Onshore Pipeline Engineering: Challenges

Oliver Sokoll – Pipeline Lead Engineer

IKT International Conference - Infrastructure Knowledge and Technology, Gelsenkirchen, 18.09.2014

Technip

Contents

1. Technip Today

- With engineering, technologies and project management, on **land** and at **sea**, we safely and successfully deliver the best solutions for our clients in the **energy business**
- **Worldwide** presence with **40,000 people** in **48 countries**
- Industrial assets on all continents, a fleet of 30 vessels (9 under construction)
- 2013 revenue: €9.3 billion

Energy is at the core of Technip

Technip

1. Two Business Segments, One Technip

Subsea

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

Onshore/Offshore

- Gas treatment and liquefaction (LNG), Gas-to-Liquids (GTL)
- Oil refining (refining, hydrogen and sulphur units)
- Onshore pipelines

Onshore Pipelines

- 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

  Floating Liquefied Natural Gas (FLNG)

  Construction yard

The best solutions across the value chain

Technip

1. Water Transmission System - Phase 1&2

Fujairah – UAE

- **Completion:** Phase 1: 2004
  Phase 2: 2013
- **Scope**
  - Project Management
  - Engineering, Procurement, Construction

Securing 40% of the Water Supply of the UAE

Pipeline System

- Length: 2 x 180 km
- Diameter: 64 inch (ca. 1.63 m)
- Pressure: MOP 56 barg
- Capacity: 18.900m³/h

Pumping Station

- Booster Pumps: 9 (1.4 MW each)
- Main Pumps: 9 (11 MW each)

Technip

1. We do not “want“ to see this …

Quelle: en.starafrica.com

1. … and definitely not that …

2. Pipeline Systems – Transmission Pipelines

Quelle: freeassociationdesign.wordpress.com

Quelle: crc-evans.com

Here: Space is not a challenge

2. Pipeline Systems – Flowlines and Trunklines

Here: Space is a challenge

Quelle: Technip

2. Pipeline Systems – More Components

- **Terminals / Stations**
  - Pump and compressor stations
  - Storage terminals
  - Metering units
  - Block valve stations
  - Scrapers
  - Slug catchers
  - Blending Units

