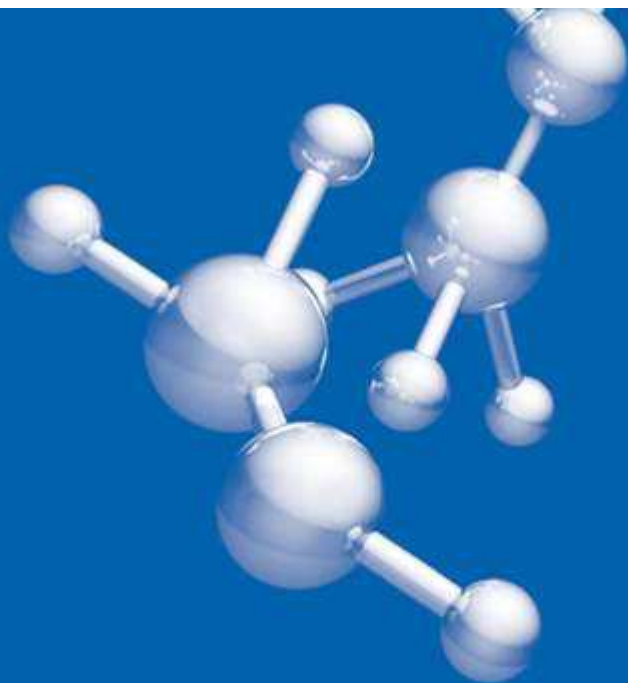




**Lurgi**



***Lurgi GmbH***

ECRI Sponsors Meeting

Essen, 04.12.2008

H. Maschke

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- Air Liquide
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## The World of Air Liquide Air Liquide in brief



- Air Liquide is a **world leading international Group** specializing in industrial and medical gases and related services. Today they are present in **72 countries**
- Founded in **1902**, Air Liquide currently combines the resources and expertise of a global Group with a powerful local presence, based on independent **customer-focused teams**
- From the start, Air Liquide has based its **development on innovation, geographic expansion, creativity and initiative**
- Air Liquide supply **oxygen, nitrogen, hydrogen** and many other gases and services to many customers (steel and oil refining, chemistry and glass, electronics and paper, metallurgy and food-processing, aerospace and healthcare). Their **innovative solutions** improve customers' industrial performance while helping to **protect the environment**

## The World of Air Liquide World Business Lines



- **Industrial Merchant** : gases in small or medium quantities to users in very diverse sectors
- **Large Industries** : high volumes of industrial gases and energy solutions (chemicals, refining, metals)
- **Electronics** : carrier and specialty gases, liquid chemicals and related equipment. Installations and services for semiconductor and flat screen manufacturers
- **Healthcare** : three areas of activity supply of medical gas, services and equipment to hospitals, homecare and hygiene
- In addition to these four major activities, **Related Activities** with engineering, welding, diving and chemicals





Lurgi was purchased by Air Liquide in **Summer 2007**.

Lurgi is a **leading technology company** operating worldwide in the fields of process engineering and plant contracting.

The strength of Lurgi lies in **innovative technologies of the future** focussing on customized solutions for growth markets.

