Key Issue:

1-Biological Diversity

11-Benefits due to Power Generation

Climate Zone:

Cf: Temperate Humid Climate

Subject:

- Measures for Ecosystems

Effects:

- Conservation of Ecosystems

Okutadami Dam

Project Name: Okutadami and Ohtori Expansion Hydropower Project

Country: Fukushima Pref., Japan (Asia)

Implementing Party & Period

- Project: Electric Power Development Co. Ltd. (J-POWER)
1997 (Commencement of construction) -

- Good Practice: Electric Power Development Co. Ltd. (J-POWER)
1997 -

Keywords:

Biological Diversity, Mitigation, Golden Eagle, Nature Conservation, Accountability, Hydropower redevelopment

Abstract:

The Okutadami and Ohtori Power Stations became two of the largest conventional hydropower in Japan, following the expansion that increased the power output (combined) of 455 MW by 287 MW to a total of 742 MW. The expansion started in full swing in July 1997 and was completed in June 2003. The expansion was carried out in a rich natural environment within a natural park – the habitation of large predatory birds in danger of extinction such as golden eagles and Hodgson's hawk eagles. This, therefore, necessitated efforts to minimize environmental loads during the planning and construction stages. With particular attention to ensuring no interference to the habitation and breeding of golden eagles and Hodgson's hawk eagles, environmental conservation measures were taken to protect their nesting places and minimize interference with the ecosystem supporting the survival of these birds. Moreover, to facilitate social consensus building on the expansion, extra effort was put into information disclosure to promote accountability. Thanks to such efforts, the expansion is considered an example of successful coexistence of natural protection and development in Japan.

1. Outline of the Project

Hydropower generation attracts interest as a clean, recyclable energy source free from CO2 emissions. However, the sites for economically feasible hydropower development are few in Japan. This circumstance led to the redevelopment of existing conventional hydropower. For the purpose of improving the peak supply capacity, the expansion of power generating facilities was planned using existing dams and reservoirs at the Okutadami Dam (normal water surface level of EL. 750 m and total storing capacity of approx. 600 tons, completed in 1961) located on the border between Fukushima Prefecture and Niigata Prefecture and at the Ohtori Dam (normal water surface level of EL. 557 m and total storing capacity of approx. 16 million tons, completed in 1963). The expansion of the power stations (hereafter referred to as the "expansion"), carried out by Electric Power Development Co. Ltd. (J-POWER), started in full swing in July 1997 and the operation of the new facilities started in June 2003. With the completion of the expansion, the Okutadami Power Station has a combined (original and additional) power output of 560,000 kW and the Ohtori Power Station has a combined power output of 182,000 kW. The Okutadami Power Station in particular became the largest conventional hydropower in Japan.

Table 1 Specifications of the Okutadami and Ohtori Power Stations
(Original and Additional Facilities)