Complexity is a challenge

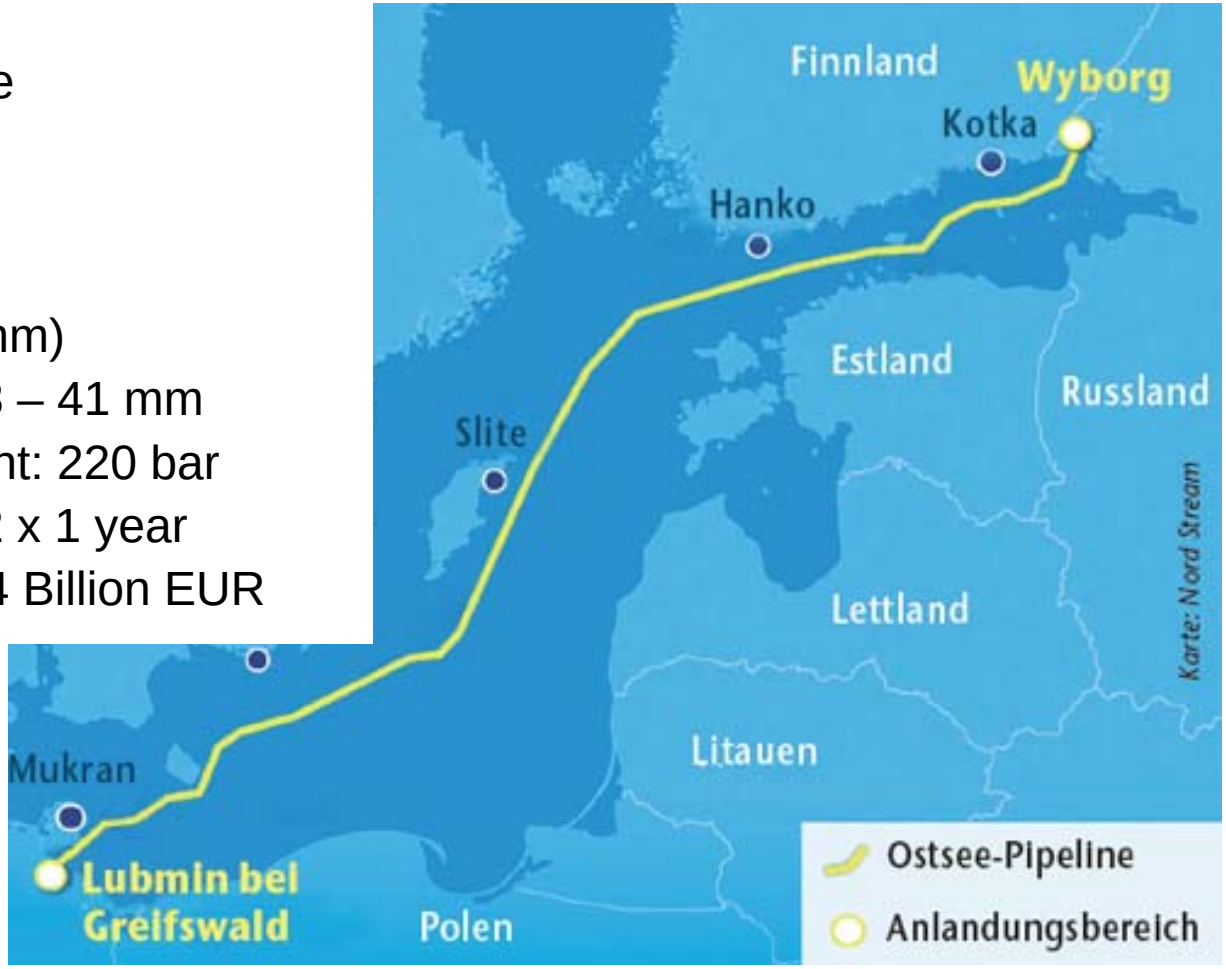
Technip

2. Pipeline Systems – Long Structures

Example: Nord-Stream

- **Facts**
  - Offshore gas pipeline
  - Baltic sea
  - Russia to Germany
  - 1,200 km long
  - O.D. 2 x 48” (1220 mm)
  - Wall Thickness 26.8 – 41 mm
  - Pressure at start point: 220 bar
  - Construction Time: 2 x 1 year
  - Total Investment: 7,4 Billion EUR

