IEA :Implementing Agreement for Hydropower Technologies & Programs
Hydro 2012 International Conference and Exhibition
29 to 31 October 2012 Bilbao, Spain

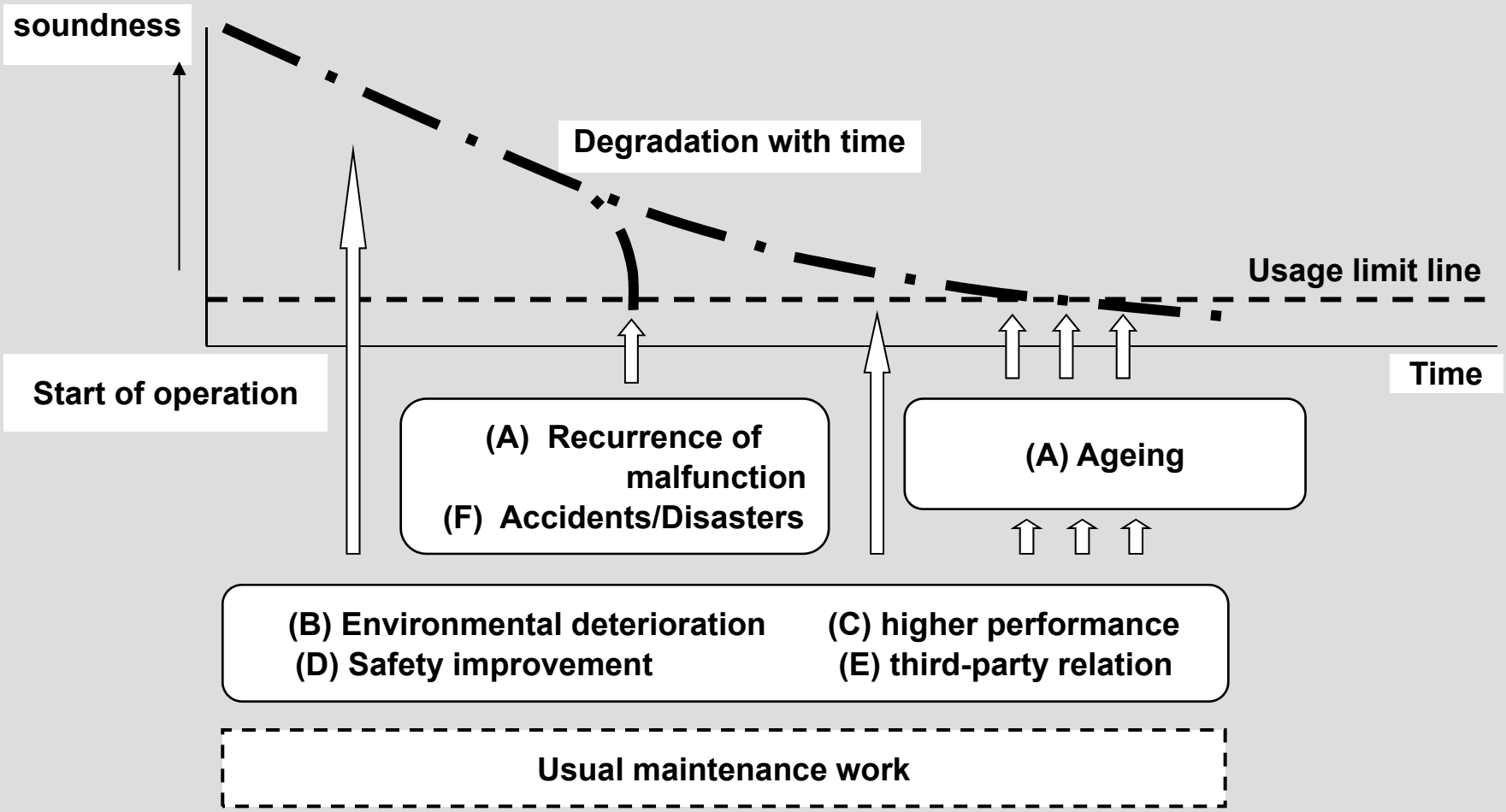
Session 17:IEA Hydropower Annex-XI
Renewal and Upgrading of Hydro Plants

The process for collecting case histories of best practice

October 31, 2012

New Energy Foundation
Kenji YOKOKAWA

Conceptual Life Cycle



Trigger Causes

Trigger Causes	Expected Performance
(A) Ageing and recurrence of malfunction	(a) Improvement of efficiency
	(b) Improvement of durability and safety
	(c) Cost reduction
	(d) Easy maintenance with less labor
(B) Environmental deterioration	(a) Sedimentation reduction
	(b) Improvement of river environment
	(c) Others
(C) Needs for higher performance	(a) Improvement of efficiency. Addition of units, Expansion of power & energy
	(b) Role change of hydropower generation. Addition of new functions
(D) Needs for safety improvement	(a) Improvement of safety
(E) Needs due to third party factors	(a) Sustainable operation (sometimes accompanied by power reduction)
(F) Accidents/Disasters	(a) Recovery