ITEMS		OKUTADAMI		OHTORI	
		EXISTING	EXPANTION	EXISTING	EXPANTION
RIVER		TADAMI RIVER IN AGANO RIVER SYSTEM			
DAM・RESERVOIR	NAME	OKUTADAMI DAM, OKUTADAMI RESERVOIR (EXISTING)		OHTORI DAM, OHTORI RESERVOIR (EXISTING)	
	H.W.L.	EL. 750 (m)		EL. 557 (m)	
	L.W.L.	EL. 690 (m)		EL. 551 (m)	
	EFFECTIVE DEPTH	60 (m)		6 (m)	
	RESERVOIR AREA	11.5 (km^2)		0.89 (km^2)	
	CATCHMENT AREA	595.1 (km^2)		656.9 (km^2)	
	DAM TYPE	CONCRETE GRAVITY TYPE DAM		CONCRETE GRAVITY ARCH TYPE DAM	
	HEIGHT	157 (m)		83 (m)	
	LENGTH OF DAM CREST	480 (m)		187.9 (m)	
	VOLUME	1,636.3 $\times 10^3 (m^3)$		160.0 $\times 10^3 (m^3)$	
	GROSS RESERVOIR CAPACITY	601 $\times 10^6 (m^3)$		15.8 $\times 10^6 (m^3)$	
	EFFECTIVE RESERVOIR CAPACITY	458 $\times 10^6 (m^3)$		5.0 $\times 10^6 (m^3)$	
	DESIGN FLOOD DISCHARGE	1,500 (m^3/s)		2,200 (m^3/s)	
LOCATION		AZA KOMAGATAKE HINOEMATAMURA MINAMIAIZUGUN FUKUSHIMA PREF.		AZA IRIYAMA OAZA TAGOKURA TADAMICHOU MINAMIAIZUGUN FUKUSHIMA PREF.	
GENERATION TYPE		DAM CONDUIT TYPE	DAM CONDUIT TYPE	DAM TYPE	DAM TYPE
MAXIMUM OUTPUT		120,000kW× 3	200,000kW× 1	95,000kW× 1	87,000kW× 1
MAXIMUM DISCHARGE		249 (m^3/s)	138 (m^3/s)	220 (m^3/s)	207 (m^3/s)
MAXIMUM EFFECTIVE HEAD		170.0 (m)	164.2 (m)	50.8 (m)	48.1 (m)
POWERHOUSE		(TYPE) UNDERGROUND (H) 37.80 (m) (W) 18.50 (m) (L) 87.60 (m)	(TYPE) UNDERGROUND (H) 39.20 (m) (W) 17.90 (m) (L) 45.00 (m)	(TYPE) SEMI-UNDERGROUND (H) 50.80 (m) (W) 37.20 (m) (L) 28.45 (m)	(TYPE) UNDERGROUND (H) 48.20 (m) (W) 22.00 (m) (L) 44.50 (m)
TURBINE	TYPE	VERTICAL FRANCIS	VERTICAL FRANCIS	VERTICAL KAPLAN	VERTICAL KAPLAN
	MAXIMUM OUTPUT	137,000kW× 3	205,000kW× 1	100,000kW× 1	89,500kW× 1
GENERATOR	TYPE	3 PHASES VERTICAL	3 PHASES VERTICAL	3 PHASES VERTICAL	3 PHASES VERTICAL
	MAXIMUM OUTPUT	133,000kVA× 3	223,000kVA× 1	100,000kVA× 1	97,000kVA× 1
TAILRACE LENGTH		3,048 (m)	3,444.67 (m)	–	109.25 (m)
PENSTOCK	LENGTH	No. 1 185.9 (m) No. 2, 3 189.5 (m)	280.41 (m)× 1	69.2 (m)× 1	93.39 (m)× 1
	DIAMETER	4.3～3.8 (m)	6.5～4.0 (m)	7.5～6.35 (m)	6.8～6.2 (m)
OPERATION SERVICE DATE		02-Dec-1960	07-Jun-2003	20-Nov-1963	07-Jun-2003

Table 1 shows the output and specifications of original power generating facilities at the Okutadami Power Station and the Ohtori Power Station as well as those of additional power generating facilities built by Electric Power Development Co. Ltd. (J-POWER).
Fig. 1 and Fig. 2, on the other hand, respectively shows a plane view and air view of the Okutadami Power Station and Fig. 3 shows an air view of the Ohtori Power Station.

