Progress of On-going APEC Self-Funded Project (EWG 04 2020S):

Innovative Approaches for Scaling-Up Renewable Energy Deployment in APEC

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Project Information

- **Proposing economy:** China
- **Co-sponsoring economy:** Hong Kong, China
- **Endorsed by EWG members:** 21 August 2020
- **Expected start/completion date:** 01/11/2020 - 30/04/2022
- **PO:** Jinlong Ma, Prof. of Tianjin University / Vice President of APSEC

Project summary

- The project focuses on renewable energy (RE) power generation and aims to explore innovative approaches for scaling-up RE application in the APEC region, which facilitates achieving the APEC RE goal.
- Through review, investigation and stakeholder consultation, the project will assess the RE development from the perspectives of energy system performance, sustainability, and energy access.
- Barriers and drives for RE development will be analyzed, and suggestions and recommendations on innovative approaches will be put forward through analysis of policy, technologies, business environment, case study, etc.
- **Research results will be synthesized in project report and shared.** Presentations on the findings will be made in EGs’ meeting and APSEC’s events for members to exchange experience and disseminate relevant know-how.
Work Plan


- May. 2021: Call for comments on initial results at EGs’ meeting/APSEC’s events, collect feedbacks from member economies.

- May. 2021 – Dec. 2021: research into specific subjects, prepare research report; share and discuss the findings in EGs’ meeting/APSEC’s events, and collect feedback.


Executive Summary

1. Introduction
   1.1 Overview of energy development in APEC region
      1.1.1 Energy development situation
      1.1.2 RE development situation
   1.2 Significances for scaling-up RE in APEC region
   1.3 Outline of the of the main outcomes
      1.3.1 Outline
      1.3.2 Innovations and main outcomes

2. Approach and methodology of the project
   2.1 Scope
   2.2 Assessment of RE development
      2.2.1 Performance of energy system
         (1) Electricity development
         (2) Sustainability
         (3) Energy Access
      2.2.2 Analytical framework of barriers and drives for RE development
         (1) Key stakeholders of RE development
         (2) Analysis framework

3. RE Development in APEC region
   3.1 RE development
   3.2 Energy Access
   3.3 Gap analysis

4. RE Development Approaches
   4.1 Regulation, policy and plan
      (1) RE plans and targets
      (2) Electricity target and plan
   4.2 Resources and technology
      (1) Local RE resources
      (2) Technology availability: supply chain of technology
      (3) Costs of technologies

   4.3 Enable environment / infrastructure
      (1) Government institutions setting-up and policy implementation
      (2) Resources date information for RE project development
      (3) Power system flexibility
      (4) Power grid access: technical (grid code)
      (5) Dispatching, network usage and curtailment
      (6) Utility operation
      (7) Electricity market establishment and operation

4.4 Capital and investment
   (1) Fiscal and financial policy
   (2) Investment in RE
   (3) Investment condition
   (4) RE project guidance and relevant permission
   (5) RE projects tariff condition: PPA – FiT vs auction

4.5 Business environment
   (1) Source of project finance: public and private sector, international aids
   (2) Easy to do business
   (3) International collaboration

4.6 Distributed generation microgrid
   (1) National framework/program of distributed system/microgrid – off grid electrification
   (2) Financial incentives for off-grid solutions
   (3) Technical standard and quality of mini/macro-grid (including stand alone)
   (4) Consumer affordability: for energy and connection/installation
    (5) Policy to support low-income and low-volume and remote consumer

4.7 Promote energy access

5. Case studies
6. Summary and conclusion
7. References
- **Research framework**

Social and economic development, energy regulation and policy

- Demographic & economic growth
- Energy regulation, policy and regulation
- Development plan

Environment

- Carbon market

Infrastructure

- Power network & operation
- Electricity market

Renewable energy resources

Supply technologies (centralized)

Supply technologies (distributed)

Development, investment, & implementation

Scaling-up RE

Public awareness

End-users participation

End-users
Research Progress: Overview of renewable energy development in APEC region

APEC Total RE Capacity increased by 2.3 times, from 610.5 GW (2010) to 1427.8 GW (2019)

Solar Photovoltaic Increased by 39.5 Times
Onshore Wind Increased by 4.3 Times

Raw data from IRENA and APEC Energy Database, analyzed by APSEC
## Research Progress: Overview of renewable energy development in APEC region

