CHODAI

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Japan-ASEAN New Industry Creation Project

Trial and validation project of O&M services for hydropower plant utilizing IT technology and Japanese management techniques through cooperation with Japanese-Indonesian enterprises

CHODAI CO.,LTD.
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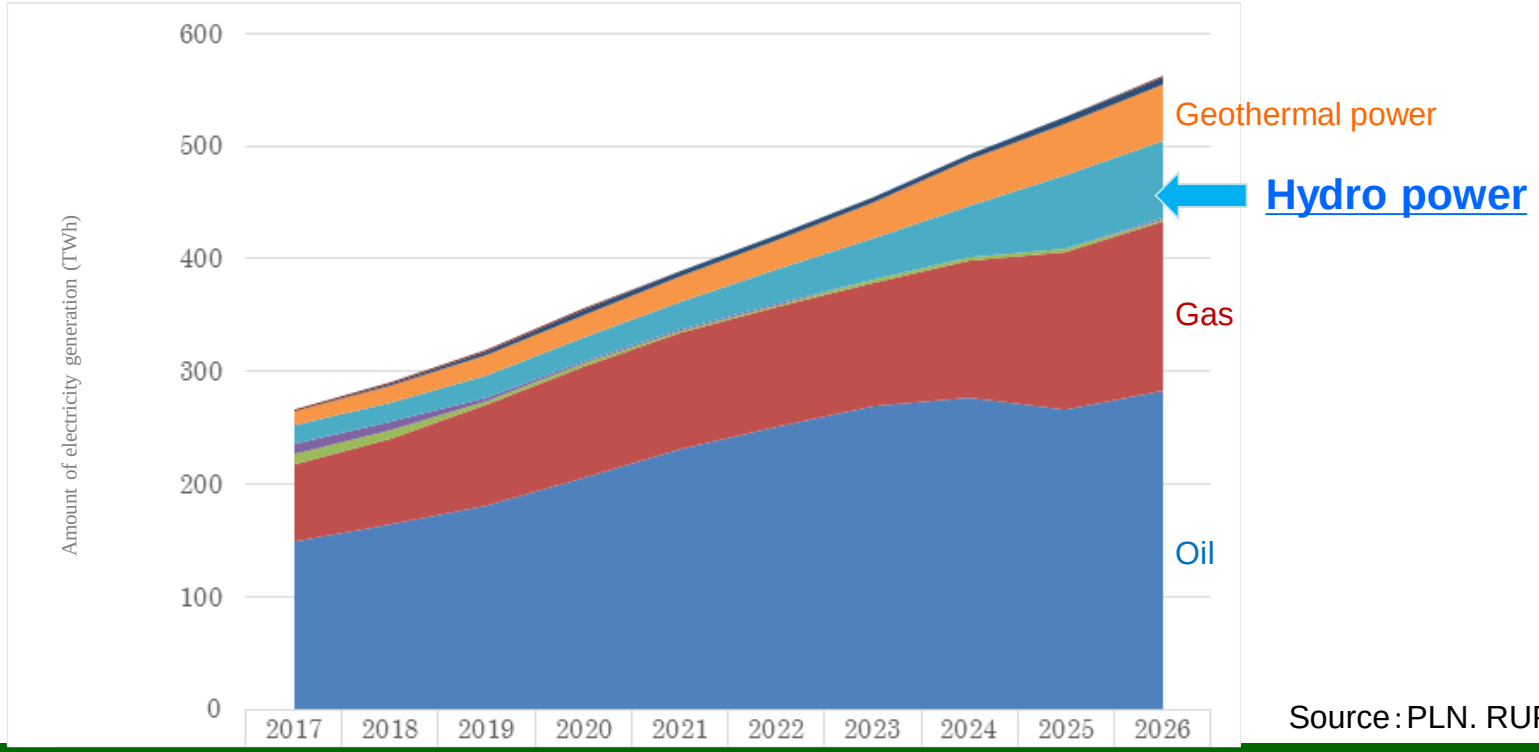
PT. AMCO Hydro Indonesia
AMCO
PT. AMCO HYDRO INDONESIA

Purpose and background of Validation Project

■ **Electric power situation in Indonesia:**

- ✓ Chronic power shortage (low electrification rate of 60% to 80% in rural areas except Jakarta)
- ✓ Because of the weak electricity transmission network, dependent on diesel power generation with high cost and high environmental impact in rural areas
- ✓ Under such circumstances, small hydropower generation is highly expected in Indonesia (the FIT system has been introduced, and the Indonesian government also boosts the development of power by private enterprises)