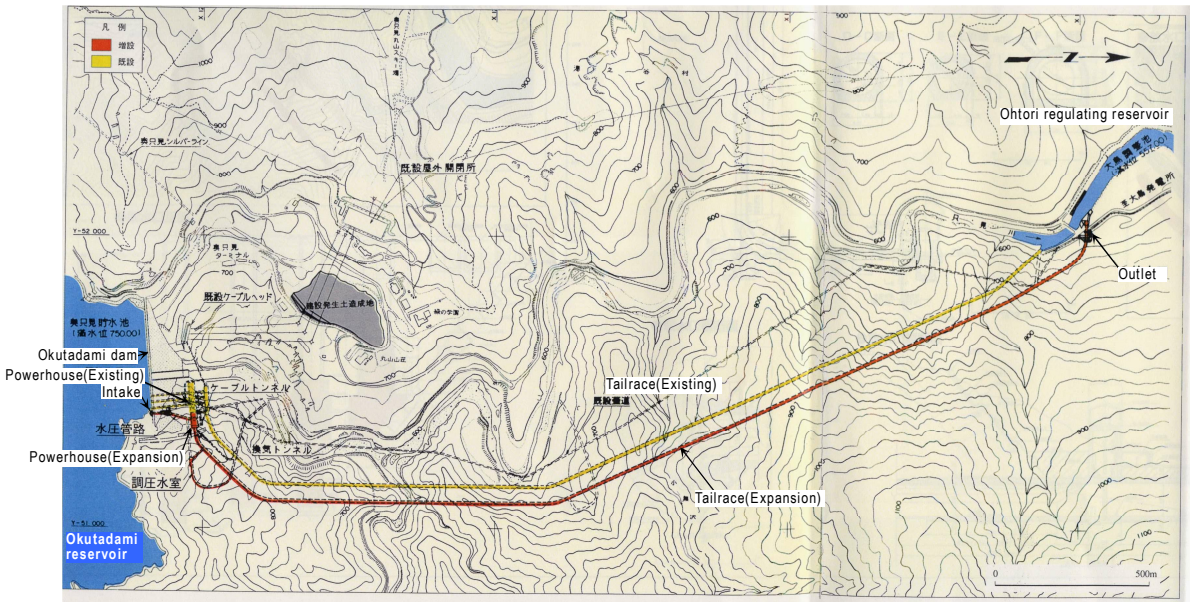


Fig. 1 A Plane View of the Okutadami Power Station (Original and Additional Facilities)

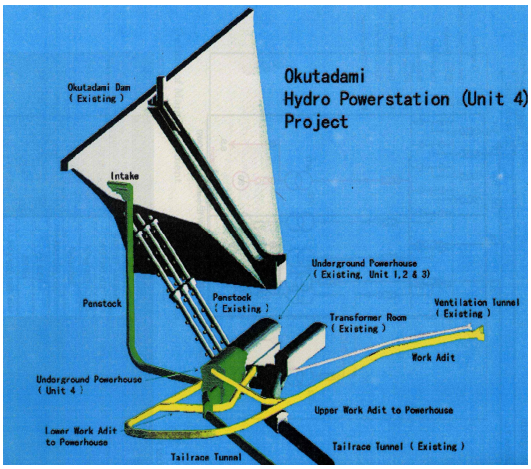


Fig. 2 An Air View of the Okutadami Power Station

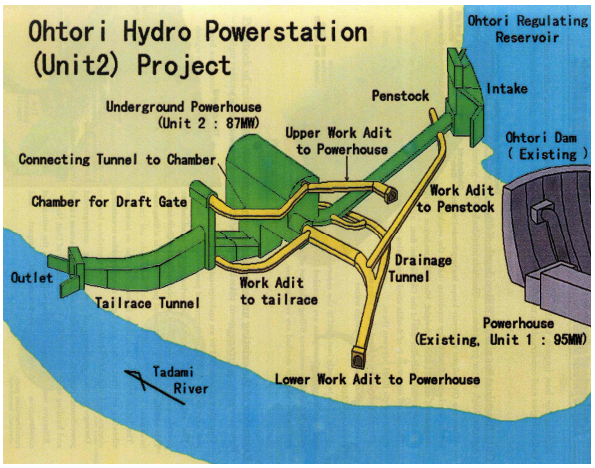


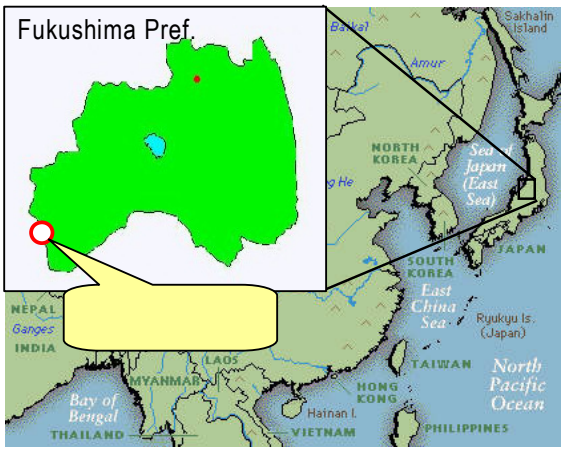
Fig. 3 An Air View of the Ohtori Power Station

2. Features of the Project Area

The area around the project site forms a valley along the Tadamigawa River, which originates from Oze, and is surrounded with mountains in the range of 1,200 m to 1,500 m. The area is climatically one of the snowiest areas in Japan, with the depth of snow accumulation near the

Okutadami Dam sometimes exceeding 5 m. The vegetation in the area comprises natural forests of Japanese beeches and is classified as natural vegetation level 9. (According to the natural environmental conservation survey report – 1976 by the Environment Agency, the natural vegetation level is classified into 10 levels depending on the degree of human interference and the highest natural vegetation level is 10.)