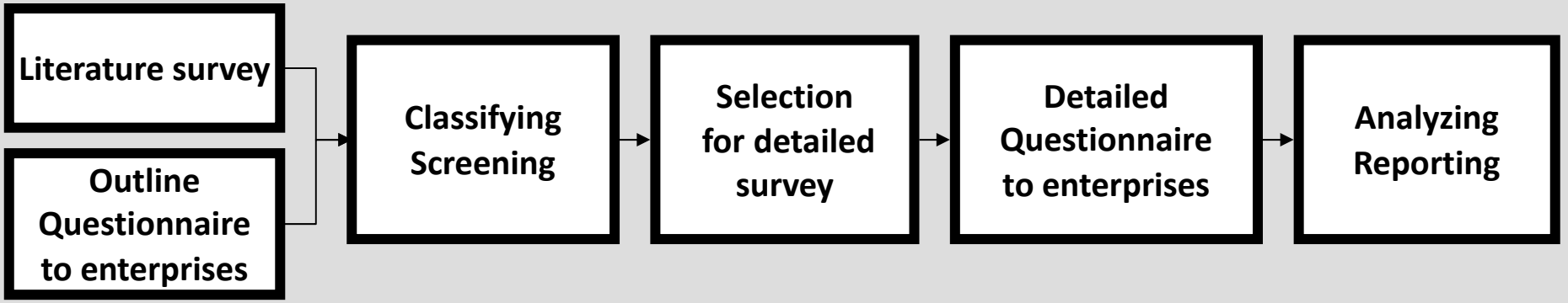
Flow Chart of Case Collection

[STEP-1] 1st round Case Collection by trigger causes

[STEP-2] Classification, Screening and Selection

[STEP-3] 2nd round Case Collection

[STEP-4] Analyzing and Reporting



10 electric cos
26 public utilities

With respect to each Category and Key point

10 electric cos
5 public utilities

Data format
(For collecting overview information)

Data format
(For collecting detailed information)

Status of Case History Collection : (Japan)

Classification of Collected Case Histories by Trigger Causes/Key Points

Case-1, Asahi*

Case-3, Tagokura*

Trigger Causes	Category-1						Category-2				Total
	(a)	(b)	(c)	(d)	(e)	(f)	(a)	(b)	(c)	(d)	
(A) Ageing and recurrence of malfunction		1	---		---		9	1	4		15
(B) Environmental deterioration			---		---	4			1	---	5
(C) Needs for higher performance	1		3	1	1		2	1	2		11
(D) Needs for safety improvement			---	1	---	---			4		5
(E) Needs due to third party factors							1				1
(F) Accidents / Disasters	---				---				2		2
Total	1	1	3	2	1	4	12	2	13	0	39

Case-2

Key Points to be focused and analyzed (1-3)

Category-1. Public Policies, Facilitation Measures, etc.

e) Projects justified by the Non-monetary valuation of stabilizing unstable power system in the up-coming low-carbon society

⇒ Cases of adjustment functions, the use of non-power dams and increased output will be collected to analyze new values of hydropower

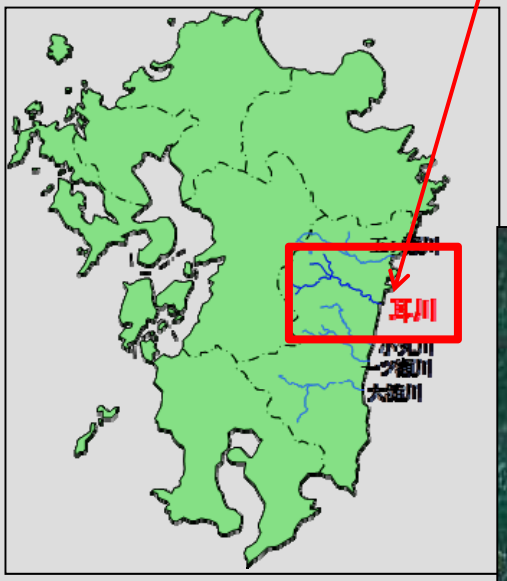
Case-1

f) Environmental conservation and improvement

⇒ Cases of measures for sedimentation, protection of fish and birds, GHG emission and mitigation are collected. Safety improvement and aseismic reinforcement are also collected.

Case-1 : Solution of Sand sedimentation and turbid water

■Mimi River



Refurbishment of dams due to damages by Typhoon in September 2005
(Construction Period : November 2011～December 2016)