Changes in power generation by fuel until 2026（Plan）



Source：PLN. RUPTL 2017

Purpose and background of Validation Project

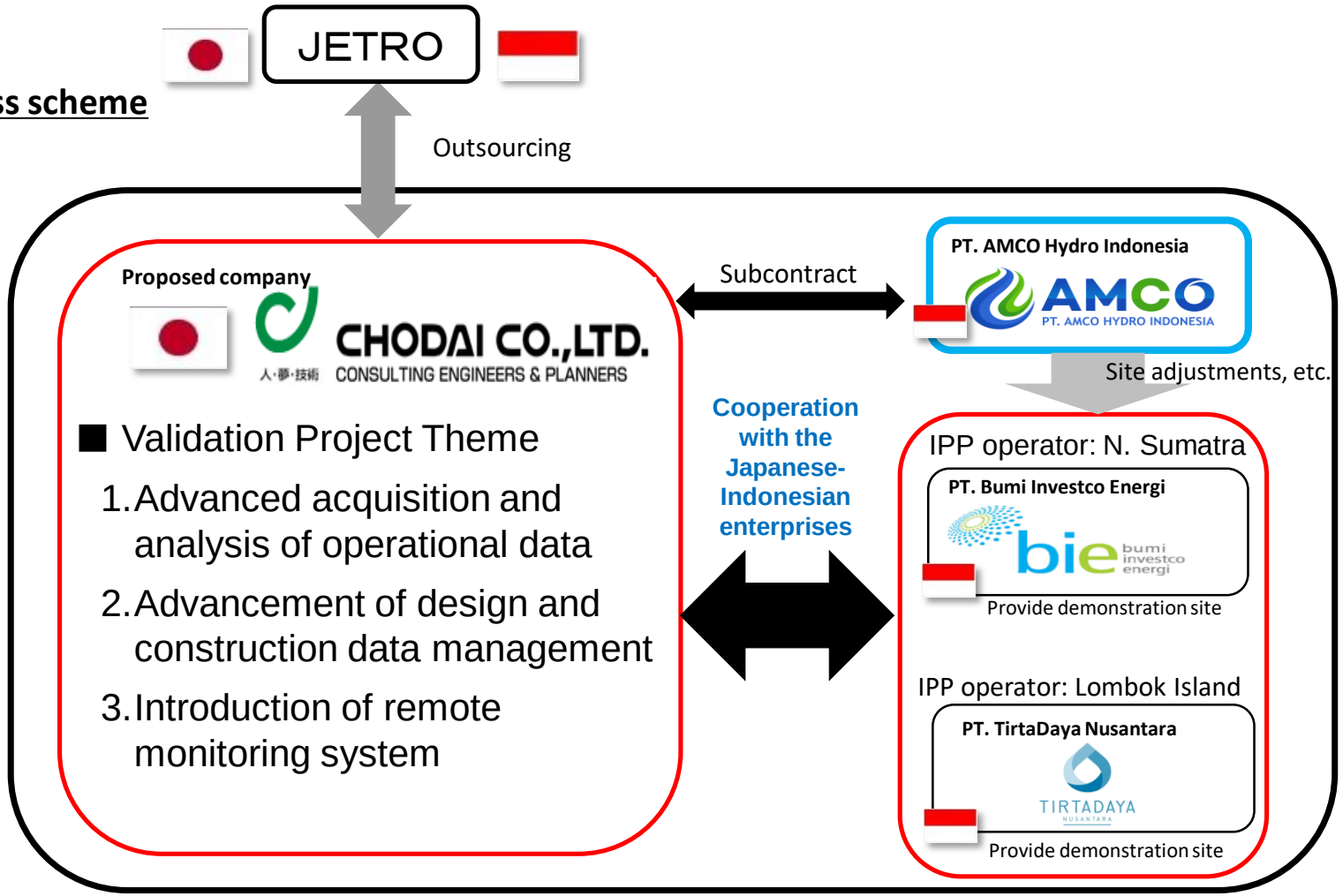
■ **The problems appear in small hydro power projects of Indonesia;**

- ✓ In the planning and design stage, consideration of natural conditions such as the topographic map of the site is insufficient
- ✓ At the construction stage, construction information is not managed functionally and acceptance remains insufficient technical verifications
- ✓ At the O&M stage, the O&M management of the power plant is not accumulated, organized and analyzed as data
- ✓ As a result, Due to the insufficient O&M system, power plants fall below than the planned amount of power generation.

❑ Based on the above, we validate "Advanced acquisition and analysis of operation data", "Advancement of design and construction data management" and "Introduction of remote monitoring system", and figure out "Maximize facility utilization ratio" of the power plant, "Minimize life cycle cost of power plant"

Implementation system of this project

Business scheme

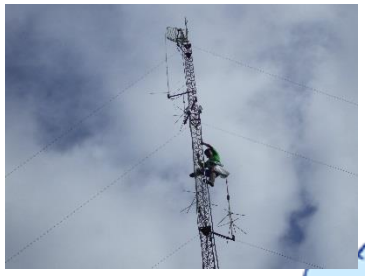


Validation theme and goal of JETRO

Validation theme	Validation contents (What's validation ?)	How to validate?
① Advanced acquisition and analysis of operational data	• Development of IoT sensor and wireless network • Validate the effect of using those data	• Building a wireless network within a power plant facility • Attach sensors to the main parts of civil engineering equipment (intake, head tank, etc.) and obtain the data such discharge, water level etc. • Using the acquired data, perform a total data analysis based on the operation and equipment status of the power plant
② Advancement of design and construction data management	• Accuracy verification of 3D topo map by drone survey • Development of 3D CIM software for power plant • Development data centralized platform of Design →Construction →O&M	• Comparison by extensive drone survey and ground field survey for the purpose of verifying the accuracy of drone survey • Creation of 3D CAD topographic map • Selection of Optimal headrace channel design by 3D model (comparison of 3 route plan) • Review centralized data management method of design and construction · O&M
③ Introduction of remote monitoring system	• Development of realistic "Remote monitoring system" in terms of cost and technology • Validate the efficiency of operation and the cost reduction effect	• Establish central monitoring station to construct remote monitoring system • Collect information of water level, power generation amount etc. at each power plant at regular time intervals and analyze emergency response and efficiency improvement including engineer's operation

Establishment of validation examples of maximizing facility utilization of power plants and minimizing life cycle cost !

