



### **Kalayaan Power Plant - Philippines, 1999-2004**

The Project is financed by IMPSA (Argentina) under BROT (Built, Rehabilitate, Operate, Transfer) agreement with NPC National Power Corporation.

The Plant consists of the construction of the new Kalayaan PSP Stage II with a capacity of 2x185 MW reversible pumping/generating units. The rehabilitation of the two existing Caliraya and Botocan hydropower plant of 32 MW and 20 MW, respectively, is also included in the frame of the CBK project.

The Kalayaan pumped storage plant is the first of this type in the Philippines, built to provide much needed peak power capacity to the Luzon electric grid. The Project makes use of the head available between the upper Caliraya reservoir, of 83 million m<sup>3</sup> capacity, built in the 40's to feed a traditional hydropower plant, and Laguna de Bay, a huge natural lagoon of brackish water. The first stage, commissioned in 1983, is equipped with two 150 MW reversible units. This project will realize the second stage, constituted by a new penstock and powerhouse, as well as associated structures.

In its final configuration (six stages), the project will include the following structures:

Two intake structures on the shore of the existing Caliraya reservoir and relevant approach channels;

Six outdoor steel penstocks, 6.0 m diameter, 1.3 km long, with a terminal bifurcation;

Six shaft powerhouses, equipped with 12 reversible Francis turbines, with the following characteristics:

- Head (generating mode): between 286.5 and 278.0 m;
- Discharge (generating mode): between 62.6 and 61.4 m<sup>3</sup>/s;
- Nominal capacity (generating mode): 150 MW (185 MW for the 2nd stage) x 12;
- Head (pumping mode): between 291.0 and 284.5 m;
- Discharge (pumping mode): between 44.8 and 48.7 m<sup>3</sup>/s;
- Nominal capacity (pumping mode): 145 MW x 12.

Significant technical aspects of Kalayaan project are related to the high ratio between the penstocks length and the available head. In order to achieve a satisfactory frequency regulation, it was necessary to enlarge and optimize the penstock diameter. Detailed studies have been carried out to verify the hydraulic conditions into the penstocks, especially the bifurcations, during the hydraulic transients.

### **Description of Actual Services provided by the Staff:**

- Topographical and geological investigations
- Hydrological analyses and reservoir operation studies

- Quantity and cost estimates, construction planning
- Final design and preparation of complete tender documents for the civil works
- Construction Design and Construction Supervision