The project site is located in such a rich natural environment inhabited by rare predatory birds such as golden eagles designated as precious natural product and is specified as first class special zone in the Echigo Sanzan Tadami Quasi-National Park.



3. Major Impacts

When the power stations were initially constructed, an environmental impact assessment was performed in accordance with the "General Guidelines for the Environmental Impact Survey Concerning the Power Station Location" (Agency of Natural Resources and Energy -- 1979) under the supervision of the Agency of Natural Resources and Energy. Electric Power Development Co. Ltd. set about an environmental impact survey relating to the expansion in November 1993, put together the "Environmental Impact Survey Report (Environmental Impact Survey Preparation Report)" in March 1995, then, worked on public relations targeting local communities which included interviews, underwent an environmental review by the Agency of Natural Resources and Energy, and in September of the same year, submitted the final report, "Revised Environmental Impact Survey Report (Environmental Impact Assessment Report)," to the Agency of Natural Resources and Energy (Note: The Environmental Impact Assessment Law, which went into effect in June 1999, governs the construction of power stations.) Since the expansion falls under the category of development activities within first class special zone in the quasi-national park, the "General Survey Report (equivalent to the environmental impact assessment report under the Natural Parks Law)" was submitted to both Fukushima and Niigata Prefecture, as part of the environmental impact assessment procedure under the Natural Parks Law, and approval was obtained under the Natural Parks Law in July 1998.

During the environmental impact survey, two pairs of golden eagles and one pair of Hodgson's hawk eagles were found nesting in the area surrounding the expansion site. The both pairs of golden eagles were found nesting on ledges of steep rock walls and the Hodgson's hawk eagles were found nesting in a Japanese beech in a forest of deciduous broadleaf trees.

Golden eagles and Hodgson's hawk eagles are very small in number and as shown in Table 2 are designated as rare species under the Law for the Conservation of Endangered Species of Wild Fauna and Flora. Since predatory birds such as golden eagles and Hodgson's hawk

eagles are positioned at the top of the ecosystem (food chain) and their survival depends on the availability of prey animals, they are considered indicator organisms that represent the level of natural richness and diversity.
Two goals were therefore set during the expansion: first, to protect the two pairs of golden eagles and the one pair of Hodgson's hawk eagles found nesting in the area and second, to conserve the natural environment that supports the survival of these predatory birds.

Table 2 Precious Animals and Plants Observed around the Expansion Site of the Okutadami and Ohtori Power Plants

Category	Species	Precious natural product	Rare domestic species	Red list
Mammals	1- Japanese serow	○		
	2- Japanese small flying squirrel			
Birds	3- White-tailed sea eagle	○	○	Endangered (IB)
	4- Hodgson's hawk eagle		○	Endangered (IB)
	5- Golden eagle	○	○	Endangered (IB)
	6- Steller's sea-eagle	○	○	Vulnerable (II)
	7- Fish hawk			Near threatened
	8- Goshawk		○	Vulnerable (II)
	9- Peregrine falcon		○	Vulnerable (II)
	10- Honey buzzard			Near threatened
	11- Sparrow hawk			Near threatened
Plants	12- Iris gracilipes			Near threatened
	13- Agrostis hideoi Ohwi			Data deficient

(Note 1) Precious natural product: Precious natural product designated under the Law for the Protection of Cultural Properties
(Note 2) Rare domestic species: Rare domestic wild animal and plant species designated under the Law for the Conservation of Endangered Species of Wild Fauna and Flora
(Note 3) Red list: List of threatened wild animal and plant species in Japan

(Wildlife Protection Division, Nature Conservation Bureau, Environment Agency 1998)
Each category is defined as follows.
Critically endangered (I) ··Species in danger of extinction (IA and IB in order of increasing risk)
Vulnerable (II) ·····Species in increasing danger of extinction
Near threatened·····Species whose survival is jeopardized
Data deficient ·····Species for which available data are too fragmentary for assessment

4. Mitigating Measures

4.1 Life Cycle of Golden Eagles and Hodgson's Hawk Eagles

The annual life cycle of the golden eagle and Hodgson's hawk eagle comprises the nest building period and non-nest building period and they are believed to be more susceptible to external disturbances during the nest building period (courting and nest building period, egg laying and incubation period and hatching and nest breeding period) (See Fig. 5 and Fig. 6).