Theme A: Advanced acquisition and analysis of operational data (1)



Repeater Tower

Water level sensor

NW System Overview for A

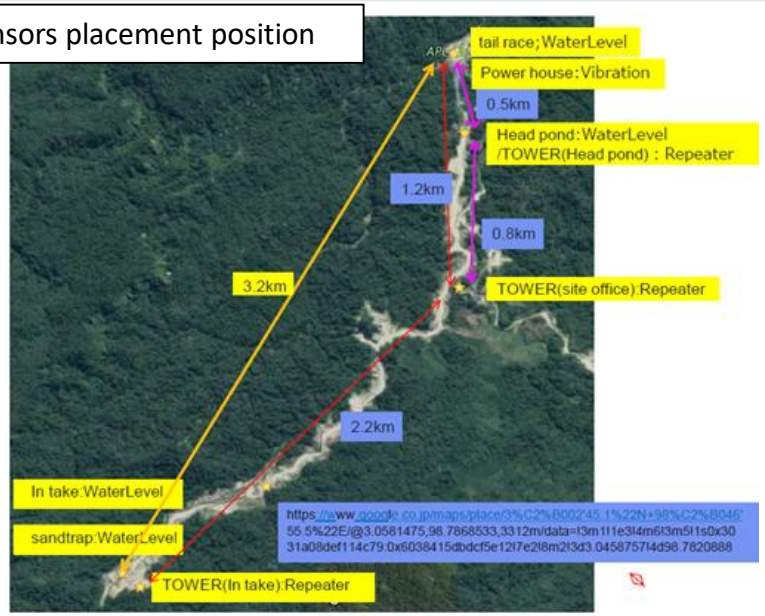
Power House Monitor

Theme A: Advanced acquisition and analysis of operational data (2)

■ Communication environment condition in small hydropower station

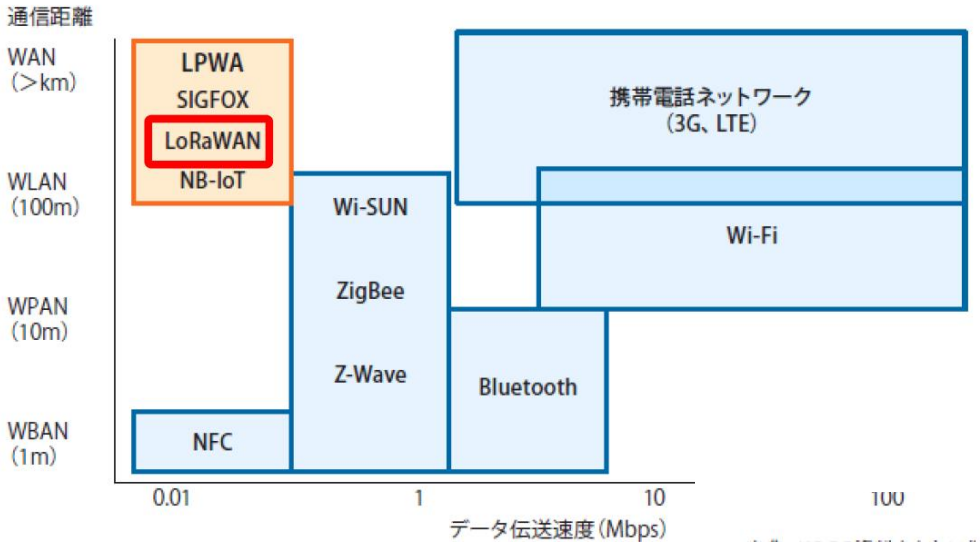
- ✓ Increased cost of cable laying in wired communication (Communication distance is long, wide area coverage is necessary)
- ✓ Often obstacle of wireless communication because of the mountainous terrain.。(There are many undulations, covered by trees)
- ✓ The power supply equipment is not deployed in the sensor installation part

Sensors placement position



■ Validation for improving Operation (Adoption of LoRa)

- ✓ Three repeaters - installed to extend communication range, covering wide area coverage
- ✓ Adjust transmission data volume and transmission speed to support low bit rate
- ✓ Power is supplied by the battery, because the commercial power supply can not be used



■ Achievement

- ✓ Successful data communication with a wireless **transmission distance of 3.5 km**
- ✓ Battery replacement period is **2 months** on average
- ✓ Sensor information can also be obtained from the personal PC in the field.