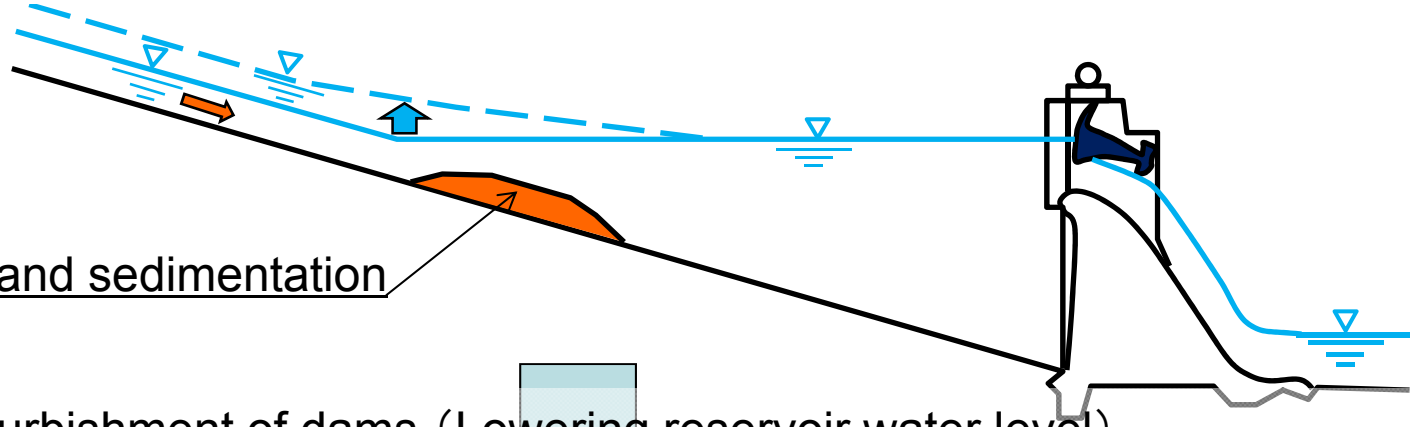
Yamasubaru dam

Saigou dam

Case-1 : Solution of Sand sedimentation and turbid water

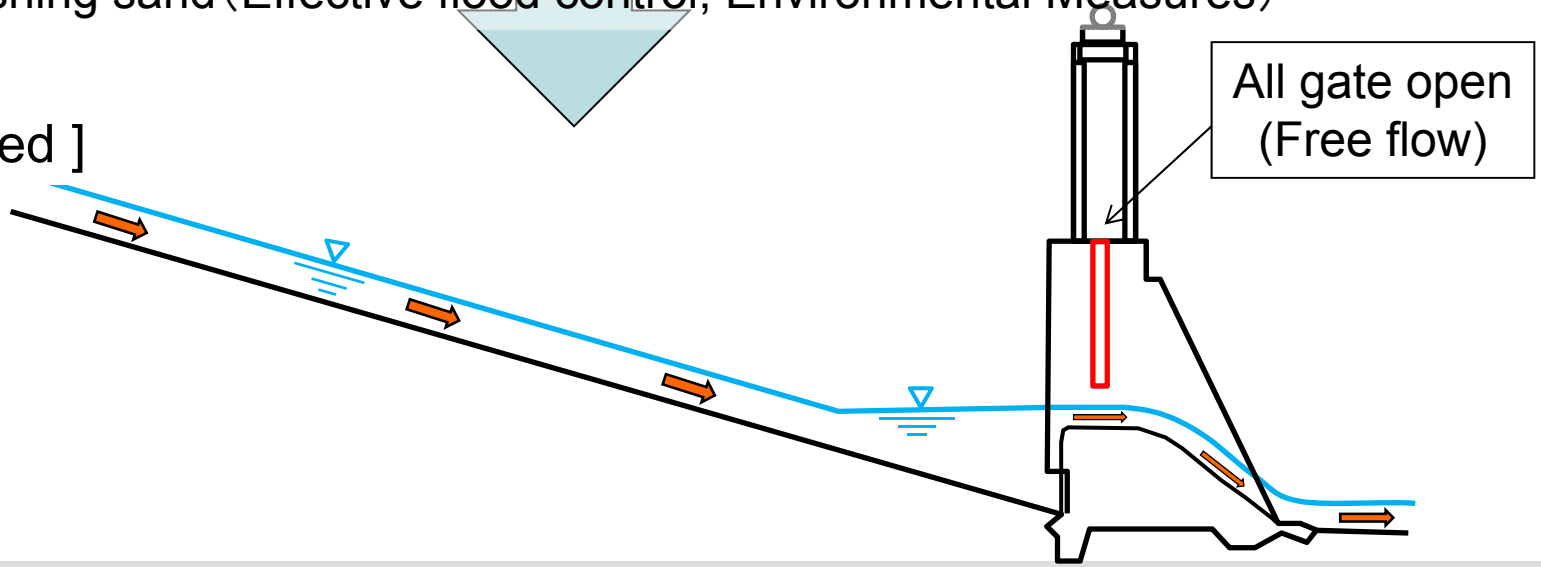
Flood control plan

[Existing]



a. Refurbishment of dams（Lowering reservoir water level）
b. Flushing sand（Effective flood control, Environmental Measures）

[Planned]



Case-1 : Solution of Sand sedimentation and turbid water

Yamasubaru dam

[Existing]

[Planned]

Saigou dam

[Existing]

[Planned]

Key Points to be focused and analyzed

Category-2. <u>Modern Technologies, Systems, material, etc.</u>

a) Technological innovation & deployment expansion of electro-mechanical(E/M) equipment
b) System and Reliability Improvement in Protection & Control (P&C)