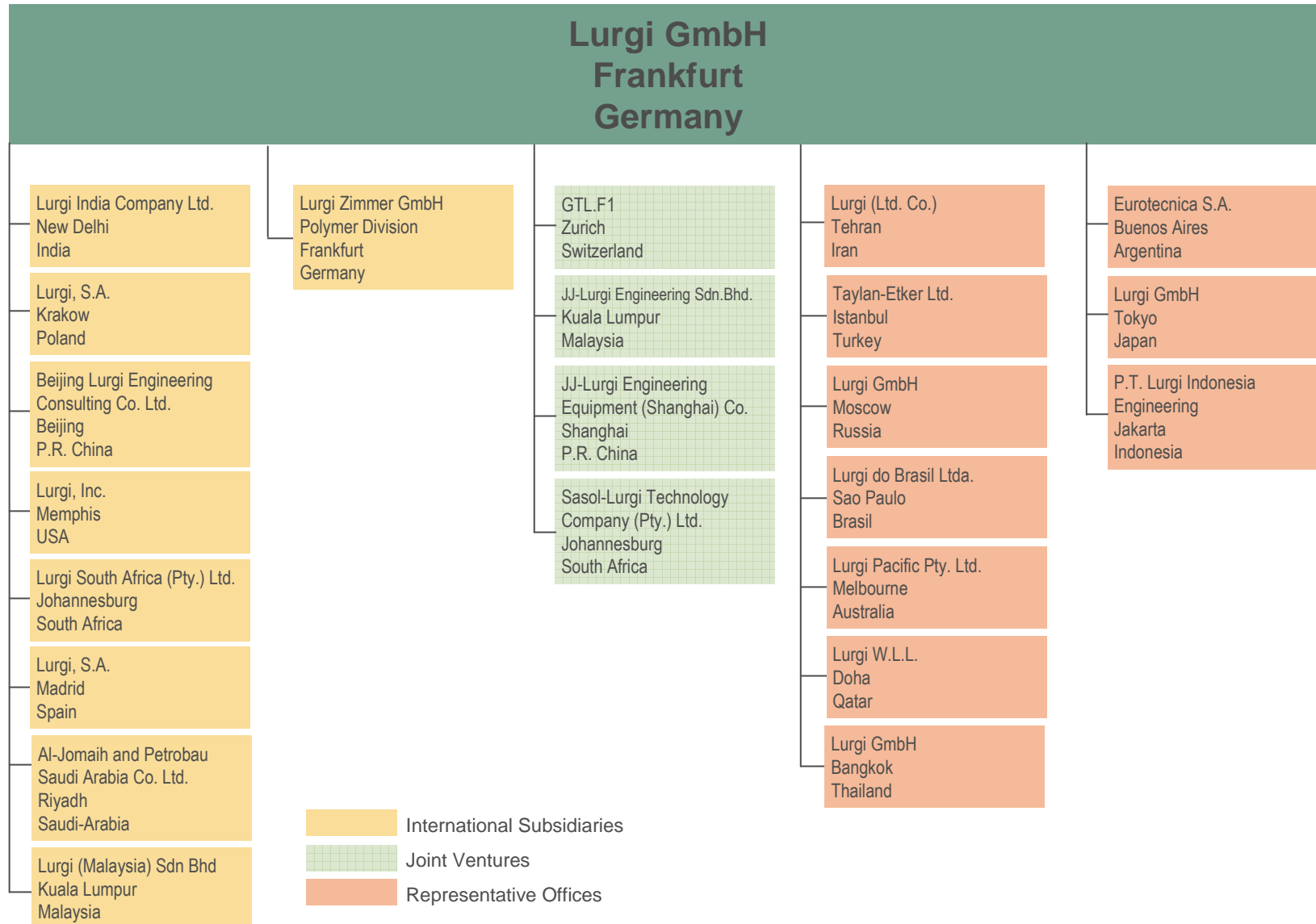
The **technological leadership** is based on proprietary technologies and exclusively licensed technologies in the areas

- gas-to-petrochemical products and synthetic fuels,
- gas generation and treatment,
- refining,
- petrochemical intermediate and end products,
- polymers,
- biofuels,
- food and oleochemicals.

From project development to the turn-key construction of plants through to full plant operation Lurgi globally engineers, builds and commissions plant complexes from a single source and under its overall responsibility.

# Corporate Overview

## Lurgi Group Organisation





**Lurgi is successfully active in the following main fields:**

- Gas-to-Petrochemicals and Gas-to-Synfuels
- Biofuels
- Gas Production and Purification
- Food and Oleochemicals
- Refining
- Petrochemical Intermediates and End Products
- Polymers



Combined Reformer, Moss gas, South Africa

Recently, Lurgi has been able to extend its competence in the field of polymers by integrating Zimmer's technologies and hereby consequently creates whole process chains.



