrids for remote energy access
  ▪ IRENA to provide technical advisory as a follow up to the RRA; study the potential of RE hybridization of existing diesel based minigrids & RE minigrids for remote areas

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1 RE in hybrid and isolated minigrids: Economic benefits and business cases
6 The Role of IRENA
Identify best practices

Thailand
The Alternative Energy Development Plan aims to increase consumption of RE by the deployment of DG (<10MW). Automatic Meter Reading (AMR) already in place.

Hachinoe, Japan
Project to reduce the impact of VRE by controlling DG output

Jeju Island, South Korea
Test-bed project. Venture into new markets models based on smart grids and RE

Malaysia
New Regulatory framework with responsibilities for utility and RE developer

Philippines
Grid codes in place that cover specific aspects to the grid integration of VRE

Australia
CSIRO convened the Future Grid Forum to assess the future high integration of RE and rise of the prosumers.
## From Planning to Operation

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<th>Facilitating the implementation process</th>
<th>Supporting operation and management</th>
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<td><strong>Infrastructure design</strong></td>
<td><strong>Technology components</strong></td>
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<td>Roadmap on renewable energy grid integration</td>
<td>Grid codes development for VRE integration</td>
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<td>Addressing Variable Renewables in Long-term Energy planning (AVRIL)</td>
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<td>Minigrid innovative technology outlook</td>
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<td>RE grid integration technology brief</td>
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**Guidelines** | **Methods** | **Model application** | **Technical information**
Appendix: Smart Grids and Renewables
Smart grids for variable renewables

Technology options in five areas

- Transmission
- Distribution
- Generation
- Consumer
- Storage

Many technology options:

- Advanced metering
- Better forecasting
- Demand response
- Distribution automation
- Dynamic line ratings
- Electricity storage
- Flexible AC transmission
- High voltage AC/DC lines
- Smart inverters
- Synchrophasors
- Variable electricity pricing
- Virtual power plants
# Benefits of smart grid functions

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Functions →</th>
<th>Wide-area monitoring and visualization</th>
<th>Flow control</th>
<th>Automated voltage and VAR control</th>
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<td>Reduced major outages</td>
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<td>Reduced restoration cost</td>
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<tr>
<td>Reduced wide-scale blackouts</td>
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## Grid investment needs for smart grids

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<th>Network Categories</th>
<th>Wind</th>
<th>PV</th>
<th>Non-variable RE</th>
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<tr>
<td>Local Distribution</td>
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<table>
<thead>
<tr>
<th>Investment categories</th>
<th>Conventional grid reinforcement</th>
<th>Smart Grid technologies</th>
<th>Retrofit</th>
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<td>Overload</td>
<td>Voltage</td>
<td>Phase imbalance</td>
<td>Backfeed (con. &amp; prot)</td>
</tr>
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</table>

*Image of a table showing grid investment needs for smart grids, with network categories and investment categories.*
Storage for renewables

Application areas and experiences in South East Asia:

Islands/minigrids
Energy Storage System launched in Sumba island (Indonesia). Increasing the penetration of VRE and improving dramatically the security of supply.

Self-consumption
Sydney (Australia). Case studies coupling PV and storage, raising self-consumption considerably and relieving problems in the grid due to VRE.

Smoothing/supply shift
Okinawa (Japan). Okinawa Electric Power Company and Toshiba developed and installed a 23 MW flywheel system for frequency control in the Okinawa power grid.
Cities – opportunities

• 75% of final energy consumption

• 52% population lives in cities; 60% in 2030 (ca 1.4 billion more)

• 31 megacities (>10 mln), 19 in Asia

• 21% of urban population lives in large cities (>1 mln)
  • Average growth rate of 1.5% p.a.

• 50% of urban population lives in small cities (<0.5 mln)
  • Average growth rate of 4.9% p.a.

• 50% of urban energy consumption in non-OECD countries; 65% in 2030