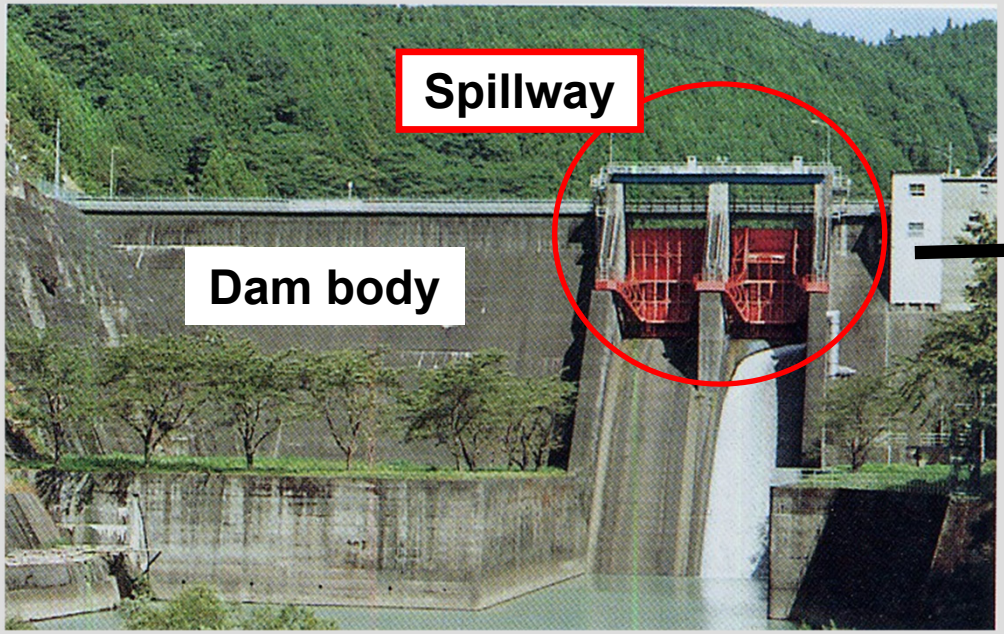
Case-2

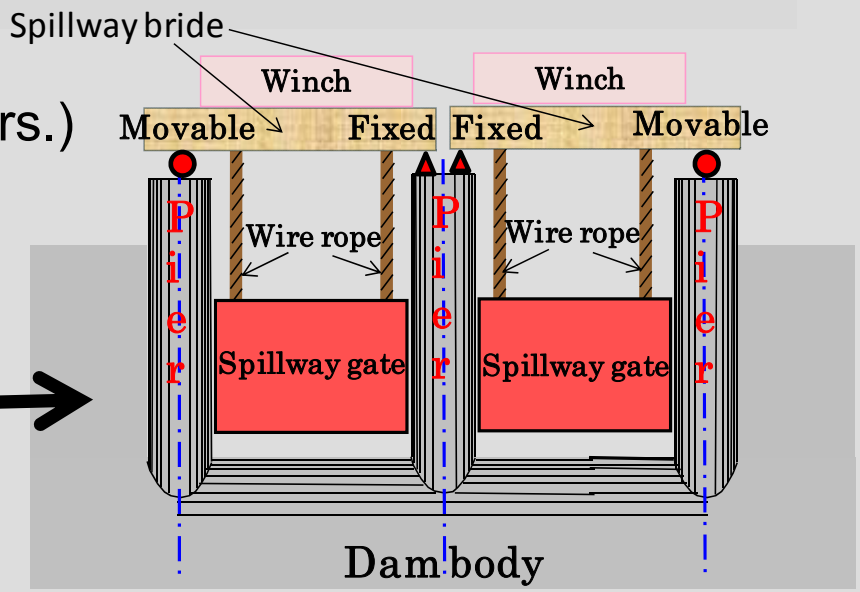
c) Technological innovation, deployment expansion and new materials used for civil and building works
d) Integration of other renewable energies into hydropower systems

Case-2 : Upgrading of Seismic Performance

Sasamagawa dam

(This dam has been used for over 50 years.)





Dam Body: Hight= 46.4 (m), Length=140.8 (m)

Centre pier: Hight=16.3 (m)
Width=2.0 (m)

Side Piers: Hight=3.7 (m)
Width= 1.8 (m)

Evaluation Result of Seismic Performance of Spillway Piers

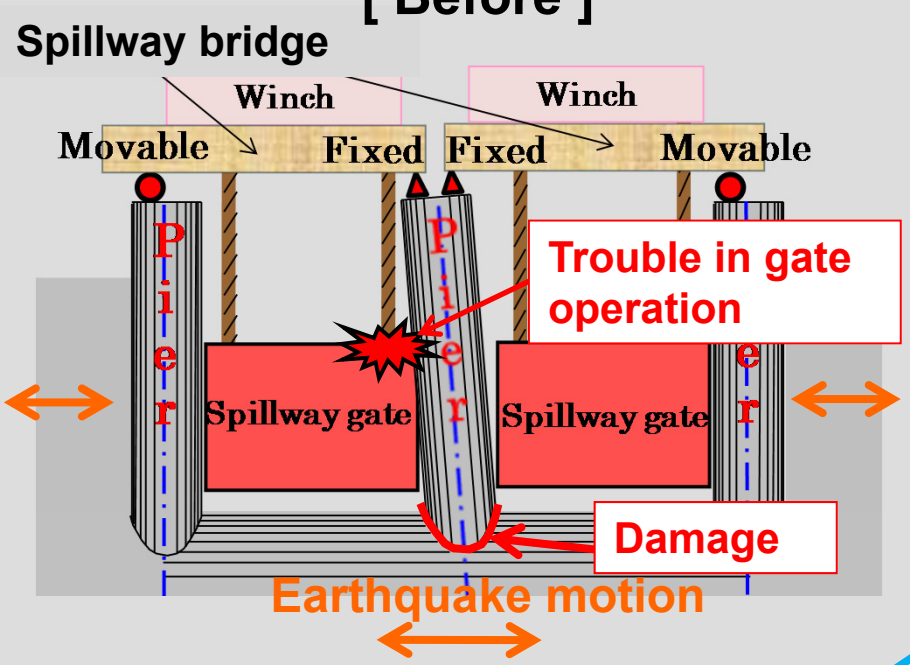
There is risk of damage in piers of the dam against Earthquakes.