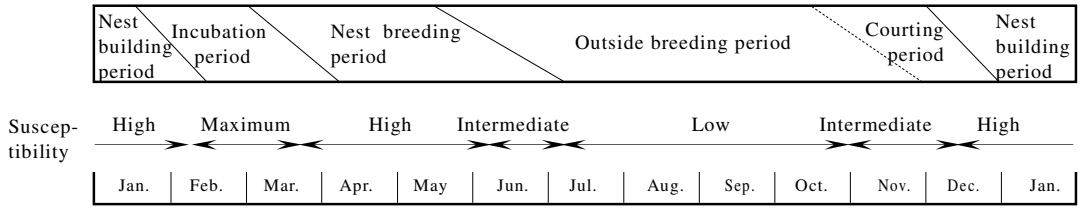


Fig. 5 Life Cycle of Golden Eagles

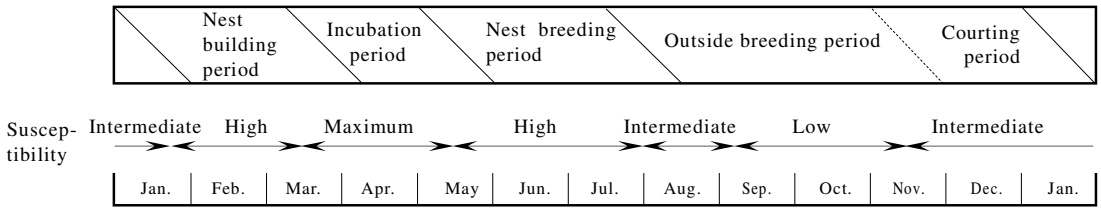


Fig. 6 Life Cycle of Hodgson's Hawk Eagles

4.2 Fundamental Policies Relating to the Protection of Golden Eagles and Hodgson's Hawk Eagles

Based on the observation (hereafter referred to as the "territorial zone survey") of flying routes and resting places of golden eagles and Hodgson's hawk eagles nesting around the construction site, the geographically important zone for the survival of these birds was determined in consideration of the life cycle of each species. Then, a construction plan as explained below was formulated with attention to minimizing interference with nest building by golden eagles and Hodgson's hawk eagles. Monitoring was also performed during the construction period.

Photo 1 A Young Golden Eagle (238 Days Old)

4.3 Protection Measures for Golden Eagles

4.3.1 Restriction of the Construction Period

During the nest building period of golden eagles (generally considered to be between November and June of the following year), no above-ground construction was planned within the important nest building zone (hereafter referred to as the "core area") determined from the

territorial zone survey. The above-ground construction within the core area, therefore, was limited to the four-month, non-nest building period of July to October.

4.3.2 Restriction on the Construction in Consideration of the Fledging of Young Birds

With regard to the resumption of the construction in July following successful breeding by golden eagles, the measures below were taken based on the concept of adaptive management in consideration of newly fledged young birds (because they can only cover a small part of the territorial zone for about a month after fledging and they are still fed by a parent bird).

1) Within the core area and the zone considered to be inhabited by newly fledged young birds in which they are still fed by a parent bird, no construction was planned for implementation for about a month after young birds fledging and the expansion was resumed after it was confirmed that the zone covered by young birds had expanded sufficiently.
2) Outside the core area, the construction started, initially on a small scale, and gradually increased in scale, after it was confirmed by monitoring that the construction had no adverse effects on young birds.
3) The construction was temporarily halted when it was found from the monitoring of young birds and their parents that the construction may have adverse effects. For example, when a young bird flew into the construction site, the construction was immediately brought to a temporary halt when requested to do so by a survey staff, and when it was confirmed that the young bird left the site, the construction was resumed.
4) In consideration of where young birds are staying and the extent of their territorial zones, the period and extent of the construction mentioned above were set with flexibility.