Theme A: Advanced acquisition and analysis of operational data (3)

■Overflow from the head pound (Pink part)

- ✓ Currently, the operator did not adjust the output corresponding to the change of the water intake
- ✓ Even though there was a margin for power generation output, overflow occurred from head pond.

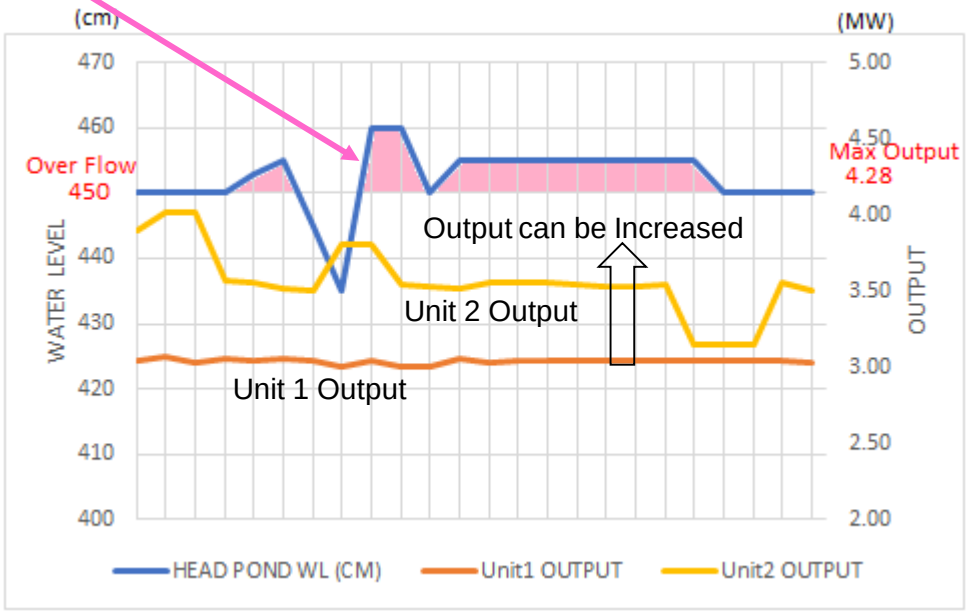
■ Validation for operation improvement

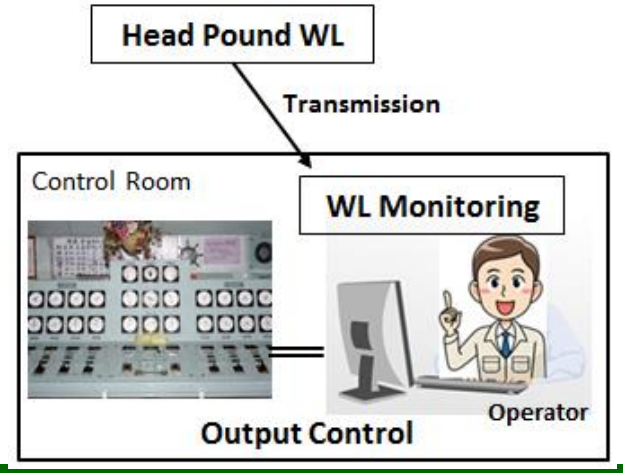
- ✓ Construct a system for transmit and display data of water stage recorder in control room by installing it on the head pond ,
- ✓ The operator directly monitors the head pond water level
- ✓ The operator monitors the head pond water level and does not cause it to overflow

■ Achievement

- ✓ Annual power loss due to overflow from head pond is about 770 MWh, which is equivalent to about **1.7% of the annual generated electricity**
- ✓ In this validation project, we proposed operation management rules to improve this, and confirmed its effect.