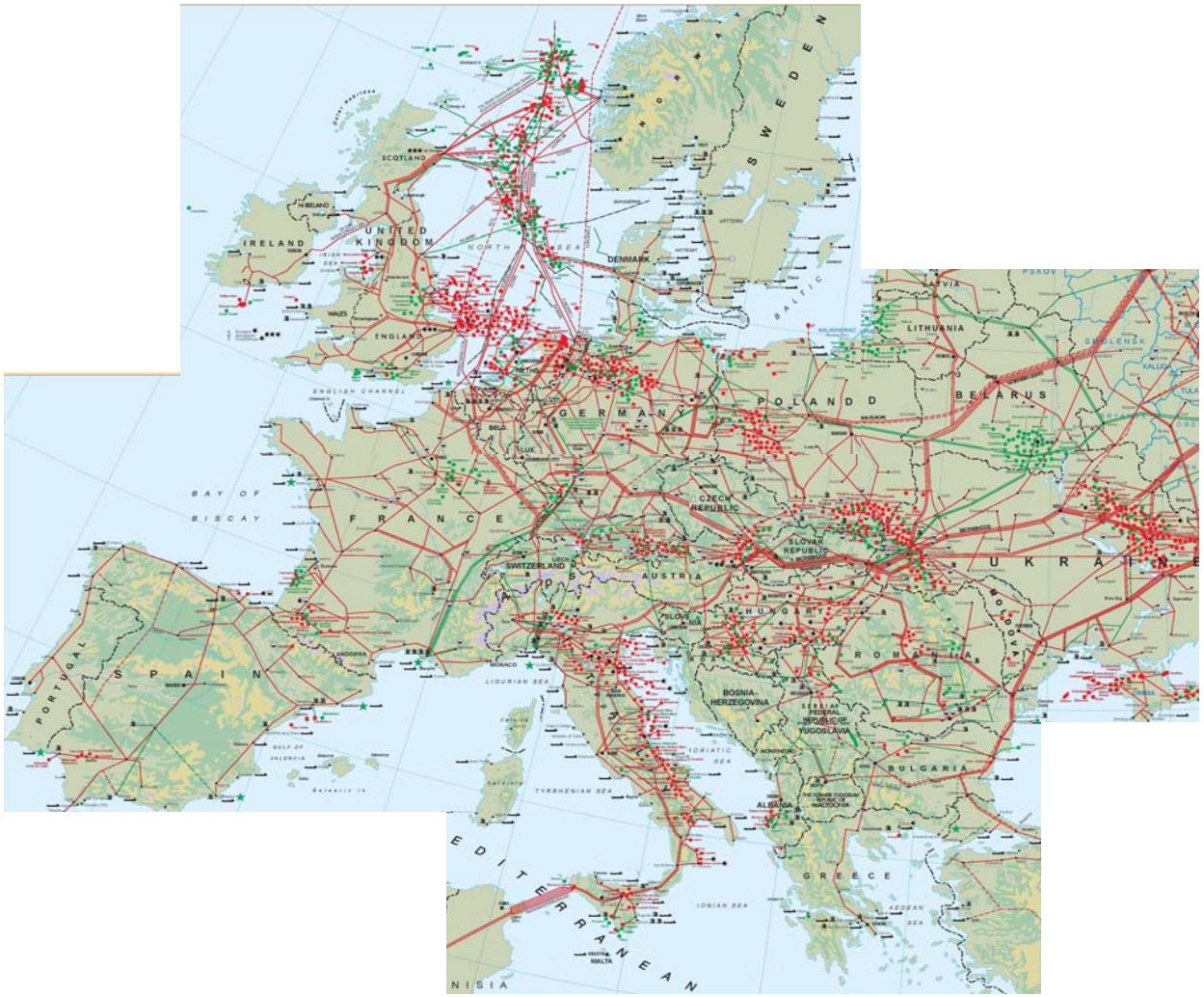
Quelle: Nord-stream.com / Europipe.com



Challenges e.g.: availability of installation equipment (vessels), transportation and storage of line pipes