Objective of Development

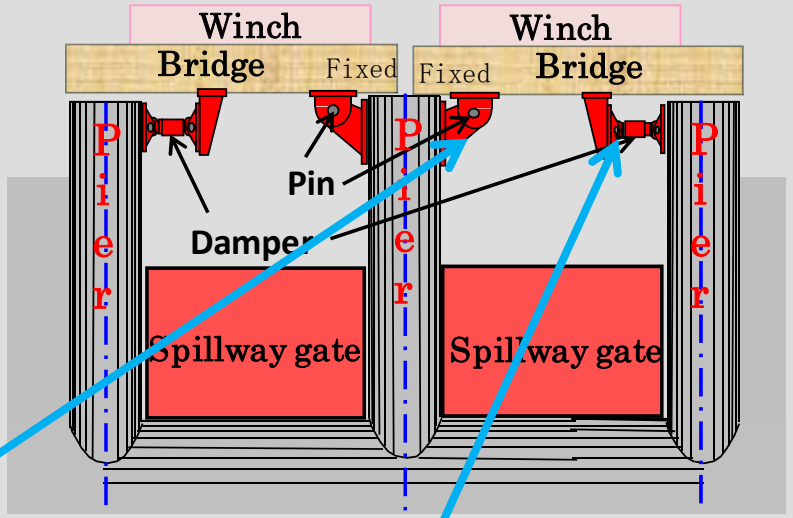
Upgrading of Seismic performance of Spillway piers in preparation for Earthquakes.

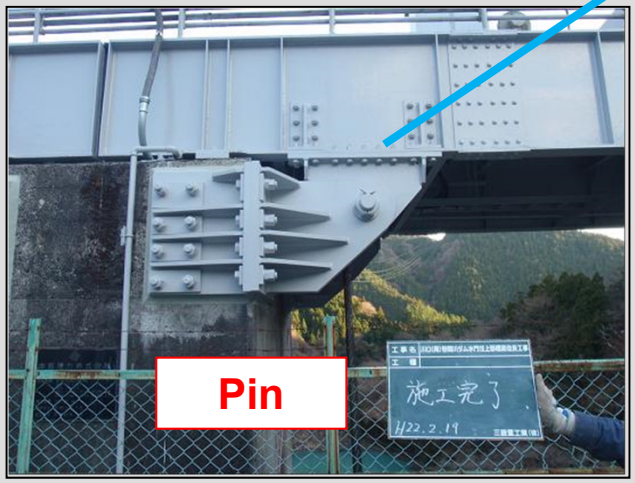
Case-2 : Upgrading of Seismic Performance

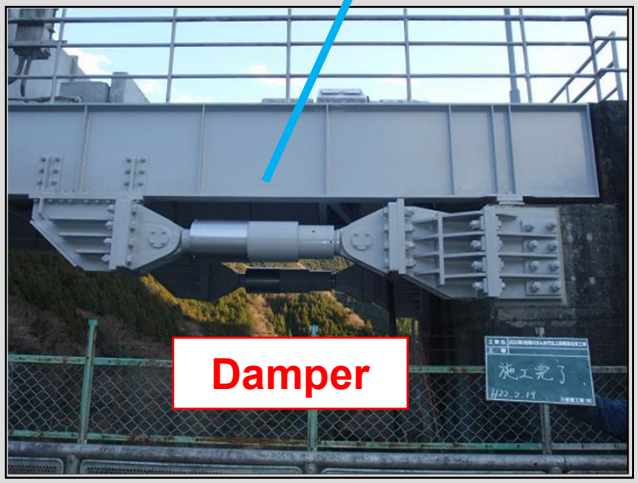
[Before]



[After]







Key Points to be focused and analyzed

Category-2. Modern Technologies, Systems, material, etc.