### Global Share of APEC's Renewable Installation Capacity (2010-2019)

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</tr>
</thead>
<tbody>
<tr>
<td>Hydropower</td>
<td>52.76%</td>
<td>53.22%</td>
<td>53.70%</td>
<td>54.66%</td>
<td>55.30%</td>
<td>55.50%</td>
<td>55.22%</td>
<td>55.06%</td>
<td>54.80%</td>
<td>54.60%</td>
</tr>
<tr>
<td>Onshore wind energy</td>
<td>44.38%</td>
<td>48.07%</td>
<td>51.82%</td>
<td>52.76%</td>
<td>53.63%</td>
<td>56.50%</td>
<td>56.69%</td>
<td>56.35%</td>
<td>57.02%</td>
<td>58.26%</td>
</tr>
<tr>
<td>Offshore wind energy</td>
<td><strong>4.09%</strong></td>
<td>6.22%</td>
<td>6.02%</td>
<td>6.81%</td>
<td>6.09%</td>
<td>6.16%</td>
<td>11.92%</td>
<td>16.11%</td>
<td>20.58%</td>
<td><strong>22.34%</strong></td>
</tr>
<tr>
<td>Solar photovoltaic</td>
<td>23.91%</td>
<td>23.82%</td>
<td>27.29%</td>
<td>37.22%</td>
<td>44.31%</td>
<td>50.48%</td>
<td>58.33%</td>
<td>62.93%</td>
<td>65.54%</td>
<td>65.65%</td>
</tr>
<tr>
<td>Concentrated solar power</td>
<td>37.60%</td>
<td>27.86%</td>
<td>18.89%</td>
<td>33.97%</td>
<td>37.47%</td>
<td>37.41%</td>
<td>36.77%</td>
<td>36.02%</td>
<td>35.25%</td>
<td>35.06%</td>
</tr>
<tr>
<td>Bioenergy</td>
<td>38.82%</td>
<td>36.98%</td>
<td>37.10%</td>
<td>36.56%</td>
<td>38.04%</td>
<td>39.01%</td>
<td>37.99%</td>
<td>38.90%</td>
<td>38.97%</td>
<td>40.06%</td>
</tr>
<tr>
<td>Geothermal energy</td>
<td>78.36%</td>
<td>77.32%</td>
<td>76.33%</td>
<td>75.50%</td>
<td>73.83%</td>
<td>71.27%</td>
<td>70.42%</td>
<td>68.79%</td>
<td>68.06%</td>
<td>66.30%</td>
</tr>
<tr>
<td>Marine energy</td>
<td>11.20%</td>
<td>56.06%</td>
<td>55.40%</td>
<td>55.29%</td>
<td>54.97%</td>
<td>54.97%</td>
<td>53.82%</td>
<td>53.41%</td>
<td>53.31%</td>
<td>53.30%</td>
</tr>
<tr>
<td><strong>Total REs</strong></td>
<td><strong>49.76%</strong></td>
<td>49.79%</td>
<td>50.41%</td>
<td>51.77%</td>
<td>52.76%</td>
<td>54.00%</td>
<td>54.84%</td>
<td>55.62%</td>
<td>56.40%</td>
<td><strong>56.93%</strong></td>
</tr>
</tbody>
</table>

### Suggestions to promote scaling-up RE in APEC (to be analyzed in depth)

- Strengthen policy support
- Promote technological progress and cost reduction
- Strengthen financial support
- Financing and business model innovation
- Optimize business environment
- Improve the flexibility of power system
- Developing distributed energy system
- Using renewable energy to promote energy accessibility
- Learn from advanced experience
- Strengthen international cooperation
## Research Progress: Trends in Renewable Energy Investment

