Managing the Water-Food-Energy Securities in the Brantas River Basin, Indonesia

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JASA TIRTA I PUBLIC CORPORATION - INDONESIA
Jasa Tirta I Public Corporation

Main Duties
- Jasa Tirta I Public Corporation is stipulated in the Government Regulation No 46 of 2010 comprising among others: preventive O&M of water infrastructures and rendering water services.

Mandate
- Jasa Tirta I Public Corporation is a State-Owned Company with a mandate from the Government to carry out specific management assignments in the Brantas and Bengawan Solo River Basin.
An archipelago of 17,508 islands – 240 million inhabitants – 5,590 rivers all over the country – divided into 133 river basins – Brantas is one of the strategic river basin of out 29 selected basins.
The Brantas River Basin

THE BRANTAS RIVER BASIN, EAST JAVA, INDONESIA

- Catchment Area: 11,800 km² (25% of East Java)
- Population (2010): 15.6 million (43% of East Java)
- Annual Rainfall: 2,000 mm
- Annual Runoff: 11.8 billion m³
- Mainstream Length: 320 km
Master Plans of the Brantas River Basin

One River, One Plan
One Integrated Management

WATER RESOURCES PROBLEMS

FIRST MASTER PLAN (1961)
IMPLEMENTATION (1962 - 1972)
FLOOD CONTROL

SECOND MASTER PLAN (1973)
IMPLEMENTATION (1973 - 1984)
IRRIGATION FOR AGRICULTURE

THIRD MASTER PLAN (1985)
IMPLEMENTATION (1984 - 2000)
BULKWATER SUPPLY

FOURTH MASTER PLAN (1998)
IMPLEMENTATION (1999 - 2020)
CONSERVATION & MANAGEMENT

SUSTAINABLE WATER RESOURCES
Infrastructures in the Basin

Master Plan I (1961 - 1973)
- Bening Dam (84)
- Waru-Turi B. (92)
- Selorejo Dam (72)
- Wlingi Dam (78)
- Sutami Dam (72)
- Lahor Dam (77)
- Sengguruh Dam (88)
- T.Agung Tunnel (91)
- Lodoyo Dam (83)
- Wlingi Dam (78)
- Sutami Dam (72)
- Lahor Dam (77)
- Sengguruh Dam (88)

Master Plan II (1974 - 1985)
- Gunungsari B. (81)
- New Lengkong B (74)
- Menturus R.D (93)
- Jatimlerek R.D (93)

Master Plan III (1986 - 2000)

- Bening Dam (84)
- Waru-Turi B. (92)
- Selorejo Dam (72)
- Wlingi Dam (78)
- Sutami Dam (72)
- Lahor Dam (77)
- Sengguruh Dam (88)
- T.Agung Tunnel (91)
- Lodoyo Dam (83)
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- Sengguruh Dam (88)
## Socio-Economic Impacts in the Brantas River Basin

<table>
<thead>
<tr>
<th>Benefit</th>
<th>Unit</th>
<th>Before development 1960</th>
<th>After Development 1990</th>
<th>Managed as of the Year 2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flood control</td>
<td>Inundation area</td>
<td>Frequent flood</td>
<td>Controlled</td>
<td>More Controlled</td>
</tr>
<tr>
<td>Irrigation</td>
<td>Harvest intensity</td>
<td>0.8 times / year</td>
<td>1.8 times / year</td>
<td>2.2 times / year (122 %)</td>
</tr>
<tr>
<td>Electricity</td>
<td>Million kWh</td>
<td>170</td>
<td>910</td>
<td>1,031 (113 %)</td>
</tr>
<tr>
<td>Domestic water supply</td>
<td>Million m³</td>
<td>73</td>
<td>125</td>
<td>352 (282%)</td>
</tr>
<tr>
<td>Industrial water supply</td>
<td>Million m³</td>
<td>50</td>
<td>115</td>
<td>159 (138 %)</td>
</tr>
<tr>
<td>Water quality</td>
<td>Average BOD/year</td>
<td>-</td>
<td>12 - 16 mg/lt</td>
<td>3 - 14 mg/lt</td>
</tr>
<tr>
<td>Infrastructures</td>
<td>Condition</td>
<td>-</td>
<td>Less Maintained</td>
<td>Maintained</td>
</tr>
</tbody>
</table>

Brantas River Basin = 25% area of East Java Province
GRDP Brantas River Basin = 59% GRDP in the East Java Province (as of 2010)
Irrigation and Rice Production in the Brantas River Basin

- Reservoirs in the Brantas River basin provides water for irrigated area of about 121,000 ha (from the total paddy field area of 304,000 ha).
- The Brantas River basin plays significant role to support East Java Province as National Rice Supplier (9 millions ton of rice per year/ 18% of National rice supply – 5.8% from the Brantas River basin).
Water for Domestic and Industry in the Brantas River Basin

- **Domestic water use**
  - Raw water for domestic purposes is provided for regional water supply enterprises known as *Perusahaan Daerah Air Minum* (PDAMs) that provide treated drinking water to urban areas.
  - There are six PDAMs in the Brantas River basin using raw water of about 300 million m³ per-year.