Technip

2. Pipeline Systems – Europe



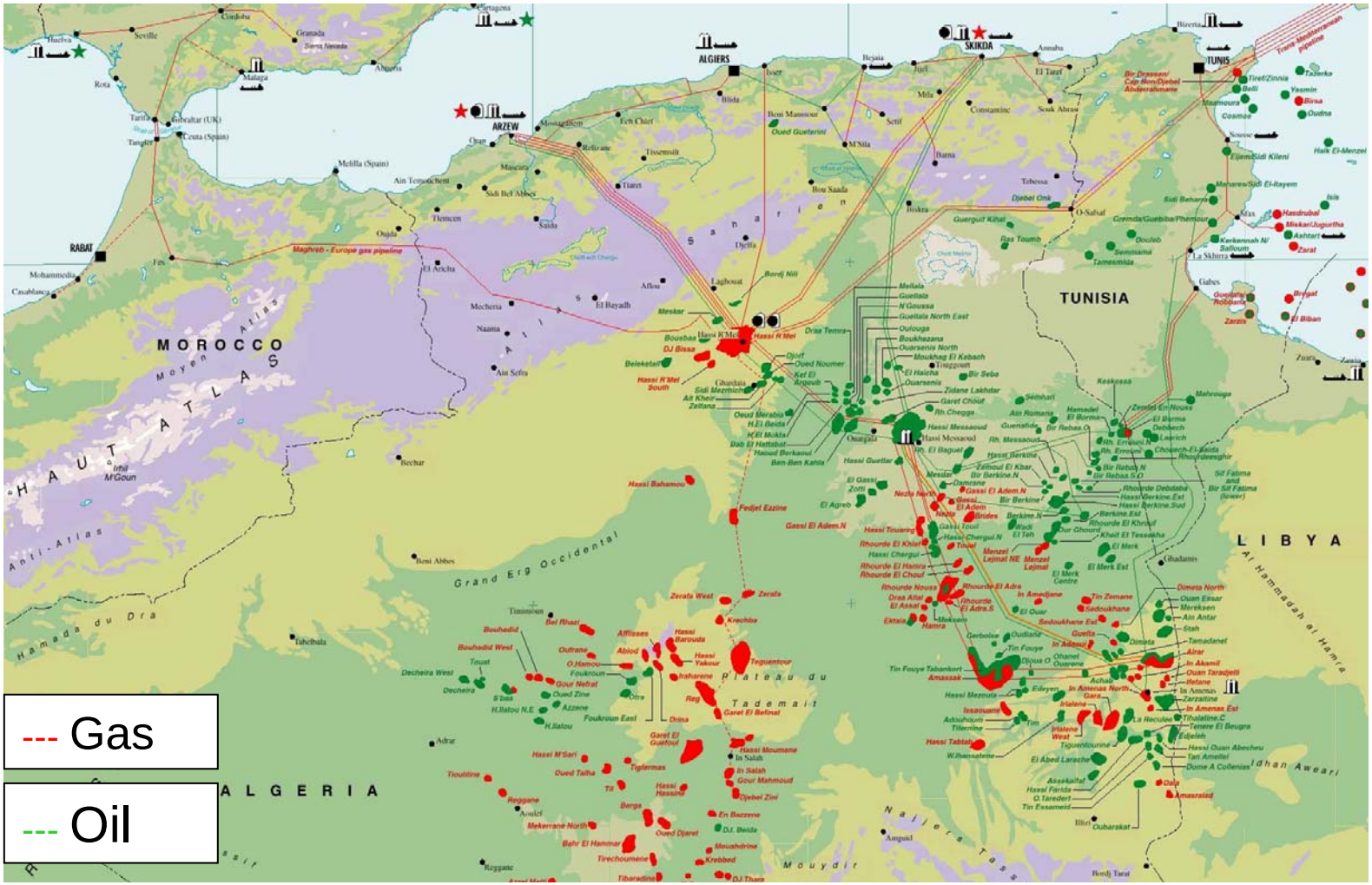
--- Gas

--- Oil

Challenges, e.g.: density of population and existing infrastructure

Technip

2. Pipeline Systems – Northern Africa



Challenge, e.g.: safety

Technip

2. Pipeline System – Central Africa

Source: Google Earth / Technip

Challenges, e.g.: safety, health, transportation

Technip

2. Pipeline Systems – Crossing of Obstacles

- Railroads
- Roads
- Constructions
- Rivers, Waterways
- Protective Areas, etc.

Quelle: herrenknecht.com

Challenges, e.g.: assessment of feasibility, special requirements of operators (railroad), impact on capital expenditures

Technip

2. Pipeline Systems – Media

- Crude Oil
- Natural Gas
- Fuel
- Groundwater
- Waste Water
- Carbon Dioxide
- Slurry
- Marine Water

Challenges, e.g.: assessment of potential impact on line pipe material (corrosion and abrasion)

