

3. Achievement of the Project

3-1 Inputs

3-1-1 Japanese side

a) Dispatch of JICA Experts

A total of 14 experts, totaling 75.87 man months, have been dispatched to the Project. The detailed list of Japanese Experts is shown in **Annex 5**.

b) Training of CPs Personnel in Japan

A total of 11 CP received training in Japan. The detailed list of trainees and training period is shown in **Annex 6**.

c) Equipment Provided

Machinery and equipment worth a total of 236,125,000 yen equivalent were provided the Japanese side as of September 2008. The detail of the provided equipment is shown in **Annex 7**.

d) Operational Expenses

As of September 2008, a total of 19,719,000 yen was allocated for Project operational expenses by the Japanese side. The detail of the operational expenses is shown in **Annex 8**.

3-1-2 Mongolian side

a) Appointment of CP

As of September 2008, a total of 7 persons were assigned to the Project. The detailed list of the C/Ps is shown in **Annex 9**.

b) Provision of facilities, support staff, and other operational expenditure.

The necessary facilities for the Project activities, including a Project office and seminar room in NAMHEM have been provided appropriately.

c) Cost-sharing of Operational Expenses

Operational cost-sharing with the Mongolian side has been promoted from the beginning of the Project. As of September 2008, a total of 235.1 million tugrig has been provided by the Mongolian side. In addition to this amount, the C/Ps' salary and travel allowance, electricity and water bills of the Project office, as well as other consumables were paid for by Mongolian side. The detail on cost sharing in direct operational expenditure by the Mongolian side for the Project is shown in **Annex10**.



3-2 Activities Implemented

Most of the Project's activities, as specified under the PDM, have been implemented. The achievements for each of the activities are summarized in **Annex 11**. A products list produced under these activities is shown in **Annex 12**.

3-3 Achievement of Output

Output 1: Numerical Weather Prediction

Operational numerical weather prediction using a regional model around Mongolia is implemented.

Output 1 has already been achieved and its achievement level was found Excellent (A).

Output 1 intends to focus on capacity development for the weather service staff dealing with the numerical weather prediction by utilizing clustering PC system supplied under the Japan's Grant Aid. CPs received lectures and practical training on the numerical weather prediction from Japanese Experts, and obtained basic technical knowledge and skills to perform the duties at satisfactory level.

- *Regional numerical weather prediction system originated by NAMHEM is commenced in the daily operation.*
NAMHEM used to be providing information for 3-day forecast by MM5 using the Korean Global Model Data as a boundary condition. The working group for the numerical weather prediction, which was set up under the Project, replaced the Korean Model with the JMA Global Model Data which enabled 5-day forecasts. This numerical weather prediction model has been successfully incorporated into the daily operation system.
- *Four (4) staffs are capable of operational numerical weather prediction (NWP).*

Seminars have been conducted to obtain knowledge on 'Dynamic Meteorology' and 'Numerical Weather Prediction' among the engineers in the Institute of Meteorology and Hydrology. Mainly three (3) engineers, members of the working group, plus 3 junior engineers are now working for the development of the numerical weather prediction operation.

Output 2: Climate Change Projection
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Climate change projection due to global warming using a climate model is implemented.

The achievement level of Output 2 is Good (B).

NAMHEM has a plan to publish climate change projection under 'Development

Programme of NAMHEM on Meteorological and Environmental Sector by 2015'. This output aims to support the programme through the improvement of the climate model and the human resource development. Activities under this Output have been negatively affected by CPs' overseas study of key personnel during the project implementation.

- *Information on climate change due to global warming over Mongolia is publicized.*

CP is currently undertaking the climate change simulation, which are 20-year present day and 20-year future climate simulation, using the Mongolian regional climate model (RegCM3). The analysis of the simulation result is going to be finalized by the end of the Project. It is necessary for NAMHEM to plan timing and means to publish the result on the climate change as soon as possible.