**Lurgi has extensive experience in performing services based on various contract types:**

- Reimbursable Contracts
- Alliance/Incentive Contracts
- Lump Sum Contracts
- EPC (Engineering, Procurement, Construction) Contracts
- LSTK (Lump Sum Turnkey) Contracts

for

- Grassroots Plants
- Revamp/Modernization of Plants
- Expansion of Plants
- Relocation of Plants



Phenol Plant, Antwerp

# Lurgi Product Portfolio



**Traditional**  
(from crude oil)



**Alternative**  
(from gas & coal)



**Renewable**  
(from biomass)



## Chemicals, Fuels & Energy

- Sel. Refinery Technologies
- Hydrocracker
- FCC
- HDS
- Petchems
- Aromatics
- Polymers

- Syngas
- Hydrogen
- Methanol
- MTP
- DME
- FT
- MPG
- Coal Gasification

- Biodiesel
- Ethylester
- Fatty Acid
- Fatty Alcohol
- Bioethanol



**Alternative**

■ **Gas-to-Chemicals and Gas-to-Synfuels**

- MegaMethanol<sup>®</sup>
- Methanol to Propylene (MTP<sup>®</sup>)
- Methanol Derivatives
- Methanol as an Energy Source (MtPower<sup>®</sup>)
- Integrated Production Complexes (Megamint<sup>®</sup>)
- DME
- Coal Gasification
- Fischer-Tropsch
- Gas-based Refinery

**Alternative**

■ **Gas Production and Purification**

- Steam Reforming
- Autothermal Reforming
- Combined Reforming
- Pre-Reforming
- Synthesis Gas Complexes (MegaSyn<sup>®</sup>)
- Partial Oxidation (MPG)
- Claus / OxyClaus<sup>®</sup>
- RECTISOL<sup>®</sup>
- PURISOL<sup>®</sup>
- SULFREEN<sup>®</sup>
- Lurgi Tailgas Treatment (LTGT<sup>®</sup>)
- OmniSulf<sup>®</sup>
- AQUISULF<sup>®</sup>
- MDEA, aMDEA<sup>®</sup>

## Technology Expertise Lurgi's Technology Portfolio II



### Traditional

#### ■ Petrochemical Intermediates and End Products

- Olefins
- Butadiene
- Phthalic Anhydride
- Terephthalic Acid (E PTA)
- Acrylic Acid
- Polymers

