Geothermal Field Development & Power Plant EPC Services

Overview of the Mannvit-Technip collaboration
December 2010
Mannvit & Technip Collaboration

Top notch combined value in geothermal development services

Our collaboration offers geothermal project developers and financers with a single point source of responsibility for geothermal development services

- Collaboration effective since October 2009
- US Western States
- Indonesia
Introduction

Experience combined in geothermal development

Mannvit is an Icelandic consulting and engineering service provider in all phases of geothermal project development comprising:
- Geothermal exploration, feasibility studies and resource assessments
- Resource assessments and drilling engineering
- Conceptual design, process packages and detailed engineering support
- Power plant operational and training services

Technip is a global Engineering, Procurement, and Construction (EPC) service provider to the energy industries with services including:
- Project management expertise, including complex project integration
- Risk assessment and financial engineering
- Preliminary, detailed engineering and design
- Global procurement and construction management services
Mannvit – In Brief

Iceland's premier consulting and engineering service provider

- Independent consultants in geothermal development
- About 400 employees including subsidiaries – Employee owned
- 100 specialists dedicated to the development of geothermal energy
- Geothermal Development Consultancy active in:
  - Iceland
  - Central and Eastern Europe
  - USA
  - Latin America
  - Indonesia

- Offices in
  - Iceland – Headquarters
  - Hungary, Germany and UK
40 years of Geothermal Development Experience

Service spanning all aspects of development and utilization

- Geothermal research & Exploration surveys
- Reservoir assessments and simulation
- Environmental consulting
- Feasibility studies
- Drilling engineering, design and supervision
- Procurement & Tender evaluation
- Power plant engineering and detailed design
- Project & Construction management
- Power plant operational services
Mannvit

Experience, standards and project management

- Decades of experience in geothermal development
- UNIDO Manual tailored to geothermal project needs
- Geothermal Reporting Code, Qualified Person with CanGEA
- Cost Estimate Classification System AACE International
- Project Management with MaPro
- Mannvit certified Quality system, ISO 9001
Project Example – Hellisheiði Power Plant

Reykjavik Energy as valued client for over 40 years

- Combined heat and power – $300 \text{ MW}_e \& 400 \text{ MW}_\text{th}$
- Over 60 boreholes drilled, depth range 1,500 – 3,000 m
- Project cost 1,000 M€
- Field development since 2002

Mannvit’s Role

- Project management
- Overall plant design
- Detailed mechanical design of plant
- Detailed design of HVAC system
- Bid preparation and tender evaluation
- Site supervision
- Commissioning
- Acceptance test
- Training of operators
- Environmental impact assessment
Project Example – Geothermal Field Development

Integrated approach to project development

Since 2006 Mannvit has provided PannErgy with day-to-day consultancy service regarding utilization of geothermal energy in Hungary

Mannvit’s Role

- Project management and EPCM
- Evaluation of potential geothermal areas
- Research, exploration and development
- Drilling engineering services
- Environmental Impact Assessment
- Reservoir engineering and monitoring
- Design of power plant
- Design of central district heating system
Technip – In Brief

Recognized leader in the execution of EPC energy projects

- A leading global provider of engineering, technologies and project management services, serving the energy industry for 50 years

- Multi-local: 23,000 team members in 46 countries, industrial assets (manufacturing plants, spoolbases, construction yard) on five continents, and operates own fleet of 19 specialized vessels for pipeline installation and subsea construction

- Highly integrated capabilities: products, technologies, assets, know-how

- Business activities organized in 3 complementary segments: Subsea, Offshore and Onshore

- Key contributor to development of sustainable solutions to the energy challenges of the 21st century
Technip – Three Segments

- Design, manufacture and supply of deepwater flexible and rigid pipelines, umbilicals, and riser systems
- Subsea construction and pipeline installation services
- Five state-of-the-art flexible pipe and umbilical manufacturing plants
- Five spoolbases for reeled pipeline assembly
- A constantly evolving fleet strategically deployed in the world's major offshore markets

SUBSEA

- Engineering and fabrication of fixed platforms for shallow waters (TPG 500, Unideck®)
- Engineering and fabrication of floating platforms for deep waters (Spar, semi-submersible platforms, FPSO)
- Leadership in floatover technology
- Two construction yards

OFFSHORE

- Gas treatment and liquefaction (LNG), Gas-To-Liquids (GTL)
- Oil refining (refining, hydrogen and sculpture units)
- Onshore pipelines
- Petrochemicals (ethylene, aromatics, olefins, polymers, fertilizers)
- Biofuel and renewable energies
- Cogeneration Projects
- Non-oil activities (pyrotechnics, life sciences, metals, buildings and infrastructures)
- Project Management Services

ONSHORE
Technip – Project Execution Approach

Quality Control in Project Execution – “Do it right the first time”

- Upfront Project Execution Planning. Continual risk assessments.

