Utilizing the energy and cost saving potential in the Mongolian energy sector through a legal framework for energy efficiency as well as performance optimization and preventive maintenance in energy utilities

Workshop on Environmentally friendly technologies and measures in the energy supply sector: potential for NAMAs, Chinggis Khaan Hotel, 24 January 2013

Sven ERNEDAL
GIZ Programme Director
Energy Efficiency and Renewable Energy

GIZ in Mongolia

- Since 1991, GIZ supports the Mongolian Government on behalf of the BMZ.
- This cooperation includes services in the amount of ten million Euros per year.
- In Mongolia, the GIZ offers different development interventions (International and local staff, development advisors, integrated experts, returning experts, int'l and local short-term experts, developmental scholars, trainees).
- Mongolia is supported by more than 130 national and international staff.
- GIZ is the largest German employer in Mongolia.
- The German support for Mongolia from 1991 to 2010 totals to about 270 million Euros (including financial cooperation).

The focus areas of the Mongolia-German bilateral cooperation

Biodiversity	• Conservation and sustainable management of natural resources • Strengthen management of protected areas
Energy efficiency	• Support Mongolian energy sector with German know-how
Sustainable resource management	• Support the establishment of a stable framework for economic development of the country

Program/Priority Area: Energy Efficiency

giz	KfW	KfW	KfW	KfW	PTB
Energy Efficiency in the grid connected Power Supply Mongolia wide ongoing	Renewable Energy I (Bogdyn hydropower station) (FC) ongoing	Energy Efficiency I (Darkhan power station) ongoing	Energy Efficiency II (Power station No. 4, UB) ongoing	Energy Efficiency III planned for 2014	Support in the field of quality infrastructure, energy sector planned for 2013

giz	Studien- und Fachkräfte Fonds in Mongolia		
Analysis of possible and urgent Energy Efficiency interventions ongoing	Feasibility Study - Energy Efficiency in the Western Energy System ongoing	Pre-feasibility Study for a large scale solar power plant in southern Mongolia ongoing	

GIZ and Energy in Mongolia

- Since 1998
- Training of Power Plant Staff, 1998–2005, € 5 Mio.
- Promotion of Renewable Energy, 1998–2010, € 9 Mio.
- „Improvement of district-heating systems in urban centres of Mongolia“, 2007–2009, € 0.7 Mio (EU AsiaProEco II)
- Energy efficiency in the grid connected energy supply, 2007 – 2013, € 3.6 Mio
- Studies financed through the BMZ study and expert fund

Energy Efficiency in the grid connected energy supply

Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung

Project Partner

Ministry of Energy

Implementation Period

Phase 1: 2007 –2010

Phase 2: 2010 – 2014

Project Budget

EUR 3,575 Mio.

Project Goal

To improve the framework conditions for investments in energy efficiency in power utilities and among end users

Project Components

1. Energy Efficiency Law and Action Plan
2. Energy Efficiency in Power Generation
3. End Use Energy Efficiency
4. Capacity Building