### Traditional

#### ■ Selected Refinery Technologies

- Hydrocracker
- FCC
- HDS
- Aromatics
- Upgrading



### Renewable

#### ■ Food and Oleochemicals

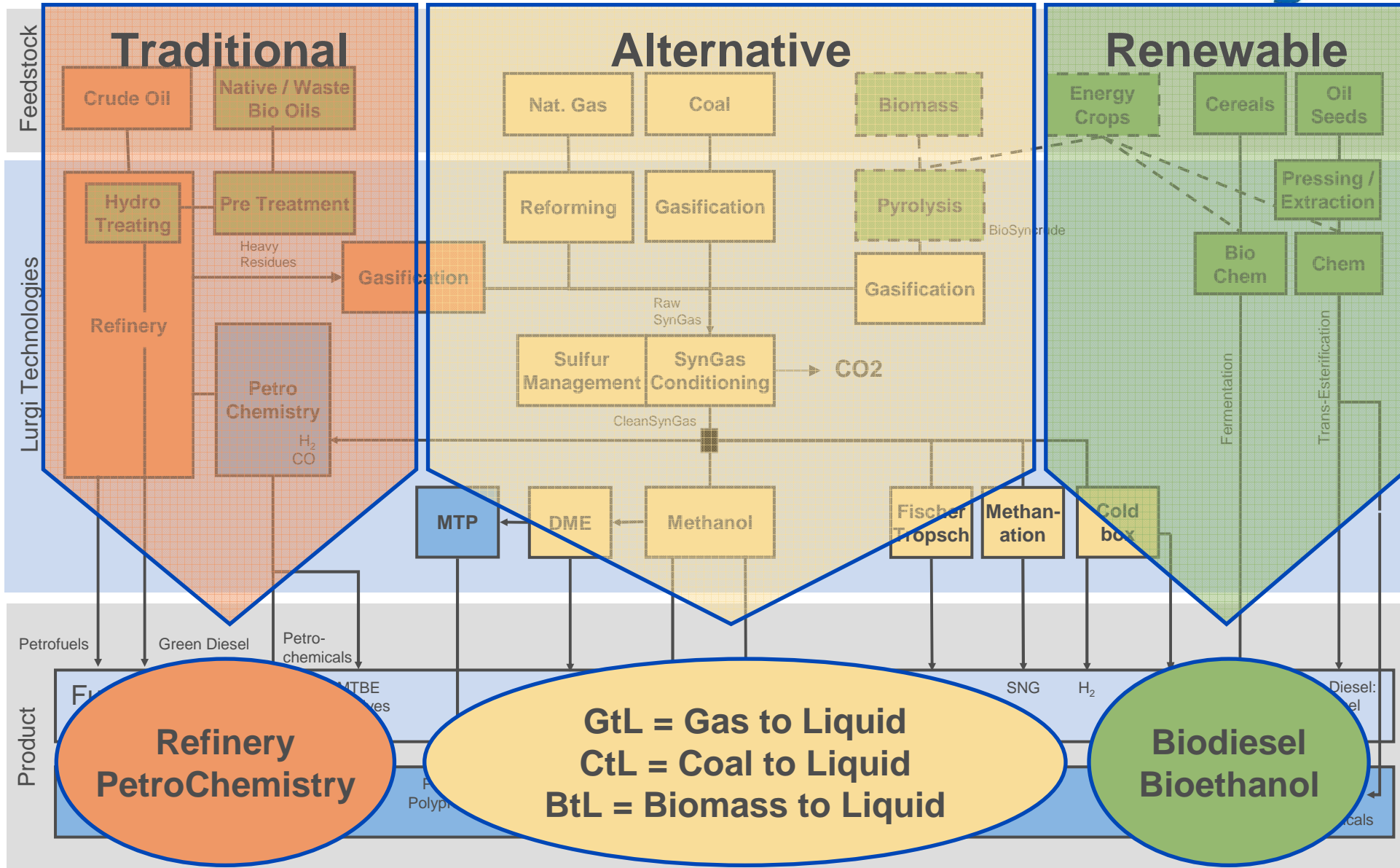
- Starch and Derivatives
- Sweeteners
- Extraction of Seeds
- Refining of Edible Oil
- Fatty Acids
- Fatty Alcohol

### Renewable

#### ■ Biofuels

- Biodiesel
- Bioethanol
- Energy from renewable resources

# Advanced Fuels and Chemicals Technologies by AL & Lurgi Main Process Streams for Fuels and Chemicals



## Selected Reference Projects Main References within the last Ten Years



Out of a large number of references, Lurgi has executed the following number of projects within the last ten years:

	Capacity Range (per unit)	No. of references within the last ten years
■ Steam Reformers	200,000 - 6,400,000 Nm <sup>3</sup> /d	18
■ Autothermal Reformers	80,000 - 7,200,000 Nm <sup>3</sup> /d	8
■ Pressure Gasification	200,000 - 7,000,000 Nm <sup>3</sup> /d	15
■ Methanol Synthesis	5,000 - 1,000,000 t/a	11
■ MegaMethanol Synthesis	1,650,000 - 2,200,000 t/a	9
■ Rectisol	300,000 - 16,000,000 Nm <sup>3</sup> /d	17
■ Amine Gas Treating	10,000 - 6,000,000 Nm <sup>3</sup> /d	27
■ Sulfur Recovery (Claus/OxyClaus®)	5 - 1,000 t/d	55
■ Phthalic Anhydride	2,000 - 140,000 t/a	9
■ Butadiene Extraction	17,000 - 180,000 t/a	10
■ Propane Dehydrogenation	350,000 t/a	2
■ Polyester	3 - 600 t/d	159
■ Polyamide	30 - 240 t/d	21
■ Staple Fiber	60 - 200 t/d	19
■ High Speed Spinning	5 - 500 t/d	36
■ Biofuels	40,000 - 250,000 t/a	80
■ Oleochemicals	Specific to technologies	131

