Review of JICA Projects in 2016 & Introduction of Projects to be implemented in 2017

Nov-2016

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Geothermal Advisor

Japan International Cooperation Agency (JICA)
1. Trend of JICA’s Cooperation in Geothermal Development

• 5 activities to be set up for accelerating geothermal development

2. JICA’s Cooperation in 2016

• Example of activities in 2016

3. JICA’s Cooperation in 2017

• Expected project to be implemented in 2017
1. Trend of JICA’s Cooperation in Geothermal Development

Stages of geothermal development and Bottlenecks

<table>
<thead>
<tr>
<th>Stage</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Geological Surface Survey</td>
<td>Aiming at improvements in accuracy rate of reservoir resource exploration and evaluation through technical cooperation projects</td>
</tr>
<tr>
<td>2. Exploratory Drilling / Resource Evaluation</td>
<td>Difficult stages to implement projects by the government of developing countries and private sectors because of high risk development due to a lot of uncertain factors.</td>
</tr>
</tbody>
</table>

Improvement of Internal Rate of Return

Our 5 activities contribute to improve IRR
1. Trend of JICA’s Cooperation in Geothermal Development

5 Activities are …

1. **Capacity Building and Human Resource Development**
   - To improve success rate of drilling
   - To reduce project time of period

2. **Test Drilling Project**
   - Direct Contribution to mitigate risk
   - 1 – 3 drilling B/H in green fields

3. **Geothermal Development Policy and Strategic Planning**
   - To dispatch Public Private Partnership advisor
   - To priorities geothermal development potentials

4. **Research Development in Exploration and Drilling technology**
   - Corroboration works universities between Indonesia & Japan

5. **Concessional Funds**
   - Grant aid and JP ODA Soft Loan for plant implementation projects
   - Private Sector Investment Finance
2. JICA’s Cooperation in 2016 (Some as examples)

1. Capacity Building and Human Resource Development

- 3 new training courses in Japan have been started
- More than 35 Japanese organizations (private sectors & universities)
- Master/Ph.D course
- In total: 480 participants from Africa (throughout 10 years)

① Geothermal policy and strategy program for executives

- Target: Executives who makes decision.
- Period: 1 week
- Implementing partners: Kyushu Electric Power, West Japan Engineering Company, METI, JOGMEC, etc.

Curriculum (2016)

<table>
<thead>
<tr>
<th>Participants</th>
<th>14th Nov</th>
<th>15th Nov</th>
<th>16th Nov</th>
<th>17th Nov</th>
<th>18th Nov</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 (twice a year)</td>
<td>AM</td>
<td>Orientation</td>
<td>Site Visit In Kyusyu</td>
<td>Site Visit In Tokyo</td>
<td>Lecture</td>
</tr>
<tr>
<td></td>
<td>PM</td>
<td>Lecture</td>
<td></td>
<td></td>
<td>Country Report presentation</td>
</tr>
</tbody>
</table>
2. JICA’s Cooperation in 2016 (Some as examples)

1. Capacity Building and Human Resource Development

② Intensive Training for Geothermal Resource Engineers

- Target: Engineer (Geology, Geochemistry, Geophysics, Reservoir engineering)
- Period: 6 months
- JICA has revived and renovated the geothermal engineer program at Kyushu University from 1970 to 2001.
- Well balanced between theoretical and practical parts comprehensively
- Implementing partners: Kyushu Univ., Tohoku Univ., Research institute, Developers, Consultants

On going (Started in June)

<table>
<thead>
<tr>
<th>Classes</th>
<th>Participants</th>
<th>Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Geology</td>
<td>18 per year</td>
<td>Research on issues from home countries (3 months)</td>
</tr>
<tr>
<td>Geochemistry</td>
<td>Lecture (3 months)</td>
<td>Poster presentation at Geothermal Research Society of Japan</td>
</tr>
<tr>
<td>Geophysics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reservoir</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15 participants from 8 countries
- Bolivia, Djibouti (4), Ecuador, Indonesia (2), Kenya (3), Nicaragua (2), Papua New Guinea, Tanzania
2. JICA’s Cooperation in 2016 (Some as examples)

1. Capacity Building and Human Resource Development

3. Drilling Management for Geothermal Development

- Target: Engineer (Drilling Manager, NOT Drillers)
- Period: 5 weeks
- Trainees will learn drilling technology, logistics, contract and case study, finally exercise drilling planning.
- In case study, countermeasures and lessons from failure drilling in Japan will be introduced.
- Implementing partners: Geothermal developers and contractors in Japan