- **Industrial water use**
  - Due to reliability of water supply in the Brantas River basin for industrial uses and the port facilities in Surabaya Metropolitan Area, investment in industrial development has increased sharply.
  - There are 143 industries having licenses to abstract water of about 191 million m³ per-year from the rivers in the basin.
HEPPs in the Brantas River Basin

- Total installed capacity = 281 MW
- Electricity production = 1 billion kWh per year

<table>
<thead>
<tr>
<th>HEPP</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sengguruh</td>
<td>2 x 14.5 MW</td>
</tr>
<tr>
<td>Sutami</td>
<td>3 x 35 MW</td>
</tr>
<tr>
<td>Wlingi</td>
<td>2 x 27 MW</td>
</tr>
<tr>
<td>Lodoyo</td>
<td>4.5 MW</td>
</tr>
<tr>
<td>Tulungagung</td>
<td>2 x 18 MW</td>
</tr>
<tr>
<td>Selorejo</td>
<td>4.48 MW</td>
</tr>
<tr>
<td>Wonorejo</td>
<td>6.5 MW</td>
</tr>
<tr>
<td>Mendalan 1</td>
<td>5.6 MW</td>
</tr>
<tr>
<td>Mendalan 2-4</td>
<td>3 x 5.8 MW</td>
</tr>
<tr>
<td>Siman</td>
<td>3 x 3.6 MW</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production (million kWh)</td>
<td>1,103</td>
<td>997</td>
<td>1,500</td>
<td>1,118</td>
<td>1,032</td>
</tr>
</tbody>
</table>
The W-F-E Related Issues and Challenges in the Brantas River Basin

- In-efficient water uses, especially the irrigation sector.
- The decrease of effective storage capacity of the reservoirs due to sedimentation.
- Shortage of water in serious drought year.
- Increase of population and various economic activities, has direct impact on water quality degradation in downstream area.
- Some HEPPs (such as Sengguruh, Wlingi and Lodoyo) lose its effective heads due to reservoir sedimentation.
<table>
<thead>
<tr>
<th>NO.</th>
<th>RESERVOIR NAME</th>
<th>HWL (mill. m³)</th>
<th>LWL (mill. m³)</th>
<th>YEAR</th>
<th>DEAD (mill. m³)</th>
<th>EFFECTIVE (mill. m³)</th>
<th>GROSS (mill. m³)</th>
<th>YEAR¹</th>
<th>DEAD (mill. m³)</th>
<th>EFFECTIVE (mill. m³)</th>
<th>GROSS (mill. m³)</th>
<th>DEAD (%)</th>
<th>EFFECTIVE (%)</th>
<th>GROSS (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sengguruh</td>
<td>292.50</td>
<td>291.4</td>
<td>1988</td>
<td>19.00</td>
<td>2.50</td>
<td>21.50</td>
<td>2011</td>
<td>0.470</td>
<td>0.576</td>
<td>1.043</td>
<td>2.46</td>
<td>23.04</td>
<td>4.85</td>
</tr>
<tr>
<td>2</td>
<td>Sutami</td>
<td>272.50</td>
<td>246</td>
<td>1972</td>
<td>90.00</td>
<td>253.00</td>
<td>343.00</td>
<td>2011</td>
<td>23.280</td>
<td>133.891</td>
<td>157.167</td>
<td>25.86</td>
<td>52.92</td>
<td>45.82</td>
</tr>
<tr>
<td>3</td>
<td>Lahor</td>
<td>272.70</td>
<td>253</td>
<td>1977</td>
<td>6.70</td>
<td>29.40</td>
<td>36.10</td>
<td>2011</td>
<td>4.600</td>
<td>24.430</td>
<td>29.025</td>
<td>68.58</td>
<td>83.10</td>
<td>80.40</td>
</tr>
<tr>
<td>4</td>
<td>Wlingi</td>
<td>163.50</td>
<td>162</td>
<td>1977</td>
<td>18.80</td>
<td>5.20</td>
<td>24.00</td>
<td>2011</td>
<td>2.410</td>
<td>2.003</td>
<td>4.415</td>
<td>12.83</td>
<td>38.52</td>
<td>18.40</td>
</tr>
<tr>
<td>5</td>
<td>Lodoyo</td>
<td>136.00</td>
<td>130.5</td>
<td>1980</td>
<td>0.20</td>
<td>5.00</td>
<td>5.20</td>
<td>2011</td>
<td>0.350</td>
<td>2.294</td>
<td>2.640</td>
<td>173.00</td>
<td>45.88</td>
<td>50.77</td>
</tr>
<tr>
<td>6</td>
<td>Selorejo</td>
<td>622.00</td>
<td>598</td>
<td>1970</td>
<td>12.20</td>
<td>50.10</td>
<td>62.30</td>
<td>2011</td>
<td>1.700</td>
<td>36.411</td>
<td>38.109</td>
<td>13.92</td>
<td>72.68</td>
<td>61.17</td>
</tr>
<tr>
<td>7</td>
<td>Bening</td>
<td>108.60</td>
<td>96.4</td>
<td>1981</td>
<td>4.50</td>
<td>28.40</td>
<td>32.90</td>
<td>2007</td>
<td>2.060</td>
<td>22.819</td>
<td>24.880</td>
<td>45.80</td>
<td>80.35</td>
<td>75.62</td>
</tr>
<tr>
<td>8</td>
<td>Wonorejo</td>
<td>183.00</td>
<td>141</td>
<td>2000</td>
<td>16.00</td>
<td>106.00</td>
<td>122.00</td>
<td>2011</td>
<td>10.150</td>
<td>97.091</td>
<td>107.240</td>
<td>63.43</td>
<td>91.60</td>
<td>87.90</td>
</tr>
</tbody>
</table>