3. Pipeline Design

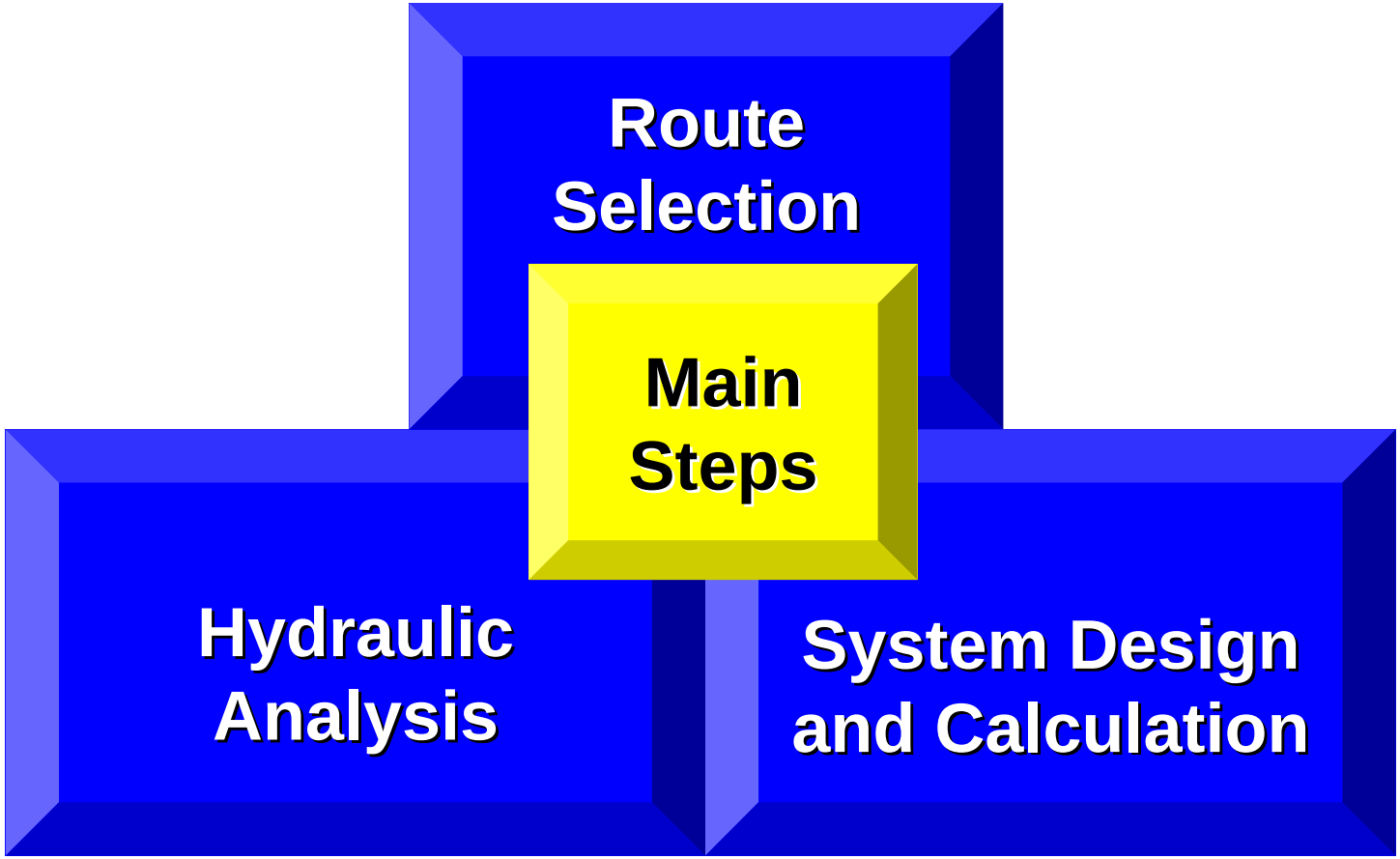
- **Data Acquisition (1st Step Desktop Study):**
  - Design Codes & Standards
  - Battery Limits: Start point, End point
  - Medium Data: Chemical Composition
  - Operational Parameters: Flow Capacity, Pressure, Temperature
  - Environmental Data: Temperature (min./max.), **Topography**, **Soil,** Seismic etc.

Advantage:	**Safety and Health is not an issue, Design Activities can commence**
Potential Disadvantage:	**Source + Accuracy of data about topography and soil**