Current situation - Energy Efficiency

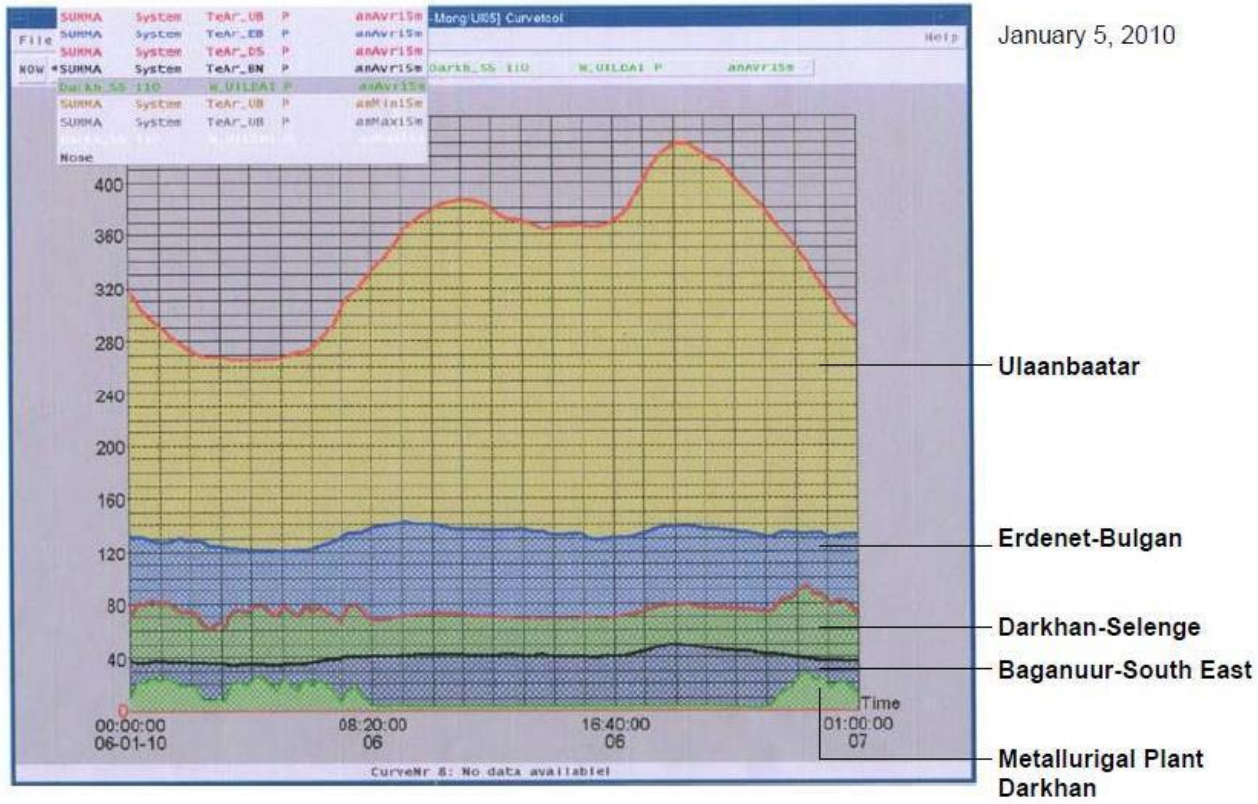


Figure 1. Typical peak load curve in different power grid systems (5. January 2010)

- The urbanization and the boom in the mining sector has lead to increasing energy demand
- The energy demand will increase by 200% in 20 years
- The energy supply is today primarily based (>95%) on coal resources
- The carbon intensity in Mongolia (CO_2/GDP) is 60% higher than in Russia and 4 times higher than in S. Korea
- The energy demand can most likely not be met by 2014
- The electricity imports from Russia during the evening peak load is expensive
- Power plants and electricity networks have high losses and insufficient capacity
- High energy saving potential among end-users

Project Achievements

1 Energy Efficiency Law and Action Plan

- Support for the development of an energy efficiency law and action plan
  - Presentation of draft EE Law to ministerial working group (2011)
  - Analysis of energy saving potential and options to reduce the peak load (2011)
  - Study of Designated Consumers as defined in EE Law (2012)
  - Business Model to promote energy efficiency investments (ongoing)
- Preparation of feasibility studies for energy efficiency investments and securing financing support for pilot project implementation, including:
  - GIZ PPP Projects
    - Boiler Brick Lining, Power Plant Darkhan (2010, €0.2 Mio)
    - Training Center for Medium/Low voltage switch gears, Energy Training Center (2012, €0.4 Mio)
  - KfW Energy Efficiency II Programme, Power Plant 4 (2011, € 8 Mio)
- Support for the revision of the energy law and parliament decision 72

Project Achievements

2 Energy Efficiency in Power Generation

- Preparation of feasibility studies for energy efficiency investments
  - Upgrade substation Erdenet (ca. 10 Mio. Euro) and Bulgan (ca. 4,5 Mio. Euro)
- Introduction of Standards, Norms and Guidelines
  - Technical Standard for Wind Power Plants (DIN 61400)
  - Thermographic Assessment of components in high voltage substations (DIN 54191)
  - Technical Guidelines for brick lining in power plant boilers
- Identification of energy saving potential in Mongolian Power Plants
  - Thermodynamical simulations in Choibalsan and Erdenet Power Plant
- Technical support for Mongolian Power Plants
  - Commissioning of emergency supply units and operator training
  - Upgrade of Instrumentation & Control Systems in Choibalsan and Darkhan CHP