Note: *) Based on the sounding results in the latest year
Some Initiatives to Manage the W-F-E Securities in the Brantas River Basin

- Promote water resource-efficiency as the first step towards effectively managing the water-food-energy nexus.
- Restore and maintain the effective storage of reservoirs in the basin.
- Conduct Artificial Rain Project using Weather Modification Technology (during drought season).
- Develop drinking water supply systems.
- Support National Movement to Increase Food Production on Corporation Basis (Gerakan Peningkatan Produksi Pangan Berbasis Korporasi - GP3K).
- Develop regulated fish cultivation in the reservoirs to augment protein consumption.
- Develop potential sites for hydro electric power generation (including mini/micro HEPPs in irrigation areas, modify existing facilities to install HEPPs).
The Reservoirs Dredging

Wlingi Reservoir (2012)

Selorejo Reservoir (2012)
Drinking water supply system development in the Brantas River Basin

Type C
SPAM SEKARAN (LAMONGAN)
Capacity: 30 L/s

Type A
SPAM PANTURA I
Capacity: 50 L/s

Type A
SPAM GRESIK
Capacity: 50 L/s
Artificial Rain Project in the Brantas River Basin

- The latest project was conducted on 23 Oct - 7 Dec 2012
- The additional water stored in the Sutami Reservoir = 161,803,000 m³
- Resulted additional electricity production of about 48,993,453.70 kWh
- Provided additional water for irrigation area of about 18,727 ha

<table>
<thead>
<tr>
<th>Station</th>
<th>Sbr. Brantas</th>
<th>Malang</th>
<th>Jabung</th>
<th>Tangkil</th>
<th>Ponco kusumo</th>
<th>Dampit</th>
<th>Sengguruh</th>
<th>Wagir</th>
<th>Sutami</th>
<th>Tunggorono</th>
<th>Pujon</th>
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<tr>
<td>Cumulative rainfall (mm)</td>
<td>531</td>
<td>104.5</td>
<td>145</td>
<td>27</td>
<td>376</td>
<td>464</td>
<td>330</td>
<td>296.6</td>
<td>254</td>
<td>949</td>
<td>354</td>
</tr>
</tbody>
</table>
FACTORS RELATED TO NATIONAL PROGRAM ON STRENGTHENING FOOD SECURITY

Rice production surplus (10 mill ton in 2015)

- **Increase productivity**
  - Best seeds
  - Equipments, etc

- **Extensification (related to water)**
  - New paddy filed

- **Intensification (related to water)**
  - Increase Cultivation Index in existing irrigation area