Relation of Head Pond Water Level and Output

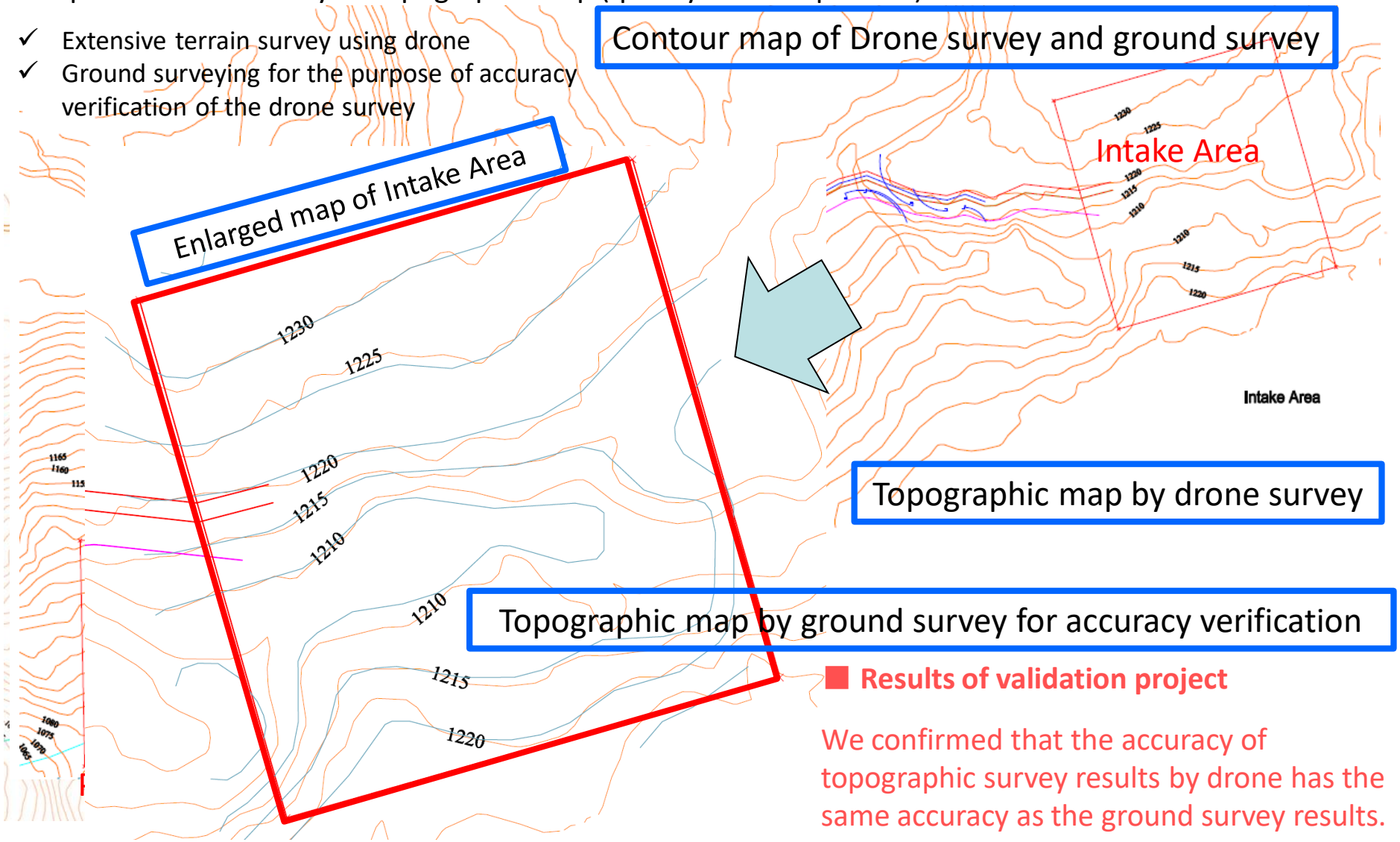




Theme B: Advancement of design and construction data management (1)

■ Improvement accuracy of Topographic map (quickly and inexpensive)

- ✓ Extensive terrain survey using drone
- ✓ Ground surveying for the purpose of accuracy verification of the drone survey



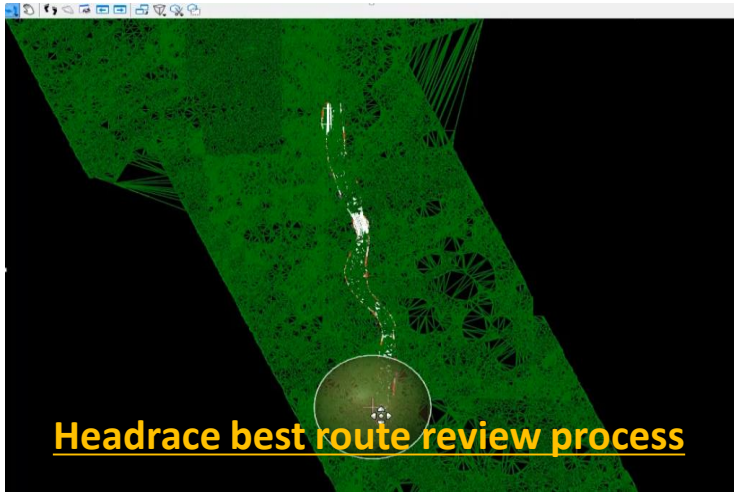
■ **Results of validation project**

We confirmed that the accuracy of topographic survey results by drone has the same accuracy as the ground survey results.

Theme B: Advancement of design and construction data management

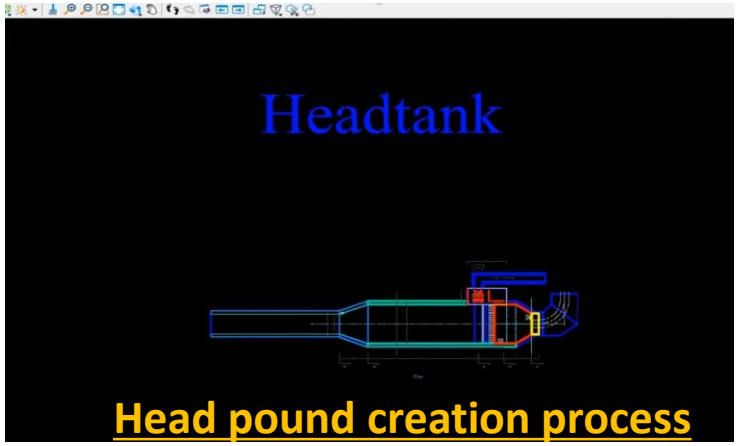
■ Optimum power generation layout plan assumed F/S stage