- Engineering: Continuous Improvement in Productivity – Update work processes and minimize rework.

- Procurement: Extend and continually update our worldwide knowledge of suppliers / manufacturers.

- Construction: Plan our own construction management solutions. Form partnerships as needed. Work with local constructors.
Technip – Project Execution Approach
Construction Driven and State of the Art Project Execution

THE CLIENT Construction

E+P Delivery Engineering

The Start-up Packages Approach

THE MAKE IT HAPPEN FACTOR
FEED frozen prior to EPC start
Technip – Project Examples

Recognized Leader in the Execution of EPC Energy Projects

- Hydrogen / Cogeneration Projects, USA & Canada

**Clients:**
- Air Products, Port Arthur I, TX: Frame 6 GT integrated w/SMR
- Air Products, Port Arthur II, TX: Frame 7 GT integrated w/SMR
- Exxon-Mobil, Torrance, CA: GT integrated with SMR
- Texaco, Wilmington, CA: SMR steam to Steam Turbine
- Syncrude, AB, Canada: SMR steam to Steam Turbine
- Air Products, Wilmington, CA: SMR steam to Steam Turbine

**Scopes of Work:**
- EPC / EPCM / EP

**Types of Contract:**
- Lump Sum / Reimbursable

**Project Descriptions:**
- Electric power production in 20 – 118 MWe range
- Gas turbines - GE frames 5 (25 MW), 6 (38 MW) or 7 (85 MW)
- Gas Turbine exhaust (GTE) used as combustion air in Steam Methane Reformer (SMR)
Technip – Project Examples

Recognized Leader in the Execution of EPC Energy Projects

- HyWind Project, Norway
- 2.3 MW e Offshore Wind Turbine in 220 metres water depth
  - SPAR buoy concept with 100 m draft
  - Subsea power cables to onshore local grid
  - 65 m high steel tower for Siemens wind turbine generator
Combined Experience and Excellence

Attractive and Market Competitive Solutions

Mannvit

- Iceland's Premier Consulting & Engineering Service Provider
- Geothermal Consulting Engineers since 1960s
- Experienced in all Stages of Geothermal Development
- Well Positioned to Assess Resource Risks

Technip

- Project Execution Excellence
- Highly Experienced EPC Contractor
- Global Procurement Network
- Construction Management Solutions
- Financial Strength
Value Proposition
Consulting and EPC contracts in Geothermal Project Development

Mannvit and Technip’s collaboration offers single point source of responsibility for geothermal developers and their investors

- Geothermal consulting
- Geothermal exploration
- Geothermal reservoir engineering
- Feasibility studies
- Drilling engineering services
- Project management
- Risk management
- Engineering & Design
- Procurement
- Construction management
- Power plant start-up services
- Operations support
Geothermal Service Map

Environmental Consulting
Services include:
- Air & Water quality
- Soil investigations
- Environmental modelling
- Project management
- Strategy assessment
- Operational licenses
- Environmental monitoring
- Environmental mitigation
- Environmental Impact Assessment

Geothermal Exploration
Services include:
- Data mining & review
- Geological mapping
- Geochemical sampling & analysis
- Well siting
- Databases and data management
- Geophys. exploration:
  - Resistivity
  - Gravity
  - Seismic interp.
- GIS services & cartography

Geothermal Drilling
Services include:
- Pad preparation
- Well design
- Bid preparation
- Tender evaluation
- Supervision of drilling contracts
- Drilling Engineering
- Mud logging
- Inspection
- Work over programs
- Drilling supervision

Reservoir Engineering
Services include:
- Conceptual modeling
- Reservoir modeling
- Underground cold & heat storage
- Resource assessments & code classification
- Well testing and evaluation
- Reservoir monitoring
- Well logging
- Surface runoff & groundwater modeling

Power plants
Services include:
- Feasibility studies
- Cost estimations
- Conceptual design
- Process design
- Overall plant design
- Site layout & planning
- Equipment specifications
- Bid preparation and bid evaluation
- Site supervision
- Commissioning
- Acceptance test
- Training of operators
- Project management
Mannvit-Technip

Your Partners in Geothermal Development

- Qualified
- Experienced
- Dedicated
- Execution Excellence
- Financial Strength
- Geothermal A-Z
Annex
Project Management: The Technip Way

► Bidding Discipline

► Control of Project Execution

► Global Procurement Network
Bidding Discipline

Ensure appropriate risk/reward achieved on each contract

Each project is evaluated on its own merits
No market share or asset utilization target supersedes this rule
Two principles are implemented concurrently:
- Project Director: single point of accountability for each project
- Senior Management: hands-on policy, supported by central expertise
Global Procurement Network

EPC internet-based procurement system

A worldwide network for increased flexibility and competitiveness