- *Two (2) staffs are capable of climate change projection.*

At the beginning of the Project, seminars were conducted jointly with the working group of Output 1 to share the knowledge on 'Dynamic Meteorology' and 'Climate Change'. Moreover, one of the CPs participated in the training on 'Climate Change Projection Technique using the Regional Climate Model due to Global Warming' in Japan. As a result of the activities under Output 2, one (1) CP obtained knowledge and skills to collect and analyze data on climate change for its projection.

Output 3: Weather Forecasting

Short/middle/long-term weather forecasts based on NWP outputs are issued.

The achievement level of Output 3 is Good (B).

Though the basic meteorological data has been remarkably increased and also the data processing equipment has been upgraded in these years, technical methodologies to utilize such data and hardware have not been enough acquired in NAMHEM. Output 3 targeted the working group members on weather forecast, and intended to establish forecast support materials (guidance) based on the numerical weather prediction. Activities under this Output have been somewhat negatively affected by a CP's retirement and overseas study of personnel during the project implementation.

- *Short/middle-term forecasts for scale smaller than province (aimag) is implemented.*

A new forecasting method such as guidance for 1 to 5-day forecasts (short and middle-

term forecasts) at the provincial scale has been developed by using ECMWF data, and 1 to 5-day forecasts have been performed in their daily operation. It enabled NAMHEM to improve accuracy of daily maximum/minimum surface air temperature at the 28 principal cities, which was strongly demanded by Mongolian people.

- *Long-term forecast for scale similar to the province (aimag) is implemented.*

Long-term forecast has been developed with JMA ensemble mean forecast data. Results of the experiment which has been conducted on a trial basis for preparation of 4-week forecast by utilizing the JMA data will be submitted to the Scientific Board under the Institute of Meteorology and Hydrology to gain the permission for the application in the daily operation.

- *Five (5) staffs are capable of advanced weather analysis using data from NWP models.*

Five (5) engineers, members of the working group on weather forecast, attended the lectures on the ‘Short/Middle/Long-term Weather Forecast’ and the ‘Radar Meteorology’ conducted by Japanese Experts, and obtained basic knowledge and skills to conduct more systematical meteorological operation. However, these activities have faced a problem of lack of human resources, two (2) of the working group members have either retired or gone studying abroad. Two (2) junior engineers have been training by CP at the point of evaluation.

Output 4: Drought/Dzud Early Warning System
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Drought/dzud early warning system (DDEWS) is established.

The achievement level of Output 4 is Good (B).

NAMHEM has faced challenges on forecast and warning of drought/dzud based on agro/zoo-meteorological observations. The activities under this Output aim at maintenance and improvement of the present agro/zoo-meteorological observations to establish an early warning system. Especially for the nomads, the bag (village)-scale pasture condition map is essential for disaster preparedness.

- *Maps of pasture biomass and plant height on the village (bag) scale are developed.*

Though CPs faced challenge on the lack of sufficient data in the early stage of the Project, the

bag (village)-scale pasture condition map, i.e. a pasture biomass map and a carrying capacity map, were successfully developed through collecting data from the observation points. Since August 2007, those developed maps, which are required for drought/dzud early warnings, have been provided to the local meteorological stations and the relevant ministries and agencies, at the same time, released to the mass media as well.

- *Guideline of warning and advisory messages is implemented in the operation.*

The guideline on an early warning system for drought and dzud was submitted to the Working Group for Evaluation on Drought and Dzud composed of NAMHEM and other ministries and agencies concerned in February 2008. The technical part of the guideline has already been used for the daily operation in NAMHEM.

- *Four (4) staffs are capable of early warning using GIS data.*

Four (4) engineers have acquired the methodology of pasture condition mapping through lectures and practical training on 'early warning system for drought and dzud' and 'GIS mapping'. Despite the fact that their knowledge level reached the sufficient level to give guidance on early warning, they have not integrated the activity into the daily operation because the guideline has not been approved yet by the said working group.

Output 5: Use of Weather Information
Knowledge and understandings about weather and climate information in central/local governments, related organizations/agencies and end-users including nomads and general public in Mongolia are deepened.

The achievement level of Output 5 is Excellent (A).