<table>
<thead>
<tr>
<th>Participants</th>
<th>Curriculum</th>
</tr>
</thead>
</table>
| 8 per year   | 1. Drilling technology introduction  
               2. Understanding of the types and operation principle of drilling equipment  
               3. Understanding of drilling parameters  
               4. Logging  
               5. Labor management Introduction and Safety management compendium  
               7. Excavation trouble Case Study (lost circulation, blowouts, etc.)  
               8. process planning and management (exercises) |
2. JICA’s Cooperation in 2016 (Some as examples)

1. Capacity Building and Human Resource Development

③ Drilling Management for Geothermal Development
1. Trend of JICA’s Cooperation in Geothermal Development

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   Direct Contribution to mitigate risk
   
   1 – 3 drilling B/H in green fields

3. Geothermal Development Policy and Strategic Planning
   
   To dispatch Public Private Partnership advisor
   
   To priorities geothermal development potentials

4. Research Development in Exploration and Drilling technology
   
   Corroboration works universities between Indonesia & Japan

5. Concessional Funds
   
   Grant aid and JP ODA Soft Loan for plant implementation projects
   
   Private Sector Investment Finance
2. JICA’s Cooperation in 2016 (Some as examples)

2. Test Drilling Project

- Formulated conceptual reservoir model & drilling plan
- Ethiopia, Djibouti, Ecuador, Nicaragua
- Formed “advisory team” – professors and developers

3. Policy of Geothermal Development and Strategic Planning

<Ethiopia>
- Master Plan
- Workshop on possible institutional structures
- Current status: GSE and EEP
- Goal: Establishment of an institution
- JICA contributed to stimulate discussion & to deliver suggestions

<Kenya>
- Public & Private Partnership (PPP) advisor to Ministry of Energy
- Current status: Lack of investment for up-stream development
- Goal: To invite private sector to the market
- Attractive market, structural mechanism/Institutional system
1. Trend of JICA’s Cooperation in Geothermal Development

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   - Private Sector Investment Finance
4. Research Development in Exploration and Drilling technology

<Indonesia>

- 2 Universities: Kyoto University & Bandung Institute of Technology

- Developing new technologies
  - i) To detect steam spots
    by comprehensively consolidate methods of remote sensing, mathematical geology, geochemistry, and mineralogy
  
  ii) To monitor environmental impacts and influences of power plant operation
    by using remote sensing technology

  iii) To establish simulation model/system
    to optimize steam utilization for long-term
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2. JICA’s Cooperation in 2016 (Some as examples)

5. Concessional Funds

<Grant Project>

Ethiopia

- Wellhead generator project in Aluto Langano
- Approx. US $ 20 million

Schedule of Grant Project

<table>
<thead>
<tr>
<th>Activities</th>
<th>Time line</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preparatory survey in the field &amp; Kick-off Meeting</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Presentation on the results of the survey</td>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Approval by the Japanese Cabinet</td>
<td></td>
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<tr>
<td>Exchange of Note, Grant Agreement</td>
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<tr>
<td>Contract with Consultant</td>
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<tr>
<td>Detail Design including tender evaluation</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>Construction supervision &amp; Acceptance inspection</td>
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</tbody>
</table>

We are here!
2. JICA’s Cooperation in 2016 (Some as examples)

5. Concessional Funds

<ODA Soft Loan>
Kenya – Olkaria V Geothermal Power Plant Construction

- Loan Agreement of JP¥45.69 billion Japanese yen
  - Aprox. US$ 456.9 million
- In March 2016
- 2 power plants (70MWe x 2), Steam gathering pipe, Transmission line
- Contributed power mix
  - 37% of 1,512MW (peak demand) – Hydro power, in 2015

Ethiopia

- Preparation of Feasibility Study for 35MWe (in Aluto Langano)
- Examination wells, discharge test, economical evaluation
3. JICA’s Cooperation in 2017

Our Challenges

1. Selections of test drilling
   - Ethiopia – Tendaho 2, Ayurobera
   - Djibouti – Hanle
   - Ecuador – Chachimbiro
   - Nicaragua – Mombacho

2. Strategical Training Courses (HR Development)
   - Strengthen education and research capacity of universities
   - Education and Research system in universities – produce geothermal engineers
   - Collaboration b/w JICA’s short-team training course & Master / Ph.D

3. Strengthen in O&M of Geothermal Power Plant
   - Aiming at improvement of project profitability
   - Capacity building of O&M
   - Internet of Things (IoT) Technology - Remote monitoring, preventive maintenance
to improve efficiency of power plant
to assist HR development
Thank you very much for your attention

ありがとうございました

有難うございました