- ✓ 3D CAD topographic map creation (hereafter referred to as "3D model")
- ✓ Review of optimal power generation layout plan (intake facility, head pound, power station)
- ✓ Selection of headrace normal/optimum plan by 3D model (comparison of 3 route plans)



■ Detailed design by 3D model

- ✓ Creation of 3D detailed design drawing based on optimal power generation layout plan
- ✓ Target is head pound, power plant

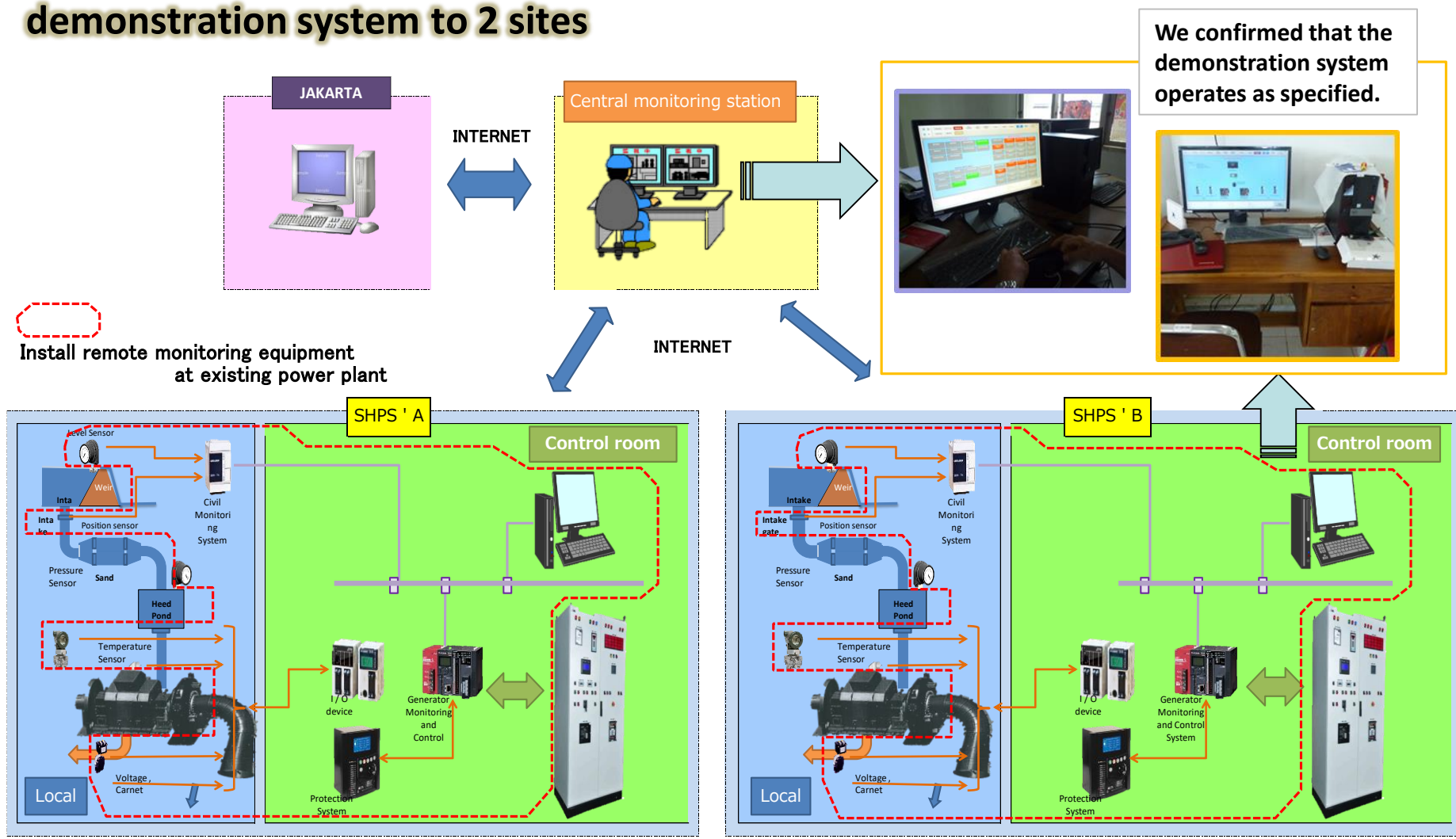


■ Results of validation project

Confirmed speed and efficiency optimum power generation arrangement plan by 3D model and template creation/use based on drone survey topographic map. We conducted a detailed design by 3D model and confirmed the rationalization of design, modification etc.