4.4 Protection Measures for Hodgson's Hawk Eagles

With regard to Hodgson's hawk eagles found nesting around the construction site, it was confirmed that the construction site and the construction roads were not included in the geographically important zone for the survival of the birds. There was, however, an overlap of about two months (July and August) between the above-ground construction period (July to October) set with attention to protecting golden eagles and the nest building period of Hodgson's hawk eagles (January to August).

Photo 2 A Hodgson's Hawk Eagle (Female)

Nonetheless, restricting conditions imposed by the heavy snowfall in winter and the luxuriant growth of broadleaf trees in summer made it difficult to directly observe the breeding of Hodgson's hawk eagles (See Table 5). Under this circumstance, it was assumed from the perspective of protection and conservation that the susceptibility of Hodgson's hawk eagles increased with the progress of breeding, and measures to reduce noise, for example, by maintaining long intervals between construction vehicles, were used on some sections of construction roads relatively close to the nesting place.

4.5 Natural Environmental Conservation Measures

The environmental conservation measures indicated below were carried out not only to protect golden eagles and Hodgson's hawk eagles but also to conserve the natural environment inhabited by prey animals supporting the survival of these predatory birds.

4.5.1 Reduction of the Renovation Area

1) The plan included the installation of a head gate in the existing Okutadami Dam using the dam drilling method and underground construction of a large part of power station facilities.
2) Attention was also directed to minimizing changes to the natural topography and minimizing the construction area when constructing a temporary facility site necessary for the expansion.

4.5.2 Maintenance of the Ecological Flow

1) A new facility for maintaining the ecological flow was installed to solve the problem of the reduced flow river caused by diversion immediately downstream from the Okutadami Dam and thus to ensure steady flow.

4.5.3 Measures against Noise and Vibration

1) To reduce blasting noise accompanying underground tunneling and excavation for the construction of an underground power station, a soundproof door was installed in the pitmouth. A method that allows delay blasting control was used to reduce blasting vibration.
2) Concrete and aggregate production facilities that cause large noise were housed in a building to reduce the outdoor noise level.
3) Low noise construction machines were used.
4) A speed limit of 30 km/h was applied to construction vehicles and a stop to idling was encouraged when vehicles were at a stop.

4.5.4 Water Quality Conservation Measures

1) All construction drainage was treated by a muddy water treatment system and released to public water after the quality of the treated water was checked.
2) A double layer of pollution prevention membranes were installed for the underground construction (of a head gate) in order to prevent the spreading of polluted water.

Photo 3 A Concrete Production Facility Housed in a Building

(Within the Temporary FacilitySite at the Okutadama Outlet)

Photo 4 Muddy Water Treatment System (Processing Capacity of 200 m^3/h)

4.5.5 Measures Relating to Lighting and Coloring

1) Minimum nighttime lighting necessary for construction safety was used. The high voltage sodium lamp was used because it has only minor effects on insects and plants.
2) Blinds were hung from the windows of temporary buildings so as not to allow interior lighting to leak to the outside and headlights of vehicles were turned off when vehicles were at a stop.
3) The use of colors disliked by birds (yellow and red) was restricted as the exterior colors of temporary facilities and construction machines.

Photo 5 Entire View of the Temporary Facility Site in Ohtori

4.5.6 Measures Relating to the Reuse of Construction Byproducts

1) Twenty percent of soil displaced by construction (excavated rocks generated from the construction of an underground power station and tunnels: equivalent to approx. 350,000 m^3 of natural ground) was crushed at the aggregate production facility and recycled as concrete aggregate, and the surplus soil was used as landfill in the reclamation site of excavated rocks (Yasaki District).
2) Construction sludge (dehydrated sludge cakes) generated from the aggregate production facility was mixed, for example, with fowl droppings, to become organic soil and was effectively used as the foundation soil for vegetation.