Case-3

a) Technological innovation & deployment expansion of electro-mechanical(E/M) equipment

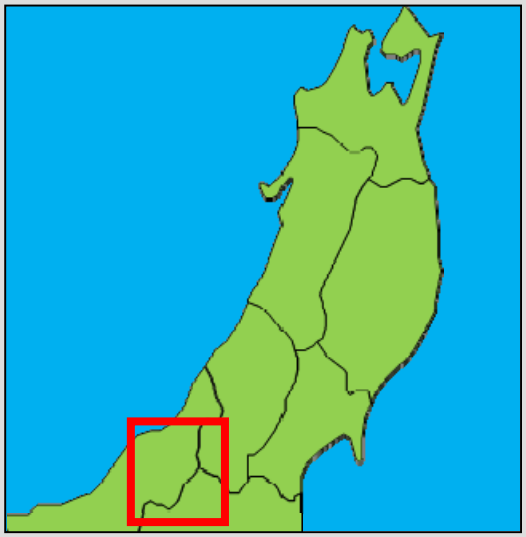
b) System and Reliability Improvement in Protection & Control (P&C)

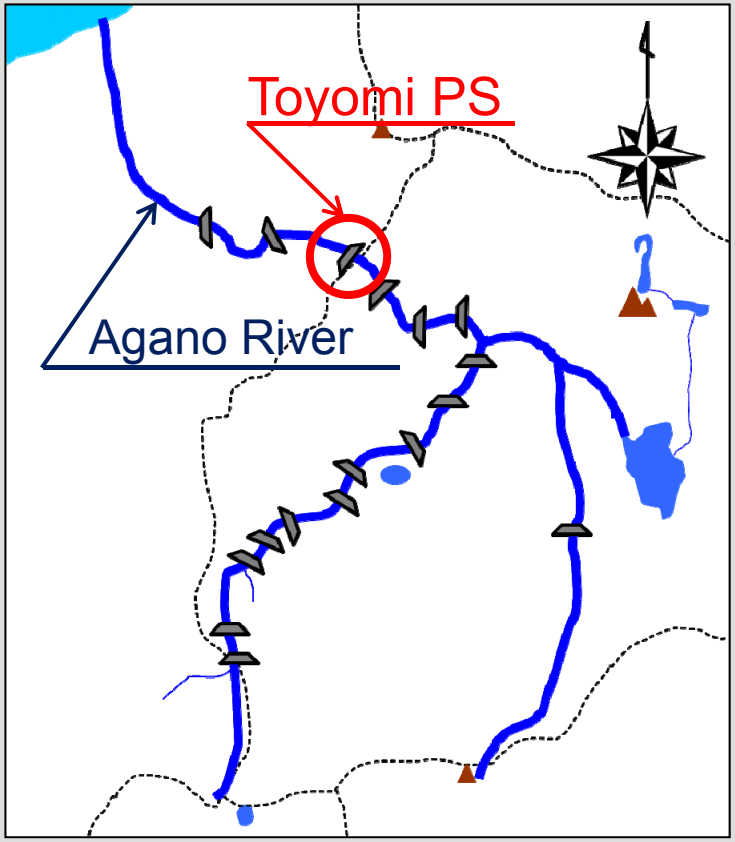
c) Technological innovation, deployment expansion and new materials used for civil and building works

d) Integration of other renewable energies into hydropower systems

Case-3 : Renovation of Power Plant

Toyomi PS
(Comissioning in 1929)





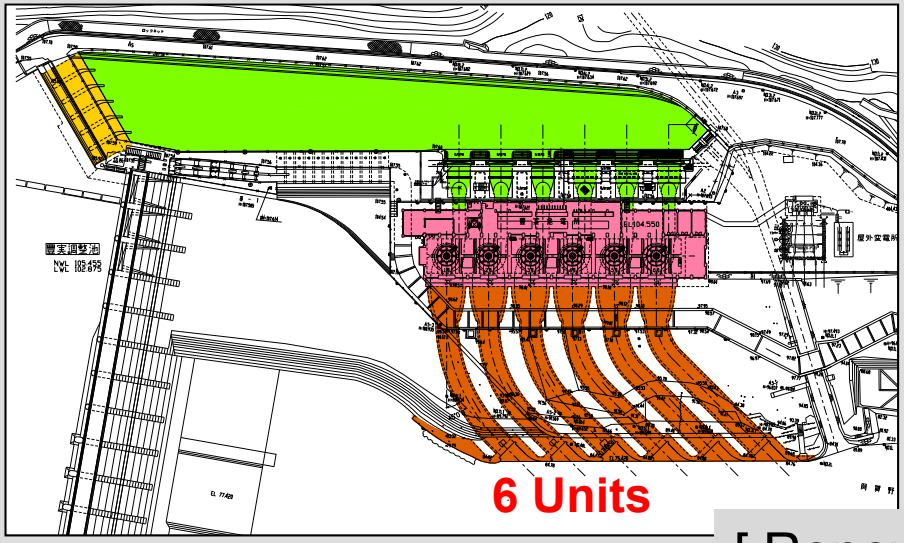
6 Units 56,400kw

Renovation of Generating Equipment and Concrete Structure due to Power Equipment Ageing
(Construction period : August 2008 ～ September 2013)