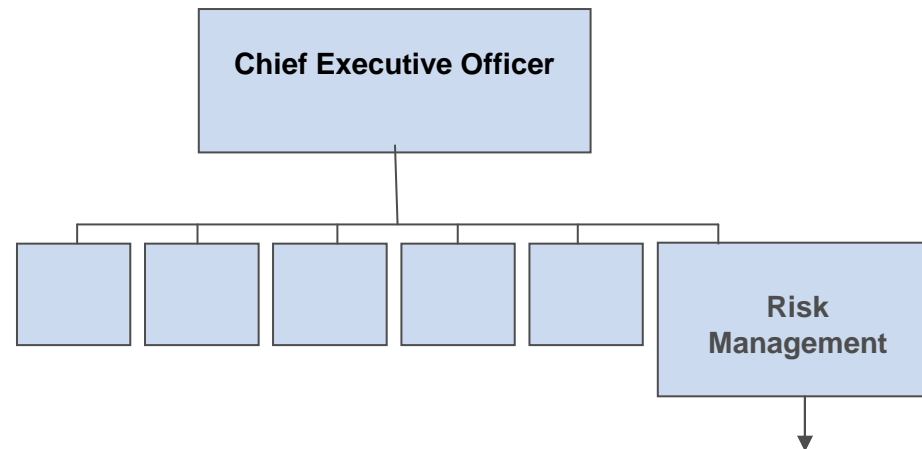
## Development of Risk Management in Lurgi



### Coming from

- solid basis of existing internal procedures and guidelines regarding Risk Management
- main responsibility with proposal/ project managers
- **Following compulsory legal requirements (KonTraG)**
  - formal installation of RAAC (Risk Assessment and Advisory Committee)
  - reporting to the Board of Directors
- **Following the acquisition by Air Liquide leading to**
  - Risk Management established as a corporate function directly reporting to CEO as of January 1, 2008