### Renewable energy capacity investment of APEC economies (2016-2019)

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<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>China</td>
<td>103.5</td>
<td>143</td>
<td>91.1</td>
<td>83.4</td>
<td>28.94%</td>
</tr>
<tr>
<td>2</td>
<td>USA</td>
<td>41.4</td>
<td>45.7</td>
<td>43.4</td>
<td>55.5</td>
<td>19.26%</td>
</tr>
<tr>
<td>3</td>
<td>Japan</td>
<td>14.4</td>
<td>13.4</td>
<td>17.6</td>
<td>16.5</td>
<td>5.73%</td>
</tr>
<tr>
<td>4</td>
<td>Chinese Taipei</td>
<td>0.7</td>
<td>0.6</td>
<td>1.8</td>
<td>8.8</td>
<td>3.05%</td>
</tr>
<tr>
<td>5</td>
<td>Australia</td>
<td>3.3</td>
<td>8.5</td>
<td>9.2</td>
<td>5.6</td>
<td>1.94%</td>
</tr>
<tr>
<td>6</td>
<td>Chile</td>
<td>0.8</td>
<td>1.5</td>
<td>1.3</td>
<td>4.9</td>
<td>1.70%</td>
</tr>
<tr>
<td>7</td>
<td>Mexico</td>
<td>0.6</td>
<td>6</td>
<td>3.8</td>
<td>4.3</td>
<td>1.49%</td>
</tr>
<tr>
<td>8</td>
<td>Viet Nam</td>
<td>0.7</td>
<td>0</td>
<td>5.2</td>
<td>2.6</td>
<td>0.90%</td>
</tr>
<tr>
<td>9</td>
<td>Republic of Korea</td>
<td>1.4</td>
<td>2.1</td>
<td>1.4</td>
<td>2.4</td>
<td>0.83%</td>
</tr>
<tr>
<td>10</td>
<td>Russia</td>
<td>0</td>
<td>0</td>
<td>1.9</td>
<td>2.3</td>
<td>0.80%</td>
</tr>
<tr>
<td>11</td>
<td>Canada</td>
<td>1.7</td>
<td>2.7</td>
<td>0.6</td>
<td>0.8</td>
<td>0.28%</td>
</tr>
<tr>
<td>12</td>
<td>Indonesia</td>
<td>0.5</td>
<td>1</td>
<td>0.8</td>
<td>0.4</td>
<td>0.14%</td>
</tr>
<tr>
<td>13</td>
<td>Malaysia</td>
<td>0</td>
<td>0.7</td>
<td>0.4</td>
<td>0.3</td>
<td>0.10%</td>
</tr>
<tr>
<td>14</td>
<td>Thailand</td>
<td>1.4</td>
<td>0.7</td>
<td>0.3</td>
<td>0.2</td>
<td>0.07%</td>
</tr>
<tr>
<td>15</td>
<td>Hong Kong, China</td>
<td>0.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Peru</td>
<td>0.4</td>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>The Philippines</td>
<td>1</td>
<td>0.3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Singapore</td>
<td>0.7</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Total APEC</td>
<td>172.5</td>
<td>227.2</td>
<td>178.8</td>
<td>188</td>
<td>71.40%</td>
</tr>
<tr>
<td></td>
<td>Global</td>
<td>241.6</td>
<td>279.8</td>
<td>272.9</td>
<td>288.2</td>
<td>81.20%</td>
</tr>
<tr>
<td></td>
<td>Share of APEC</td>
<td>71.40%</td>
<td>81.20%</td>
<td>65.52%</td>
<td>65.23%</td>
<td></td>
</tr>
</tbody>
</table>


### Renewable energy capacity investment from 2010 to 2019, top 20 markets

- 8 of the top 20 markets are in APEC region
- China, USA and Japan are the top 3 markets in the world

Source: Global Trends in Renewable Energy Investment 2020
Research Progress: Energy Access

- **Access to electricity (2018)**
- **Population without electricity (2018)**

<table>
<thead>
<tr>
<th>Country</th>
<th>% of population</th>
<th>Million people</th>
</tr>
</thead>
<tbody>
<tr>
<td>Papua New Guinea</td>
<td>58.97%</td>
<td>3.53</td>
</tr>
<tr>
<td>The Philippines</td>
<td>94.86%</td>
<td>5.48</td>
</tr>
<tr>
<td>Peru</td>
<td>95.20%</td>
<td>1.54</td>
</tr>
<tr>
<td>Indonesia</td>
<td>98.51%</td>
<td>3.99</td>
</tr>
</tbody>
</table>

- **Per capita electricity consumption (2017)**

<table>
<thead>
<tr>
<th>Country</th>
<th>Consumption (kWh/person/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indonesia</td>
<td>843</td>
</tr>
<tr>
<td>Peru</td>
<td>1475</td>
</tr>
<tr>
<td>The Philippines</td>
<td>740</td>
</tr>
<tr>
<td>Papua New Guinea</td>
<td>471</td>
</tr>
<tr>
<td>Global average</td>
<td>2845</td>
</tr>
<tr>
<td>APEC average</td>
<td>4747</td>
</tr>
</tbody>
</table>

*Source: World Bank, analyzed by APSEC*

Using renewable energy to promote energy access

- It is suggested that the relevant economies should study the relevant supporting policies, adjust the relevant regulatory system and electricity price policies for distributed energy (such as microgrid) based on renewable energy in some remote rural areas with small population and poor geographical conditions, so as to provide corresponding technical support and capacity building for stakeholders and explore appropriate business models, Make these projects profitable and financially sustainable.
THANK YOU!