Technip

3. Pipeline Design

- **Pipeline Design - Main Steps:**



Technip

3. Pipeline Design – Route Selection

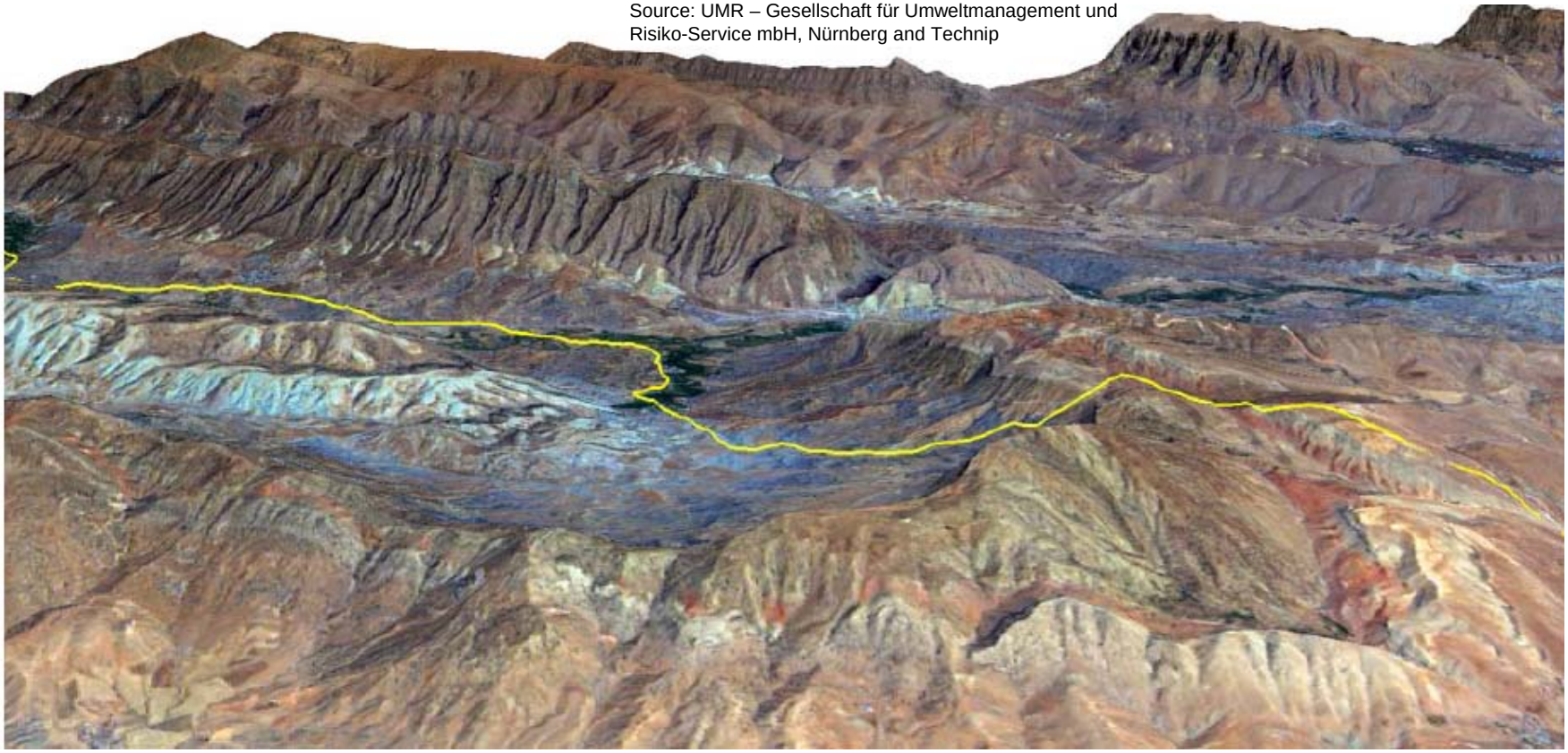
- **Route Selection:**
  - Little interference with landowners
  - Avoidance of environmentally sensitive areas
  - Sufficient accessibility
  - Minimisation of crossing points
  - Homogenous soil conditions, as easy to remove as possible

- **Sources of information used:**
  - Maps, Reports
  - SRTM-Modell (Shuttle Radar Topography Mission, NASA)
  - Satellite Photographs
  - Remote Sensing System Drysatmap® by UMR GmbH (Nürnberg, Germany) based on satellites data

Technip

3. Pipeline Design – Route Selection

Source: UMR – Gesellschaft für Umweltmanagement und Risiko-Service mbH, Nürnberg and Technip