In Mongolia, users' knowledge on weather information was insufficient due to lack of means to convey such information especially in the remote area. To improve users' knowledge and clarify their needs for weather information, seminars and workshops in Ulaanbaatar and three pilot provinces have periodically conducted under Output 5. Owing to strong ownership and good collaboration among central and provincial staffs of NAMHEM, these activities have been done smoothly although it was a first experience for some CPs to conduct workshops in the region. It was pointed out through the interview that such regional workshops were informative and valuable not only for users but for those NAMHEM officials who provide weather information because they raised the motivation

of NAMHEM staff through direct talks with the users, and also promoted information sharing among the central and provincial officials of ministries and agencies concerned. The activities also successfully promoted the relationship between NAMHEM and relevant ministries and agency especially NEMA.

- *Six Hundred and Forty (640) users are receiving explanation on use of weather information.*

During the Project period, total of 24 seminars and workshops, 3 seminars to disseminate project achievement in Ulaanbaatar and 21 workshops to utilize weather information in Ulaanbaatar and pilot provinces, have been conducted with combined efforts of both Mongolian CPs and Japanese Experts. There were totalling 943 participants. The main participants came from the relevant ministries and agencies, namely MFA, MNET and NEMA, private sector organizations who need weather information, the prefectural officials concerned with disaster prevention and nomads. The reason of exceeding target number was that the Project conducted workshops in the villages to make villagers easier to join. As previously mentioned, these were the first regional workshops conducted by NAMHEM, therefore, it was a good opportunity to provide weather information to the people in remote areas, such as areas in which the nomads reside. Moreover, over 14,000 leaflets which reflected user's needs were distributed to the participants, their neighbours and relevant municipalities.

Output 6: Operation and Maintenance of Weather Observation and Forecasting System

Weather observation and forecasting systems especially weather radar and computer network are stably operated.

The achievement level of Output 4 is Excellent (A).

This Output focused on the human resource development for the stable and sustainable operation of the Doppler weather radar and computer networking, which was supplied under the Japan's Grant Aid Assistance. CPs and Japanese Experts stated that the technical level of the NAMHEM engineers dealing with operations and maintenance of those equipment and system was sufficient to conduct their daily operation.

- *Appropriate operating rates of weather radar are maintained.*

As a result from introducing the check sheet for maintenance, the engineers have fully recognized the importance of operation and maintenance works. Through their efforts, the radar system has been well maintained.

- *Three (3) staffs are capable of maintenance of radar.*

To improve knowledge and technical level on the radar maintenance, lectures and practical trainings on system configurations and troubleshooting procedures have been conducted. Compared with the situation before the Project when there was only one engineer who properly operate and maintain the radar system, currently, five (5) engineers have been working.

- *System problems of computer networks in NAMHEM are properly managed.*

Technical issues of the computer system have been solved based on the action plan for the computer network improvement, which was developed by CPs and Japanese Experts. Through the activities, the main improvement made was to connect NAMHEM including its affiliated offices, the Meteorological Radar Station, the Meteorological Station at the International Airport by developed computer network.

- *More than two (2) staffs are capable of maintenance of computer networks.*

Technical guidance targeting two (2) engineers of ICC has been conducted. At the point of evaluation, five (5) engineers had already obtained skills on maintenance and troubleshooting of computer network. Those CPs reached sufficient technical level to continue the daily operation even after the project termination.

Output 7: DSS Monitoring
Information on monitoring of DSS issued.

The achievement level of Output 7 is Excellent (A).

Output 7, which was added to the PDM in March 2005, aims at establishment of the DSS network for monitoring dust storm and yellow sand movement. The activities started one year later than originally planned because of delayed procurement of equipment. All activities, however, are expected to be completed by the end of the Project.

- *Analyzed DSS monitoring information is developed.*

The DSS monitoring equipment such as lidars was installed at 4 observation stations in October 2007, and data collection started concurrently. The DSS movement information has been published in the meteorological journals and science magazines.