Project Achievements

3 End Use Energy Efficiency

- Concept Development for an Energy Manager and Energy Auditor Training Programmes (ongoing)
- Introduction of business models for EE Law implementation (ongoing)
- Demonstration Project for Performance Contracting in selected public or private buildings (ongoing)
- Energy Efficiency Public Awareness Campaigns (under development)

GIZ Integrated Urban Development Program (project ends 12/2012)

- Demonstration projects for Thermo-technical rehabilitation of pre-cast panel buildings and schools in Ulaanbaatar
- Eco-efficient demonstration building in Eco-City Berlin in Ulaanbaatar

Project Achievements

4 Capacity Building

- Training of technical management staff in the energy sector, such as:
  - Training in PowerTech Training Centre (KWS) in Essen, Germany
  - Assessment of losses in the power grid and high voltage substations
  - Infrastructure asset assessment for high voltage substations
  - Establishment of an Electroengineering Training Laboratory in Ulaangom
- Introduction of technologies and management concepts such as:
  - Thermographic Assessment of components in high voltage substations
  - Condition Monitoring of rotating equipment in power plants
- Networking with international organisations
  - International Conferences on Energy Efficiency in Ulaanbaatar (2009, 2012)
  - Membership in VGB Power Tech, GIZ energy efficiency network, Technical Associations like „European Council for an energy efficient economy“

Objectives of an Energy Efficiency Law

Vision for Energy Efficiency in Mongolia

1. Short Term – Reduce the electricity peak load during the evening hours in Ulaanbaatar

2. Medium Term – Ensure that investments in industrial sectors utilize green energy efficient technologies in order to save energy and money

3. Long Term – Establish an integrated Mongolian energy system that allows a combination of renewable energy and fossile fuel power plants

Objectives of an Energy Efficiency Law

The first objective

- An energy efficiency law will be the only law in Mongolia that “forces” energy consumers to make more profit (“Energy efficiency is a national source of energy”)

The second objective

- The law will more cost effectively balance investments into power capacity expansion versus energy demand reduction at the consumer side

Nine most common elements of an energy efficiency law

Notify designated consumers

- Establish benchmark of consumption
- Prepare list of designated consumers

Train and certify Energy Auditors

- Develop lecture notes
- Certification and accreditation procedures

Train and certify Energy Managers

- Develop lecture notes for performance testing of equipment.
- Certification and employment procedures

Prepare Energy Regulatory Authority

- Introduce five cost effectiveness tests
- ERA provide for incentives and disincentives

Establish EE equipment reference

- Website such as www.energystar.org
- Campaign for better informed buyers

Introduce mandatory labeling

- Label design and labeling procedures
- Control and marketing

Public awareness and marketing

- High level annual EE award event
- Professional impact monitoring to prove claims