2 Units 61,800kw

Case-3 : Renovation of Power Plant

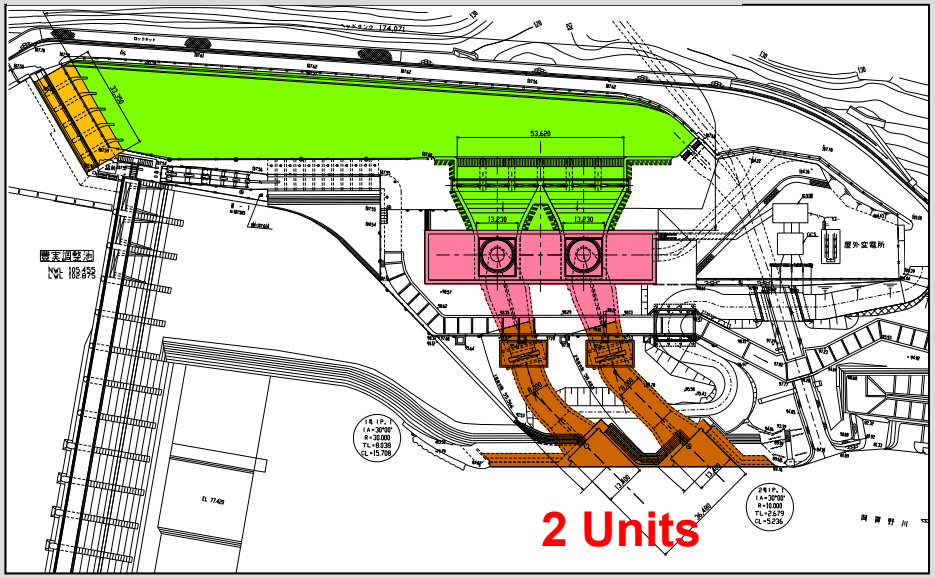
[Existing]



Legend

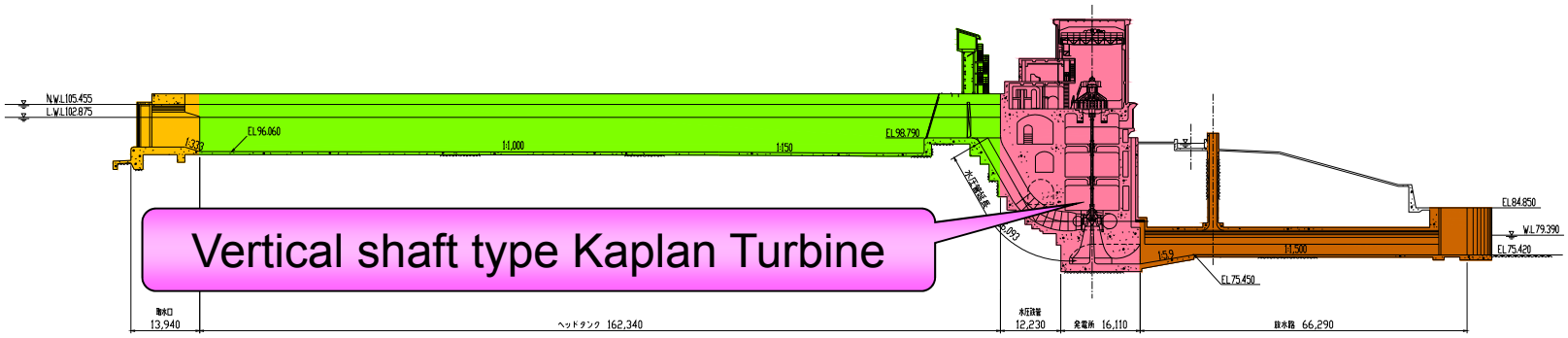
- Intake
- Channel, Head Tank
- Power House
- Tailrace

[Renovated]



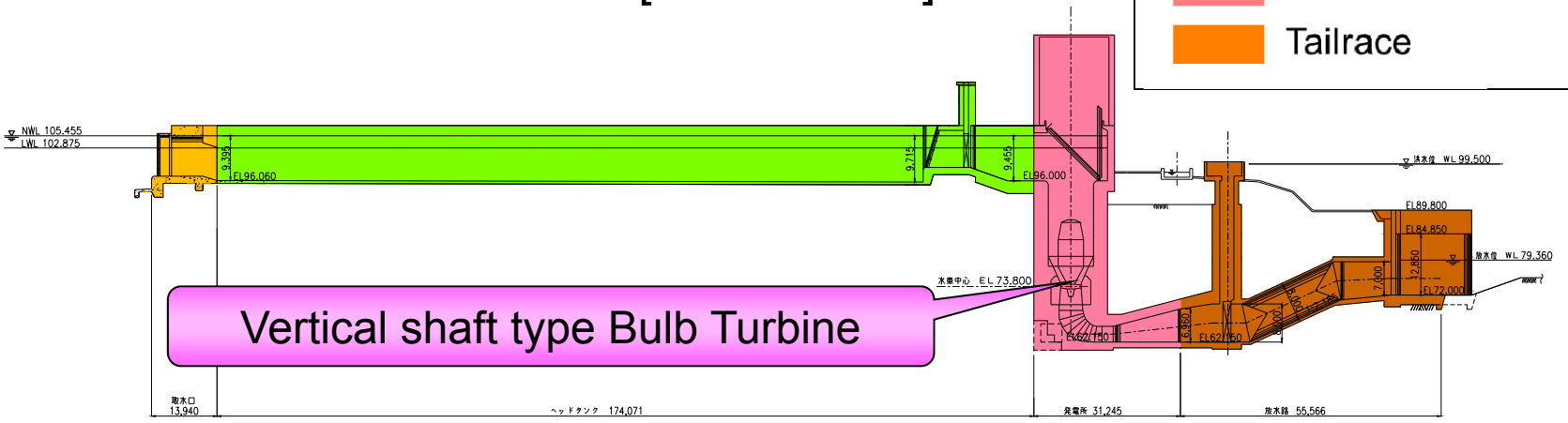
Case-3 : Renovation of Power Plant

[Existing]