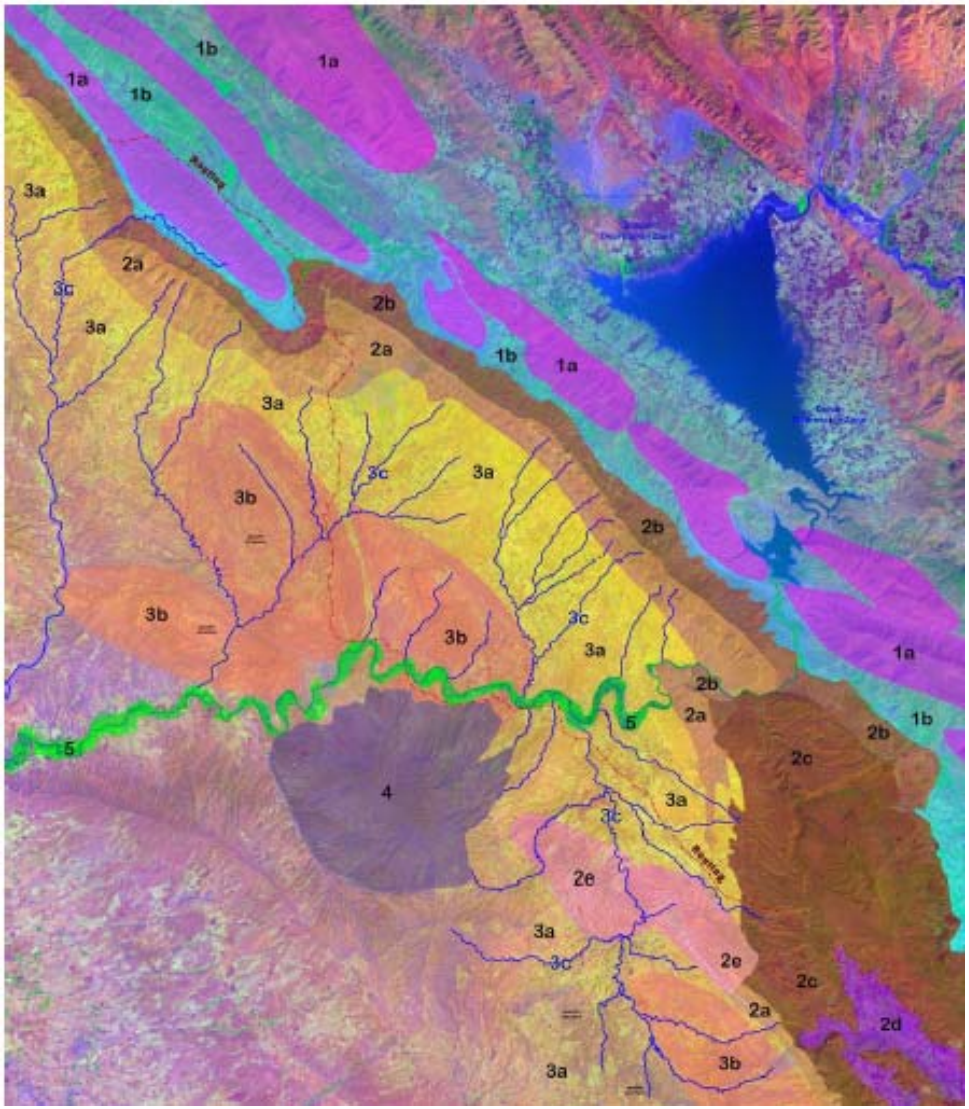


Digital Surface Model => Input for Hydraulic Analysis
Digitized Data about infrastructure => Identification of Crossings

This technology does not replace onsite investigations

Technip

3. Pipeline Design – Route Selection



Source: UMR GmbH (Drysatmap® satellite data processing and mapping, data from Sept. 3rd, 2013

Geological Zonation:

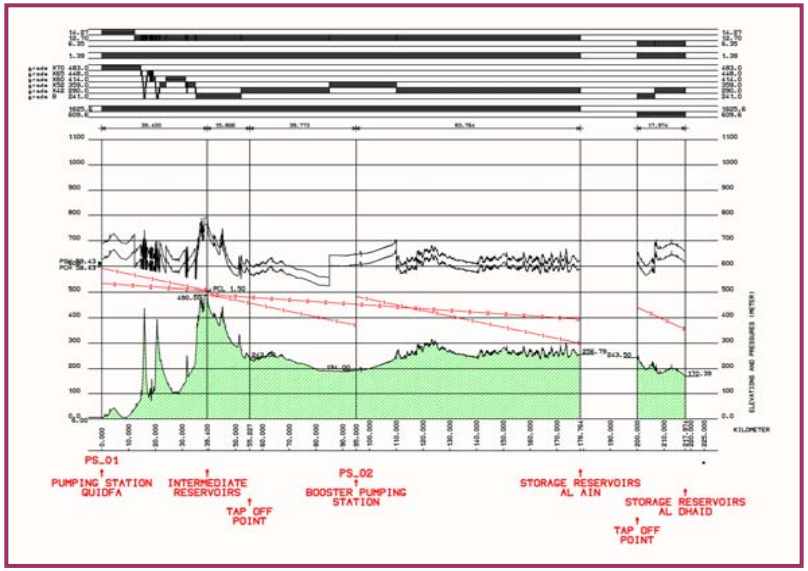
Identification of Surface Soil and its workability,

Identification of hazard potential like erosion and flooding

Technip

3. Pipeline Design – Hydraulic Analysis

- **Hydraulic Analysis Simulation:**
  - System design of new pipeline systems
  - Expansion and modification of existing systems
  - Analysis of existing systems



- **Hydraulic Simulation-Tools:**
  - Pipeline Studio
  - Pipephase
  - OLGA

- **Simulation-Tools, Process:**
  - Design II
  - Pro II

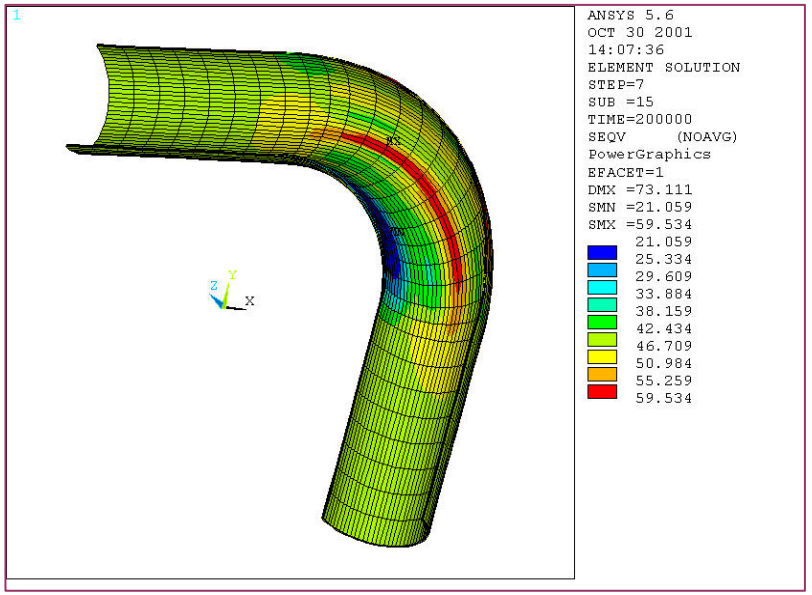
Results: Pipeline Diameter, Pressure and Pump Power

Technip

3. Pipeline Design – System Design

- **System Design and Calculations**
  - Design in compliance with national and international Codes & Standards

- **National & International Codes & Standards:**
  - EN 1594, European Standard
  - ISO 13623, International Standard
  - ASME B31.4/B31.8, US Standard
  - BS 8010, British Standard



Results, e.g.: Material Grade, Wall Thickness, Crossing Design

Technip

3. Summary

- **Pipeline Engineering:**
  - Pipelines are complex systems
  - Many information have to be taken into account
  - Challenges can be met by knowledge and wide range of adequate software tools
  - Desktop Study: Remote sensing tools can help to avoid site visits in countries with risks concerning health and safety
  - Detailed Engineering: Remote sensing tools do not replace onsite investigations (topographic survey, soil survey)

Technip

Thank you

- TECHNIP GERMANY GmbH
- Theodorstr. 90
- D-40472 Düsseldorf
- osokoll@technip.com
- Phone-No.: +49 211 659 2928
- www.technip.com

Any Questions?

Technip