EE- Financing and performance contracting

- Risk management strategies
- Central bank intervention, if any

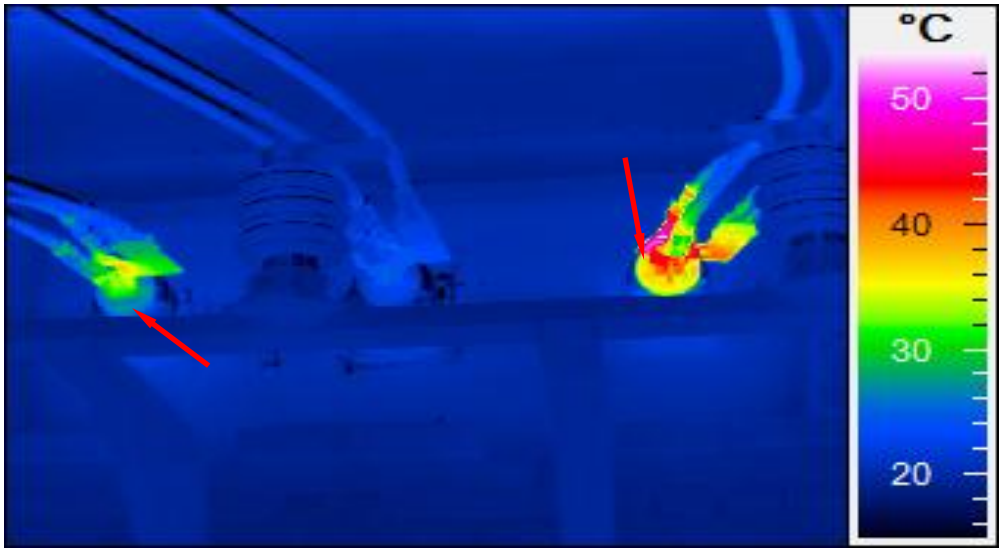
Declare private and public energy utilities as designated consumers under the law

- Performance mapping of G+T+D system
- Energy utility management of DSM programme

Thermographic assessment of components in high voltage substations

BARUUN 10kV substation

BARUUN 10 kV substation



Phase		A	B	C
Normal Current	(A)	1313	1313	1313
Measured Current	(A)	560	560	560
Load percent	(%)	43	43	43
Maximum object temperature	(°C)	**38**	25,5	**54,6**
Measured upper temperature	(T, °C)	**12,4**	-	**29**
Temperature at rated load	(T,°C)	**68**	-	**160**
Actual temperature	(°C)	**81**	-	**189**
Error category (DIN 54191)	(1 - 4)	**3**	**1**	**4**

IR Image №: AG041704.irb
Ambient t°: 15°C
Humidity: 59%
Emission factor : ε = 0,93

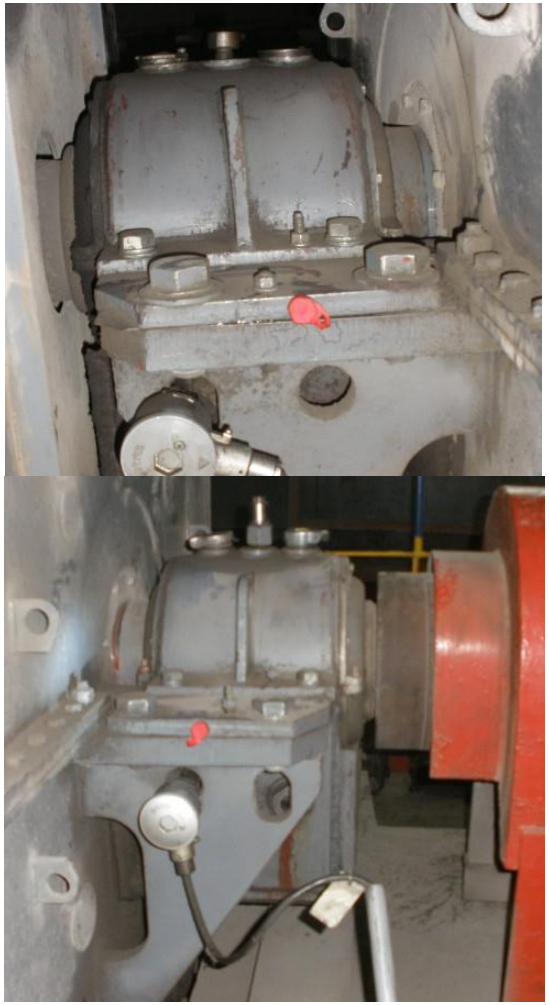
Error categories
1. **No actions required**
2. **Service during next visit**
3. **Service within 6 months**
4. **Immediate service required**

Condition monitoring campaign of rotating equipment in power plants

Monitoring Campaign Objectives

- Evaluation of machine and machine component conditions using vibration measurement data
- Periodical data collection using specific measurement routes for detailed trend monitoring
- Using the measurement data for failure analysis, like imbalance problems, bearing defects, e.g. to support service activities in planning, monitoring and failure correction
- Implementation of pro-active service activities to prevent machine failures, like early detection of imbalance problems and on-time correction
- Reduction of unplanned down-times due to unexpected machine failures
- Improving spare part management