4.5.7 Measures to Compensate for the Use of the Marshland as the Reclamation Site of Excavated Rocks

1) Since restricting conditions made it difficult to transport excavated rocks generated from the underground construction outside the construction site, a plan was made to reclaim the marshland (hereafter referred to as the “existing marshland”) within the construction site using excavated rocks. However, since the existing marshland was inhabited by aquatic plants and dragonfly species, it was considered essential to take measures to compensate for the use of the marshland environment. These measures comprised the construction of a new marshland as a replacement within the reclamation site and the restoration of the original marshland environment. More specifically, a site next to the existing marshland was reclaimed to construct a replacement and the existing and replacing marshland were used until the existing marshland was completely reclaimed. These measures allowed animals inhabiting the marshland including dragonflies to freely travel between the two marshlands and thus made natural changes of generations possible.

Photo 6 Restoration of the Marshland Environment in Yasaki Reclamation Site
(Restored Marshland – in the Right of the Photo)

4.5.8 Protection of Other Animals and Plants

1) When small animals were found in the construction site or on the construction roads, vehicles were brought to a temporary stop until the animals left the area at their own will.
2) Precious plants found in the renovation area were transplanted according to specialist advice.

4.6 Management of the Environmental Management System

Various environmental conservation measures as mentioned above were included in the environmental management system program certified to ISO 14001. While these measures were being planned and implemented, their effectiveness was monitored. If considered necessary, corrective measures were taken and the plans were reviewed.

Under the environmental management system, efforts were also directed not only toward providing technical solutions to environmental conservation but also toward improving environmental communication.

5. Results of the Mitigation Measures

Table 3, Table 4 and Table 5 show the state of breeding by two pairs of golden eagles and one pair of Hodgson's hawk eagles whose nesting places were located.

Table 3 State of Breeding by One Pair of Golden Eagles in Okutadami

Year	State of Breeding	Breeding Result
1994	Located the nesting place and witnessed the fledging of young birds in June	○
1995	Eggs laid (2/24) and incubation abandoned (4/6)	×
1996	Eggs laid (2/20) and eggs hatched (4/6). Confirmed the death of the chicks (4/7)	×
1997	Eggs laid (3/5) and eggs hatched (4/16). Confirmed the death of the chicks by the attack of a crow (4/30)	×
1998	Eggs laid (2/27) and incubation abandoned (3/28)	×
1999	Eggs laid (2/24) and incubation abandoned (3/22)	×
2000	Eggs laid (3/1) and eggs hatched (4/13). Witnessed the fledging of young birds (7/2)	○
2001	No eggs laid due to the interference by the young birds born in the previous year	×
2002	Eggs laid (3/6 and 3/7) and eggs hatched (4/18). Witnessed the fledging of young birds (7/4)	○

Table 4 State of Breeding by One Pair of Golden Eagles in Ohtori

Year	State of Breeding	Breeding Result
1995	Located the nesting place in May and witnessed the fledging of young birds in June	○
1996	Witnessed the fledging of young birds in June	○
1997	Breeding failed (The course of breeding unknown)	×
1998	Eggs laid (3/2) and eggs hatched (26/13). Witnessed the fledging of young birds (6/18)	○
1999	Eggs laid (2/15), eggs hatched (3/28) and the breeding of the chicks abandoned (4/11)	×
2000	Eggs laid (2/18) and eggs hatched (3/30). Confirmed the death of the chicks (between 4/2 and 4/27)	×
2001	Eggs laid (2/25) and incubation abandoned (end of March)	×
2002	Nest building discontinued	×

Table 5 State of Breeding by One Pair of Hodgson's Hawk Eagles Whose Nesting Tree was Located

Year	State of Breeding	Breeding Result
1998	Located the nesting place in October. The course of breeding unknown.	?
1999	Found that eggs were laid. But, the later course of breeding unknown Breeding may have succeeded since the presence of young birds was witnessed.	○ ?
2000	The course of breeding unknown	×
2001	The course of breeding unknown	×
2002	The course of breeding unknown Breeding may have succeeded since the presence of young birds was witnessed.	○ ?

The rate of successful breeding of golden eagles in Japan is estimated to be between 20 and 30%. One of the two pairs of the golden eagles had successful breeding twice, first in 2000, immediately after the start of the construction, and second in 2002. The other pair had unsuccessful breeding soon after the start of the construction. However, around the nesting place of the pair, another pair of young golden eagles with no breeding experience was frequently observed.

As already explained, since the site conditions make the observation of the nesting place difficult, the state of breeding by Hodgson's hawk eagles remained unknown. However, the presence of the birds inhabiting the area was continuously witnessed throughout the construction period.