- *Four (4) staffs are capable of DSS monitoring.*

Tutorial training by Japanese Experts has been conducted with four (4) engineers at each observation station where DSS monitoring system was installed under the Project. Four (4) engineers have become capable of maintaining the equipment in their respective workplaces. The seminar on the DSS data analysis and sharing of experiences will be held in Ulaanbaatar on 24th September 2008, inviting not only the targeted (4) engineers but also the chief of observation stations and other interested engineers.

3-4 Achievement of the Project Purpose

Project Purpose:

More reliable, useful and timely weather information including dust storms and yellow sand (DSS) data is provided through developing the capacity of the weather service staff and related environmental experts.

As of September 2008, the evaluation team concluded that the Project Purpose has been achieved to a Good (B) level.

Capacity of NAMHEM has shown improvement and the Team attributes it to: (i) introduced knowledge and skills from Japanese Experts have been effectively utilized to enhance NAMHEM's functions; and (ii) CPs have acquired sufficient capacity to train their junior engineers by themselves.

- *Weather forecasts using regional numerical weather prediction and new weather analysis methods are provided twice a day for Short-term/once a day for Middle-term/once a month for Long-term.*

This numerical weather prediction model has been successfully incorporated into the daily operation system of NAMHEM. Short-term and middle-term weather predictions have been provided as planned, and the information has continuously been transferred to the weather prediction section in NAMHEM. As for long-term prediction, results of the analysis will be submitted for approval from the Scientific Board of the Institute of Meteorology and Hydrology.

- *Information on climate change projection over Mongolia is publicized once before the end of the project period.*

CP is currently undertaking climate change simulation, namely 20-year present day and 20-year future climate simulation, using the Mongolian regional climate model (RegCM3). The analysis of the simulation result is scheduled to be finalized by the end of the Project.

Timing and method of releasing the results should be clarified.

- *Information on drought/dzud is provided annually (at the end of August).*

The bag-scale pasture condition maps, required for managing disaster risks from drought/dzud, were successfully developed under Output 4. The first bag-scale pasture maps were developed in collaboration between CPs and Japanese Experts in August 2007, and the second maps were developed by CPs in August 2008. These maps were provided to all the local observation stations and the relevant ministries and agencies such as MFA and NEMA.

- *DSS monitoring data is provided for 300 days in a year.*

The DSS monitoring data has been continually collected by NAMHEM since the completion DSS system installation in October 2007. The data acquisition rate between January and July 2008 was 95%, which exceeded the targeted rate set at 83% (300 days/year).

- *Satisfaction level of users (public administrators, nomads, etc.) on the available weather forecast information is improved.*

The follow up survey to measure the levels of user satisfaction was not conducted under the Project. Therefore, it is difficult to assess the “cause and effect” relation between the implementation of the workshop and the satisfaction levels of users on the weather information. However, interviews undertaken during the evaluation exercise confirmed that the level of reliability and satisfaction in the weather information has increased due to geographical segmentation of the forecast area.

3-5 Issues Concerning Project Implementation Process

- *Project management:* As a whole, the Project management was appropriate. Japanese Experts and Mongolian CPs have been closely working together and have discussed on the technical challenges and problems in the daily operation. As for monitoring of technical aspects, CPs were always able to obtain necessary technical guidance from Japanese Experts by e-mail, when the Experts did not reside in Mongolia. On the other hand, it appeared that continuous and regular meetings between Japanese Experts and CPs should have been conducted more often to monitor and confirm the achievements of the outputs and activities of the PDM.



- *Communication* : Communication between the Japanese and the Mongolian side has been smooth, and as a result, all CPs and other engineers have been able to actively participate in the Project activities. The Project team employed a Mongolian coordinator and translator to avoid communication gaps with Mongolian side. Moreover, NAMHEM has been encouraging its staff to join English language programmes to improve their communication skills.
- *Ownership*: The CPs and engineers engaged in the Project showed high level of ownership which enabled the Project to implement its activities smoothly. According to the interview with CPs, transferred skills and knowledge from Japanese Experts have been appropriate and have met their technical needs. Another positive factor that promoted CPs ownership was the direct communication with the participants during the regional workshops. The session motivated CPs to provide more user-friendly weather information to the end users.

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