Installation example …



The procedure …

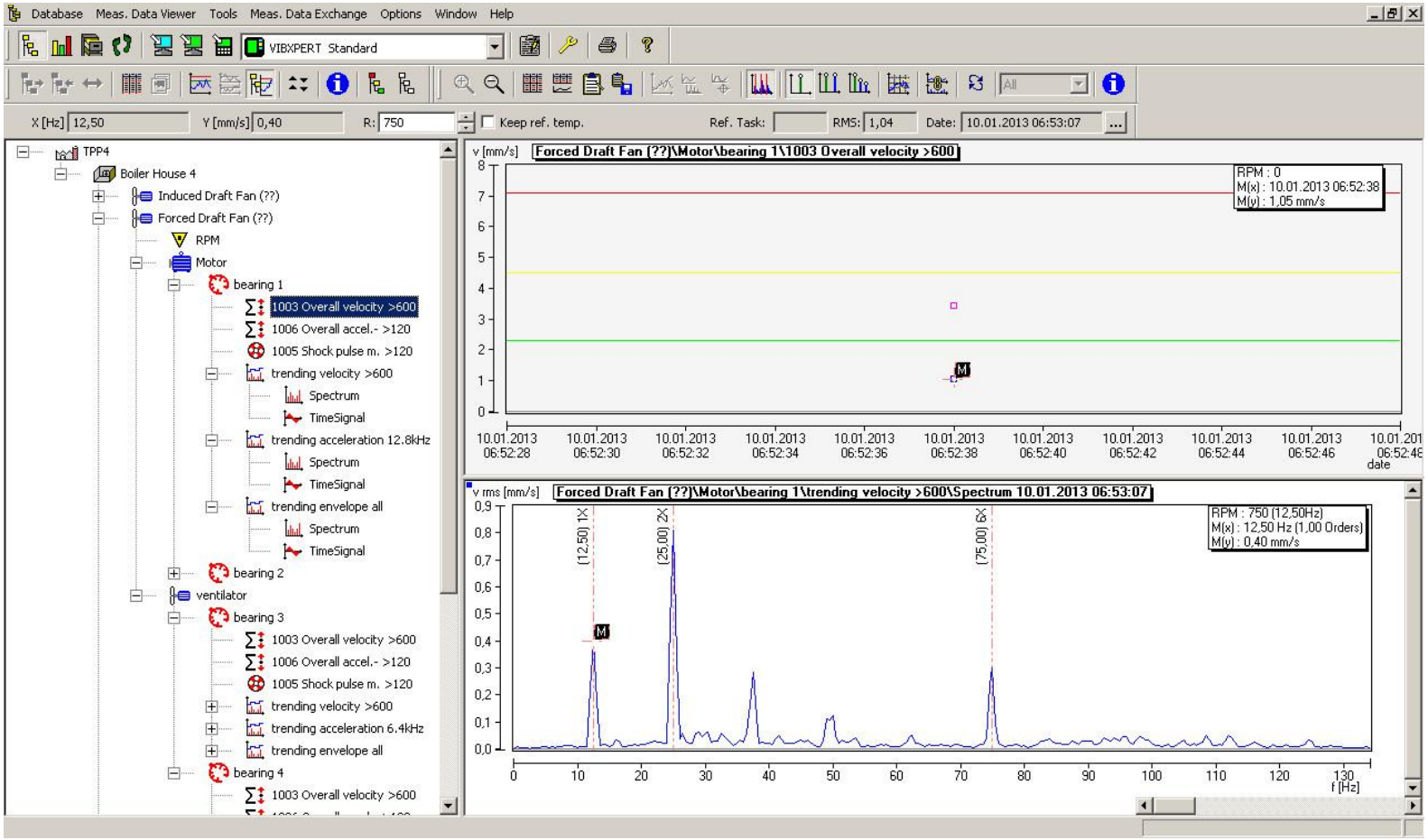
installation

coding

data collection

The procedure …

analysis



„Mapping Study“ in Mongolian Power Plants

Study Objectives

- Development, adaptation and commissioning of thermo-dynamical simulation models for Mongolian thermal power plants
- Capacity Building of local Mapping Experts including practical training in establishing and operating mapping models
- Identify cost effective energy efficiency measures in Mongolian thermal power plants
- Improved performance monitoring in power plants