These facts appear to lead to the conclusion that the expansion had no adverse effects on the golden eagles and Hodgson's hawk eagles nesting around the construction site.

Since the marshland constructed as a replacement in the reclamation site was found inhabited by animals and plants that previously inhabited the existing marshland, the compensating measures appear to have succeeded.

Moreover, noise and vibration caused by the expansion as well as the quality of construction drainage were monitored and made to fall within the criteria voluntarily adopted. Although

there were times when they temporarily fell outside the criteria, the cause was investigated to prevent reoccurrence. These measures, monitoring and corrective measures were carried out in accordance with ISO 14001 (environmental management system).

6. Reasons for Success

The expansion was carried out while pursuing cost effectiveness as well as with great emphasis on environmental conservation. The success of environmental conservation was specifically reflected in the successful breeding of golden eagles immediately after the start of the construction. The expansion of the Okutadami - Ohtori Power Stations will be regarded as a successful example of achieving the coexistence of natural protection and development.

The following factors are considered to have contributed to the success.

1) Attention was directed toward minimizing changes to the land from the planning stage.
2) A construction plan with attention to environmental conservation was formulated with the advice of specialists on predatory birds and natural ecosystems.
3) With regard to the fledging of young golden eagles, the concept of adaptive management was followed. This more specifically means that the construction was carried out while monitoring these young birds and ensuring no effects on these birds, and that flexible solutions were provided, including immediate implementation of corrective measures, in the event that something unexpected happened.
4) The environmental management system certified to ISO 14001 was used to make sure systematic and proper implementation of various environmental conservation measures.

The four points listed above comprised the technical solutions we used. It is also worthy of mention that a major effort was placed on information disclosure in order to fulfill our accountability to the society.

To win the understanding of a wide spectrum of general public about development activities in areas such as this construction site with an intact, rich natural environment, information sharing and mutual communication were considered most important. The expansion of the Okutadami - Ohtori Power Stations, therefore, entailed the implementation of technical solutions for environmental conservation as well as other various efforts to win social acceptance. These specifically included the creation of a home page to provide information including the pattern of habitation of golden eagles and the progress of the construction, and the issuing of environmental reports that included the results of environmental conservation measures taken. Efforts were also directed to promoting greater understating of the construction plan through public relations activities that included information provision to mass media whenever necessary and press conferences. Moreover, extra efforts were placed on information disclosure and dialog with certain environmental protection organizations that raised objections to the expansion.

We believe, as the entity responsible for the expansion project, that various efforts explained above proved a success, as reflected not only in successful breeding of golden eagles but also in successful building of social consensus. Two important factors considered to have contributed to the success were technical solutions for environmental conservation and information disclosure to fulfill our accountability obligations.

7. Outside Comments

1) Articles on the acquisition of ISO 14001 certification (various newspapers), October 1999
2) Article that reviewed EMS used for the expansion of the Okutadami - Ohtori Power Stations (Denki Shimbun), September 2000
3) Article titled “Construction within the Quasi-national Park Makes Steady Progress” (Denki Shimbun), October 2001
4) Article titled “Expansion Makes Progress with Environmental Consideration” (Denki Shimbun), August 2002
5) Article titled “Restored Marshland Functions Properly” (Denki Shimbun), September 2002

8. Further Information

8.1 References

1) Takaomi Tobase et al.: “Environmental Conservation Measures in the Expansion of the Okutadami - Ohtori Power Stations”, Japan Electric Power Civil Engineering Association No. 289, September 2000
2) Norikazu Shimizu: “The power station construction to coexist with golden eagles – OKUTADAMI – OHTORI Power Stations Expansion -”, Japan Society of Civil Engineers Vol. 86, April 2001
3) Kazuya Nishikawa et al.: “Protective Measures for Rare Predatory Birds during the Expansion of the Okutadami - Ohtori Power Stations and Their Results”, Japan Electric Power Civil Engineering Association No. 303, January 2003
4) Takaomi Tobase: “Acquisition of ISO 14001 Certification by the Civil Construction Organization”, Denki Joho No. 508, January 2000
5) Takaomi Tobase: “Examples of ISO 14001 Certifications”, ISOS No. 28, March 2000
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