Theme C: Introduction of remote monitoring system(1)

Review the concept of remote monitoring system and introduce demonstration system to 2 sites



Theme C: Introduction of remote monitoring system(2)

[Assumed effect of remote monitoring]

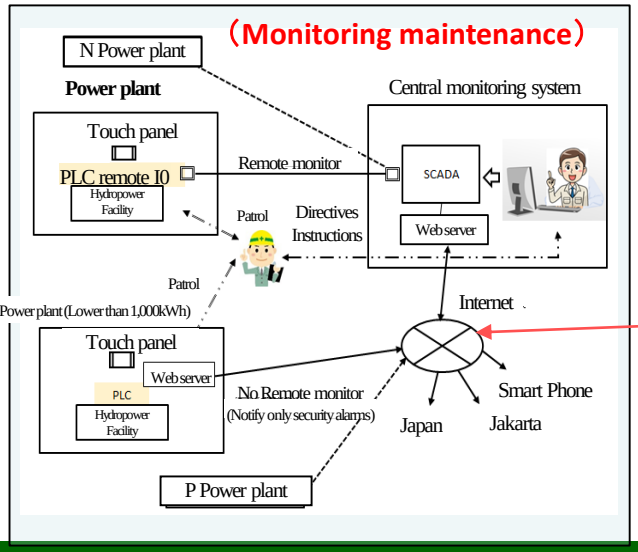
Job category	Current operational		Operation using a central monitoring station			
	All power plants	Number of people	Central monitoring station	10 MW or more power plant	10MW less of power plant	Number of people
	16plant		1plant	8plant	8plant	
Supervisor			○			4
Chief engineer	○	64	○			4
Workers	○	64		○	○	64
	4Group	128	4Group	4Group	4Group	72

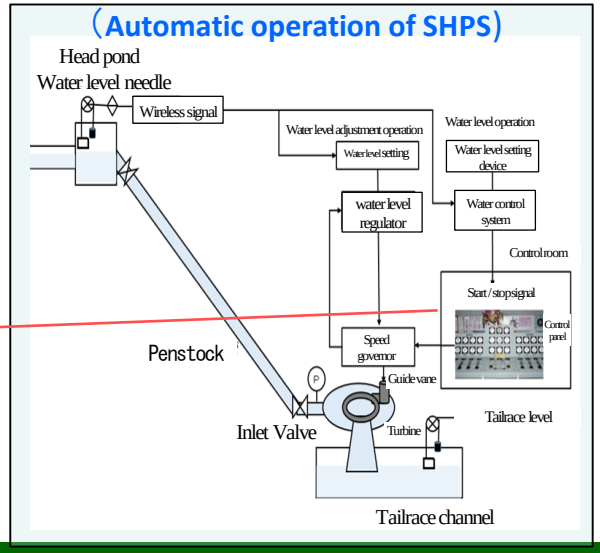
Study for labor saving when introducing this system to future planning site (16 sites)

- You can concentrate supervisors and engineers with expertise
- Local plants place workers only, so we can reduce the number of people.

128 → 72

〔Future O&M monitoring and maintenance system concept〕





Future vision

- Automation of small hydropower station (unattended operation)
- Monitoring of operation and centralization of patrol / maintenance inspection personnel