**Supply management**

- New dams and irrigation areas
  - New dams
  - Improving irrigation networks
  - Long storage

**Demand management**

- Increase efficiency
  - Intake efficiency
  - Conveyance efficiency
  - On farm efficiency

**Land management**

- Best seeds (less water)

Related to infrastructures
Regulated fish cultivation in the reservoirs
Artificial Rain Project in the Brantas River Basin

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<td>296.6</td>
<td>254</td>
<td>949</td>
<td>354</td>
</tr>
</tbody>
</table>
Develop potential sites for HEPPs

Zotloterer Gravitational Vortex

Andritz Hydromatrix
## Potential Sites for HEPPS in the Brantas River Basin

<table>
<thead>
<tr>
<th>Site</th>
<th>Capacity (MW)</th>
<th>Energy (Million kWh/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MRIRIP</td>
<td>1.0</td>
<td>6.4</td>
</tr>
<tr>
<td>ENGKONG</td>
<td>0.95</td>
<td>4.57</td>
</tr>
<tr>
<td>MENTURUS</td>
<td>1.4</td>
<td>9.22</td>
</tr>
<tr>
<td>KARANGKATES IV&amp;V</td>
<td>1.5</td>
<td>9.44</td>
</tr>
<tr>
<td>LODAGUNG I</td>
<td>0.55</td>
<td>4.75</td>
</tr>
<tr>
<td>LODAGUNG II</td>
<td>0.3</td>
<td>2.37</td>
</tr>
<tr>
<td>WANGI</td>
<td>7.0</td>
<td>28.9</td>
</tr>
<tr>
<td>LODOYO</td>
<td>7.88</td>
<td>41.0</td>
</tr>
<tr>
<td>MRICAN</td>
<td>3.35</td>
<td>21.43</td>
</tr>
<tr>
<td>LESTI</td>
<td>12.6</td>
<td>23.00</td>
</tr>
<tr>
<td>KESAMBAR</td>
<td>26.0</td>
<td>34.60</td>
</tr>
<tr>
<td>JATIMLEREK</td>
<td>1.5</td>
<td>9.44</td>
</tr>
<tr>
<td>LODAGUNG II</td>
<td>0.3</td>
<td>2.37</td>
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<tr>
<td>JASITA</td>
<td>0.55</td>
<td>4.75</td>
</tr>
<tr>
<td>KESAMBAR</td>
<td>26.0</td>
<td>34.60</td>
</tr>
<tr>
<td>LESTI</td>
<td>12.6</td>
<td>23.00</td>
</tr>
<tr>
<td>JATIMLEREK</td>
<td>1.5</td>
<td>9.44</td>
</tr>
</tbody>
</table>
Develop Micro HEPPs in the Irrigation Area

- Law No. 30 Year 2009 on Electricity and the Minister of Energy and Natural Mineral Regulation No. 31 Year 2009 on the Purchase Price of Electricity by PT PLN (Persero) from Power Plants Using Small to Medium Scale Renewable Energy Generation.

- Some benefits:
  - Additional fund for RBO to finance water resources management.
  - Reduce Government Fund allocated for water resources management.
  - Increase budget for O&M cost of irrigation channel maintenance.
# Financing sharing for HEPPS Development in Irrigation Area

<table>
<thead>
<tr>
<th>Scheme</th>
<th>Civil and Hydro Works</th>
<th>Electrical and Mechanical Works</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Government *)</td>
<td>RBO</td>
<td>*) Government share inclusion to RBO</td>
</tr>
<tr>
<td>II</td>
<td>Government *)</td>
<td>Private</td>
<td>*) Government share inclusion to RBO/ managed by Farmers Group/ Private rent Government asset</td>
</tr>
<tr>
<td>III</td>
<td>Government *)</td>
<td>Private &amp; PJT</td>
<td>*) Government share inclusion to RBO/ Private rent Government asset</td>
</tr>
<tr>
<td>IV</td>
<td>RBO</td>
<td>RBO</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>RBO *)</td>
<td>Private</td>
<td>*) RBO as majority shareholder (&gt;51%)</td>
</tr>
</tbody>
</table>
Addressing W-F-E Nexus in the Brantas River Basin

- We know well the key issues and challenges associated with the Water-Food-Energy production in the Brantas River basin. But we don’t conduct our programs in a holistic Nexus-driven approach yet.

- We need to establish understanding about the Nexus issues in all levels of the sectors.

- We need to build political will, strong commitment and synergy to work together to improve security for energy, water, and food in a holistic Nexus-driven approach.
Thank you
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