## Implementing Company Overview Risk Management on corporate level (1)



As of 01.01.2008 direct report to CEO

### Reasons

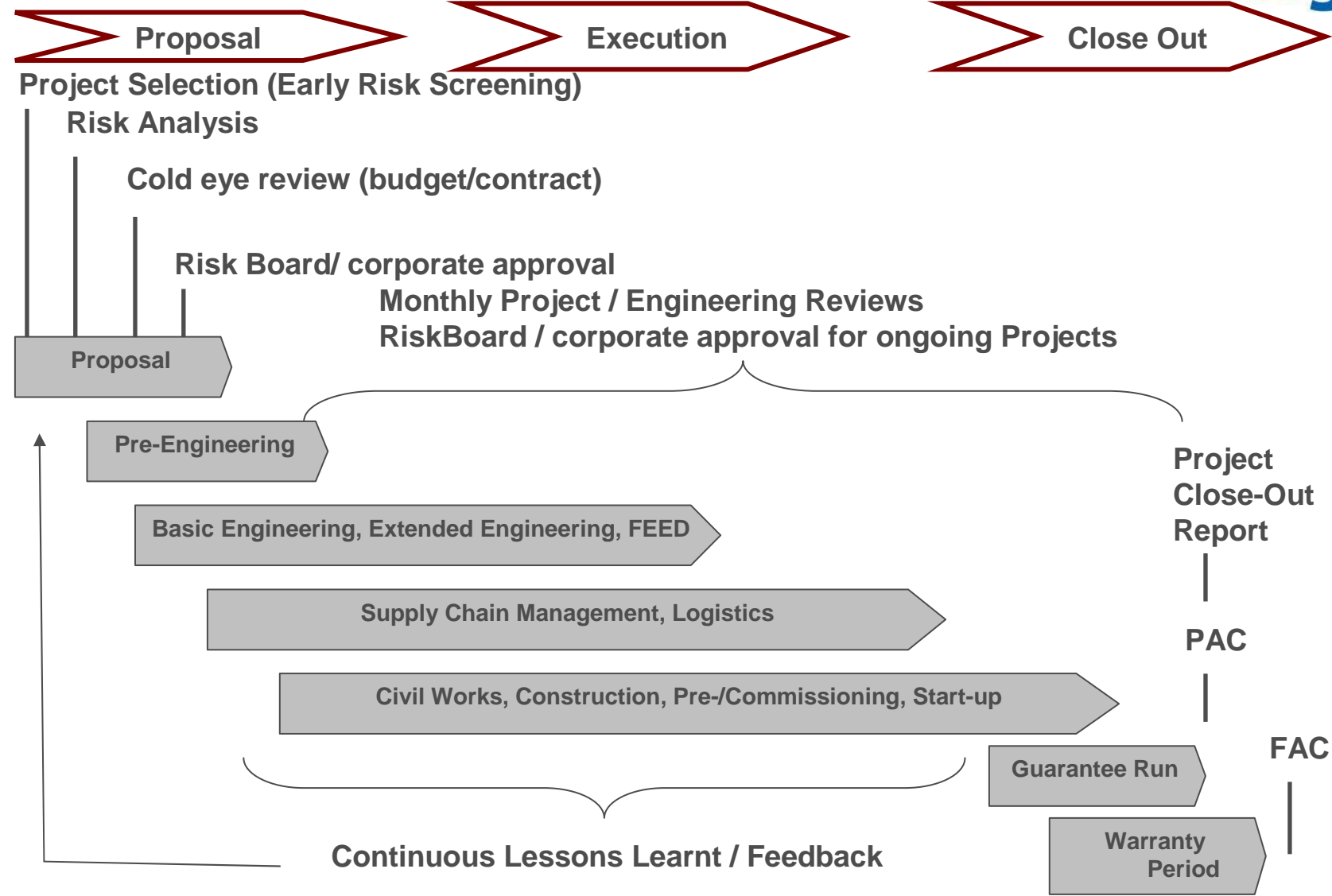
- Increasing complexity of projects and the related execution structure
- Financing and equity requirements reflecting the group interest and lead to long lasting obligations exceeding plant construction
- Increase predictability of project results and P&L influence
- Meet increasing requirements of clients, shareholders, market and auditors
- Improve competitiveness



## Targets

- Trigger risk identification and related mitigation at the earliest possible time as well as continuously during the lifecycle of a project
- Strengthen risk awareness throughout the organization
- Define process resources, responsibilities and tools
- Implement tools – organize training
- Moderate the processes; support and consult operations
- Develop experts/ expertise
- Strengthen risk monitoring – feed back loop from execution back to proposals
- Identify opportunities

# Risk Management Process on Project Level (1)



## Risk Management Process on Project Level (2)



### Step 1 Project Selection

- early risk screening by applying “Preliminary Risk Identification Format”
- Risk Management as a member of project selection committee

### Step 2 Risk Analysis Meeting (1 - 3 days) for each Proposal

- moderated by Risk Management
- involving all disciplines
- resulting in a „Project Risk Register“ accompanying the project during its full lifecycle (based on severity/probability matrix)

### Step 3 Cold Eye Reviews of budget / contract

### Step 4 Internal Project Approval procedure Risk Board chaired by Risk Management / Corporate Approval

### Proposal Submission

## Risk Management Process on Project Level (3)



Execution

Close Out

### Step 1 **Project Review Meetings** on a monthly basis

- Continuous update of “**Project Risk Register**”
- Continuous process of re-evaluation of identified risks
- Continuous risk monitoring
- Management of contingencies
- Resubmission to Risk Board, if required

### Step 2 **Engineering Review Meetings**

### Step 3 “**Lessons learnt**” – Feedback into proposals prior to close-out of project

### Step 4 **Close-out report**

**Responsibility:** Project Manager

## Upcoming Tasks



- Delegate Risk Manager for each Project
- Create database resulting from “Project Risk Register”
  - major risk areas
  - type and cost of mitigation
  - Re - Evaluation of severity and probability matrix
- Improve database resulting from “Lessons learnt”
- Establish Risk Manual for / together with clients
- Check implementation of specific risk related software

Thank you  
for your attention!