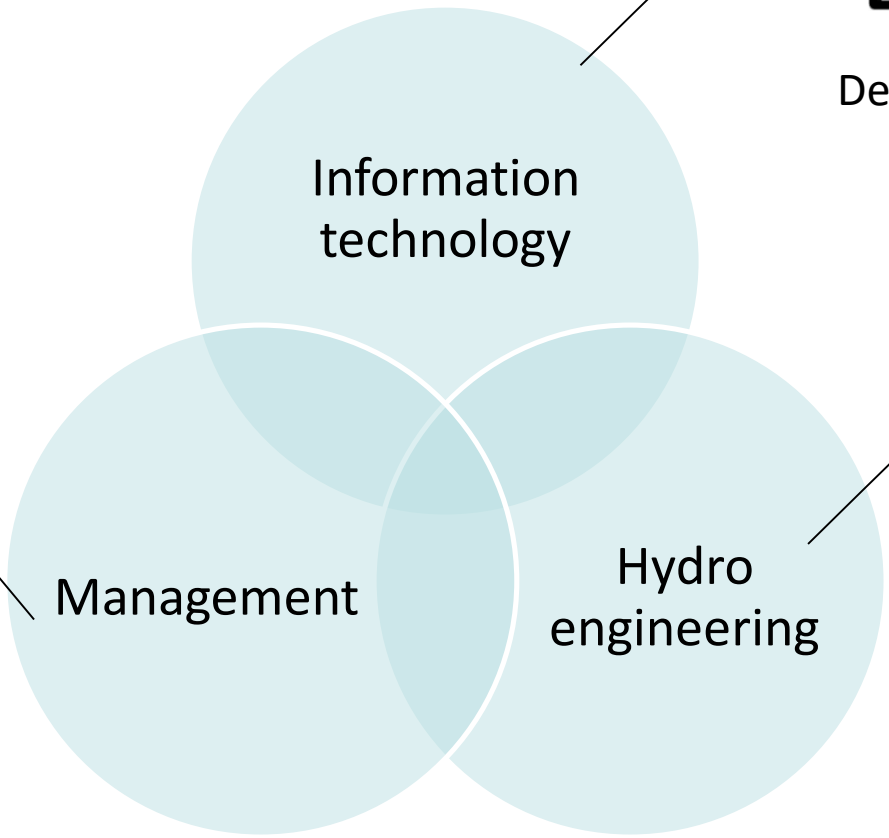
Enables further labor saving

AMCO(Asset Management Company) Service Concept

Develop Cloud System

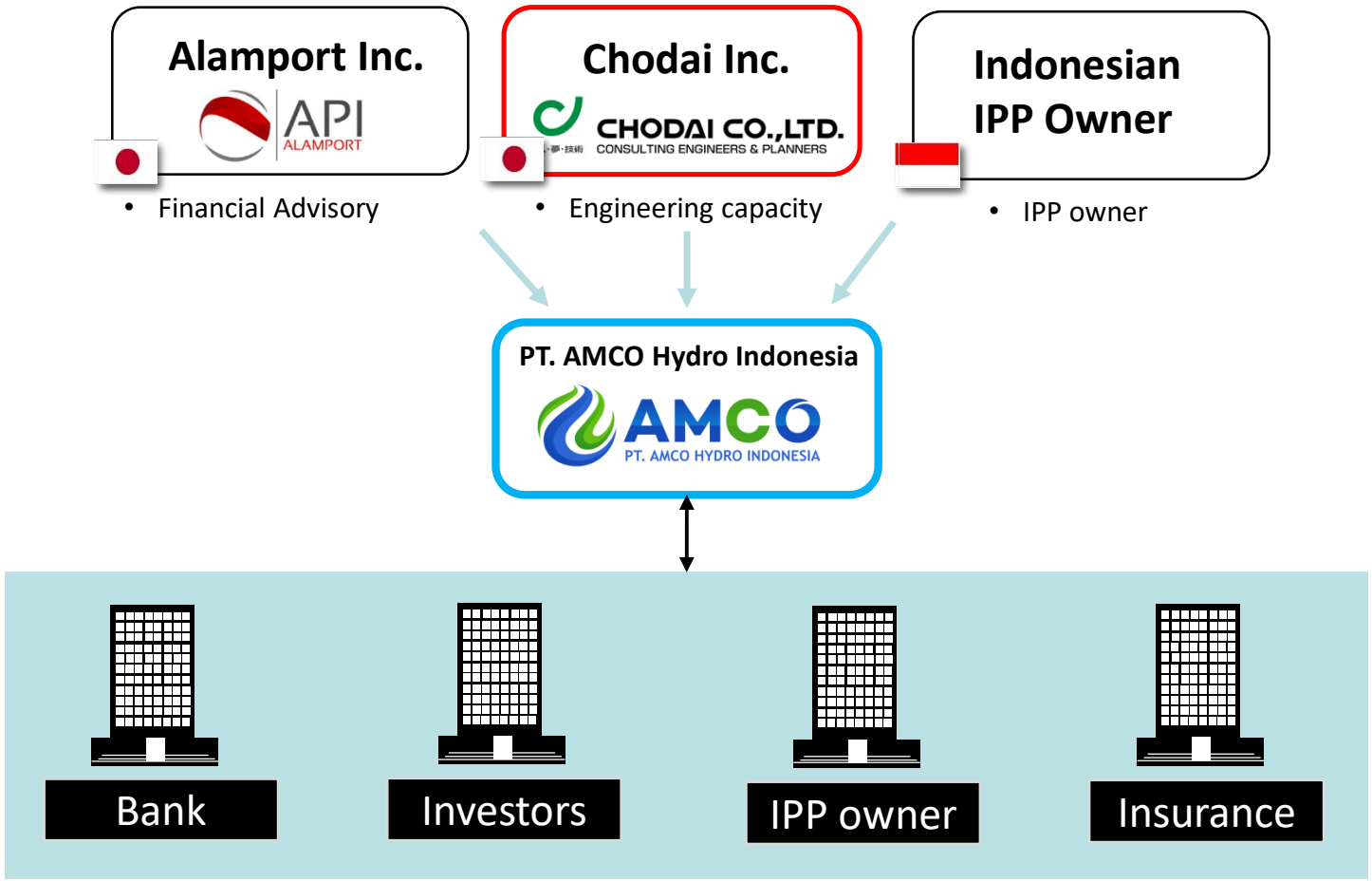
Reporting functions

Implementation support



- ✓ Creating cycle of “Visualize” => “Analyse” => “Improve” is important
- ✓ Up-grade hydro power plant in Indonesia in terms of reliability and efficiency by using information technology and Japanese management way

AMCO's formation and intention



✓ AMCO provides solutions for various stakeholders to make Indonesian hydro projects moving forward

AMCO’s future ideas

System improvement

O&M support

Indonesian made turbine

Human resource development

- ✓ AMCO is to provide Japanese know-how and combine with Indonesian resources and expand the business not only in Indonesia but also other Asian countries in future

Some bottle-necks on regulation

O&M guideline

- Guideline of technical specification
- Guideline of operation and maintenance

Regulation on information technology in using IoT devices

- Internet system still limited to remote area
- Difficult to use other countries devices due to limited channel and radio wave

Custom procedures

- Most of the IT products relying on imports from other countries (Cisco, Dell and HP etc.)

Grid system

- Many trips from the transmission line
- Guideline of transmission line together with IPP and PLN

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Thank you for your attention!!

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