Powerstation 1

(2 operation engineers, good local knowhow of units&operation)

- **Preparing measured data (averaging, plausibility)**
- **Input data**
- **Checking & evaluate model results,**
- **Transfer results&reports -> actions (operation, maintenance, repair)**

Powerstation 2

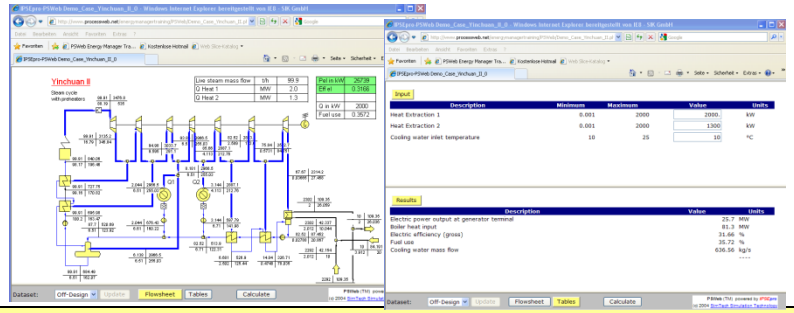
(2 operation engineers, good local knowhow of units&operation)

- **Preparing measured data (averaging, plausibility)**
- **Input data**
- **Checking & evaluate model results**
- **Transfer results&reports -> actions (operation, maintenance, repair)**

Powerstation x

(2 operation engineers, good local knowhow of units&operation)

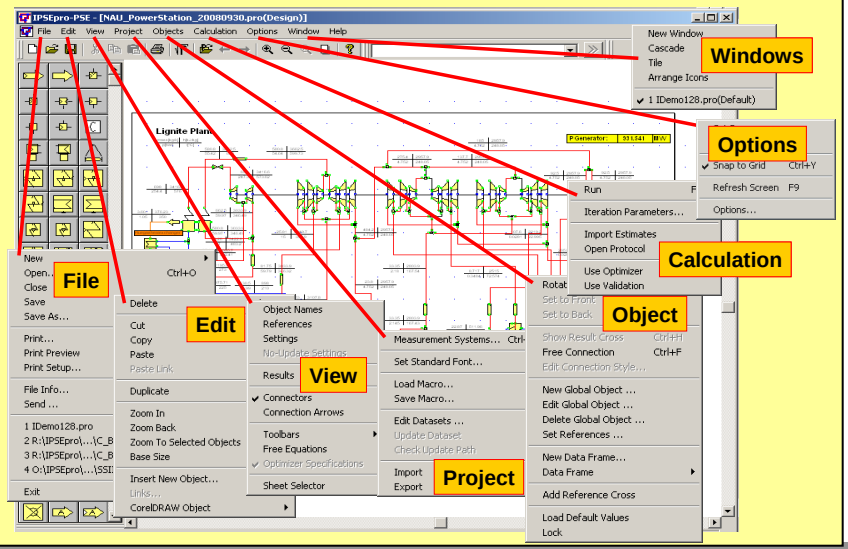
- **Preparing measured data (averaging, plausibility)**
- **Input data**
- **Checking & evaluate model results**
- **Transfer results&reports -> actions (operation, maintenance, repair)**



Central model administration

(2 experienced engineers, good thermodynamic skills, IT affinity)

- **Modelling existing plants together with trainers**
- **Model modifications of existing plants**
- **accuracy adjustment**
- **Generating result & trends and discussion with powerstation**
- **Transfer results into modernizations ideas**
- **Model extensions/changes for engineering studies**
- **Modelling new plants**
- **Checking and evaluating offered solutions**
- **Internal support coordination**
- **Hotline use and external support coordination**



Thank you for your attention

Contact: sven.ernedal@giz.de