Vertical shaft type Kaplan Turbine

[Renovated]



Vertical shaft type Bulb Turbine

Legend

- Intake
- Channel, Head Tank
- Power House
- Tailrace

Main Contents of the 2nd Round Data Collection (1)

1. Outline of the Project Site (before Renewal/Upgrading)
   - General information of the Project Site
   - Specification of the Power Plant/Facilities/Equipment
2. Description of the Renewal & Upgrading Project

2.1 Process to Identify and Define Renewal and Upgrade Work Measures

To describe about the main process of the project in chronological order. (incl. year of operation started)

2.2 Trigger Causes and Drivers for Renewal and Upgrading

To describe about the drivers for the renewal and upgrading project (requirements to the project) based on “Identification of Trigger Causes of Renewal/Upgrading” of the 1st round data collection.

- *Condition, Performance and Risk Exposure*
- *Opportunities to Increase Value*
- *Market Requirements (if necessary)*

2.3 Description of Work Undertaken

To describe the detailed specific information with a focus on the main key point of renewal and upgrading by texts, figures and tables, based on the information of “Category-1: Public Policies, Facilitation Measures, etc.” and /or “Category-2: Modern Technologies, Systems, Material, etc.”.

Main Contents of the 2nd Round Data Collection (2)

3. Feature of the Project

3.1 Best Practice Components

To describe the best practice components in connection with the written in “2.3 Description of Work Undertaken”.

3.2 Reasons for Success

Completed project: The reason why a promotional factor was able to be achieved for the renewal and upgrading project (requirements to the project). Ongoing project: The implementing work that will achieve the promotion for the renewal and upgrading project (requirements to the project).

4. Points of Application for Future Project

5. Others (monitoring, ex-post evaluation, etc.)

6. Further Information

- Reference etc.

Status of Case History Collection : (Other than Japan)

Classification of Collected Case Histories by Trigger Causes/Key Points (Tentative)

Trigger Causes	Category-1						Category-2				Total
	(a)	(b)	(c)	(d)	(e)	(f)	(a)	(b)	(c)	(d)	
(A) Ageing and recurrence of malfunction			---		---	Norway 1	Norway 3, USA 2, Finland 1, New Zealand 2, Australia 2				11
(C) Needs for higher performance			Norway 2	Norway 1			Norway 4, USA 1, New Zealand 1		Norway 1		10
(D) Needs for safety improvement			---		---	---			New Zealand 1		1
Total			2	1		1	16		2		22

Embretsfoss*

Kemijoki*

Norway (12), USA (3), Finland (1), New Zealand (4), Australia (2)

Activity Schedule of Annex-XI

Work Item	2010	2011	2012	2013	2014	2015
1. Agreeing on and starting the new ANNEX	24th					
2. Formulating a detailed activity plan						
3. Annex-11 expert meetings	July Sep	July Oct	Jun Oct			
4. Collecting cases						
1st round Case Collection						
Screening						
2nd round Case Collection						
5. Analyzing and evaluating cases						
6. Creating and releasing reports						
7. Workshops, etc.		*-1	*-2 *-3 *-4			
8. ExCo meeting	24th 25th	26th	27th			

*-1:Sacramento, USA, July 19th. *-2:Tokyo, Japan, February 2012. *-3: Washington, D.C., USA, May 30th

*-4 Bilbao, Spain, October 2012

Selected Case Histories (Category-1)

Category-1. Public Policies, Facilitation Measures, etc.

	Key points	Number
(a)	Energy policies of Countries & States	1
(b)	Investment incentives (Feed-in-Tariff (FIT), Renewable Portfolio Standard (RPS), subsidies, financial assistance, tax deductions, etc.)	1
(c)	Integrated management of water resources and river systems	5
(d)	Asset management, strategic asset management and life-cycle cost analysis	3
(e)	Projects justified by the non-monetary valuation of stabilizing unstable power systems in the up-coming low-carbon society	1
(f)	Environmental conservation and improvement	5
	Total	**16**

Selected Case Histories (Category-2)

Category-2. Modern Technologies, Systems, Material, etc.

	Key points	Number
(a)	Technological innovation & deployment expansion of electro-mechanical (E/M) equipment	28
(b)	System and Reliability Improvements in Protection & Control (P&C)	2
(c)	Technological innovation, deployment expansion and new materials used for civil and building works	15
(d)	Integration of other renewable energies into hydropower systems	0
	Total	**45**

Thank you for your kind attention

New Energy Foundation

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