ABB in Germany, GCC Open Pit Mining – Ulf Richter Hoist and Haul conference 2015/Stockholm

Benefits of high powered GCDs Applied to medium power conveyors

Presentation Contents
Gearless conveyor drives (GCD)

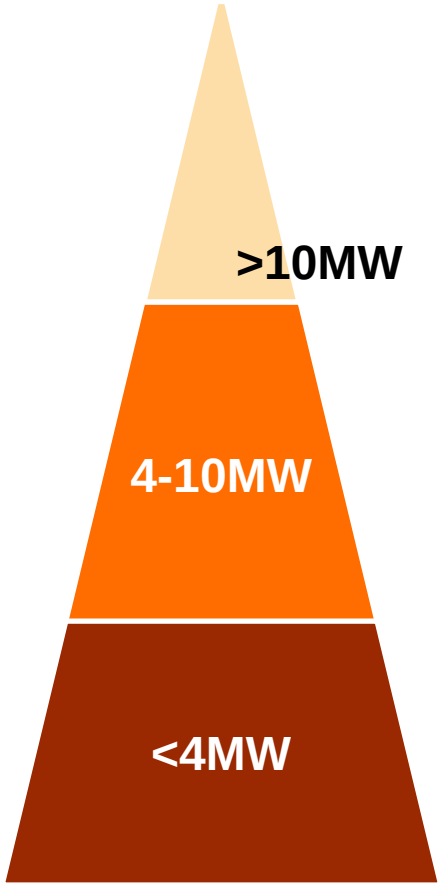
- ABB conveyor classification according power rating
- High level benefits of gearless and high power GCD design
- Challenges and motor alternative for the medium power segment
- Feasibility study: Retrofit of a 900kW conveyor drive
- ROI study

Conveyor classification
According to installed power per conveyor

High power

Medium power

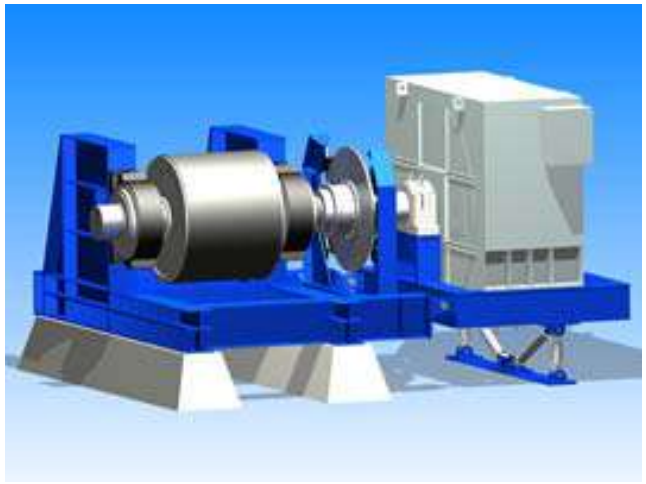
Low power



High Power GCD
Solution for the increasing efforts

Source:

tenova TAKRAF



- Less maintenance
- Less monitoring and testing
- Less components/ Higher reliability
- Higher equipment utilization
- Lower production losses
- Higher efficiency

Overland conveyor
Geared medium power drive configuration

Angular gear box
and brake:

Limited to ~3500kW

Pulley

2 x 1250 kW,
998 min^{-1}, 690V

Coupling

Brake

Pulley with antifriction
bearings

Frequency Converter
ACS800

Keeping gearbox availability high
Gearbox testing

Gearbox test rig

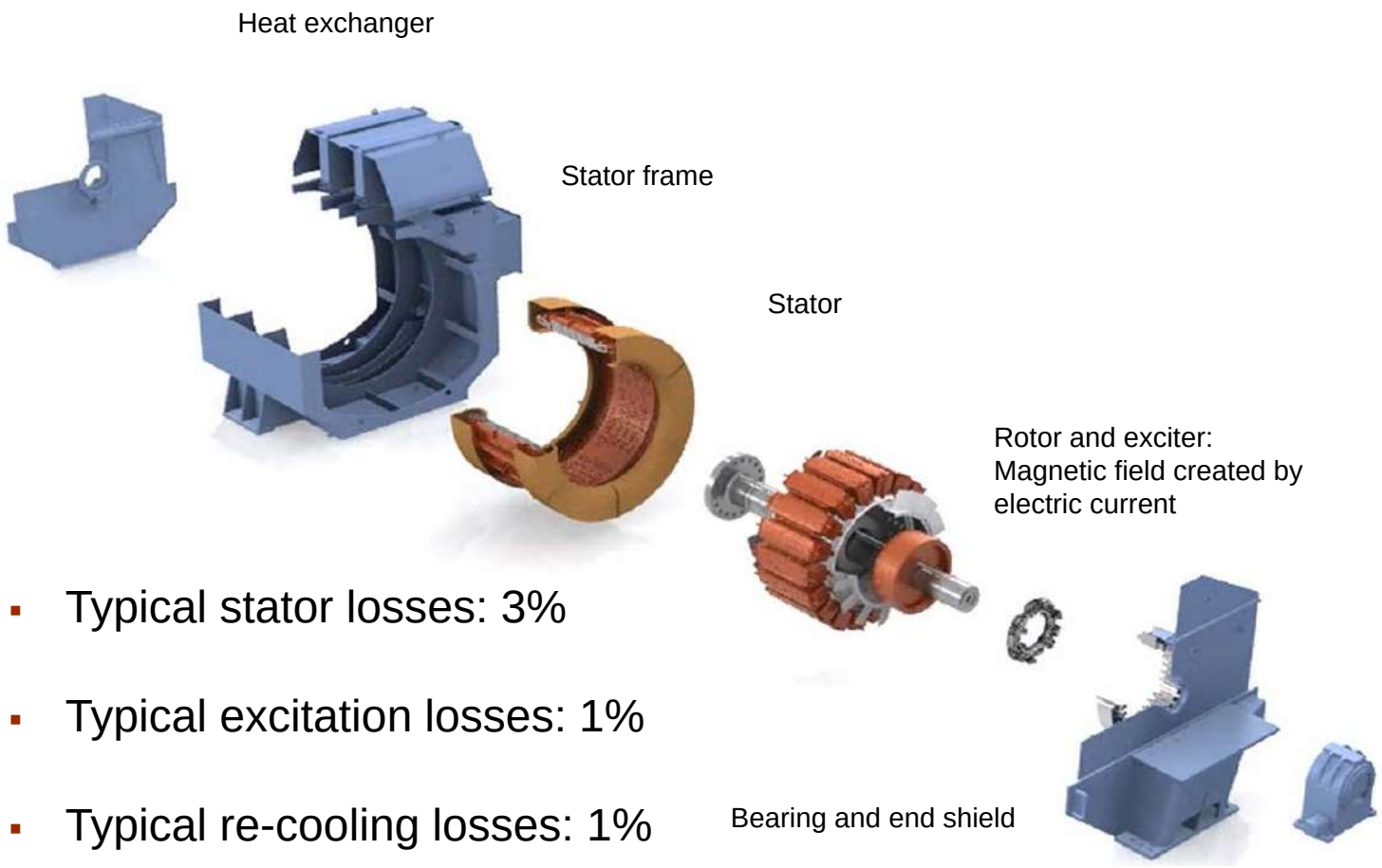
- To guarantee gearbox availability requires strict quality management
- Test of new and overhauled gearboxes is necessary
- Even new gearboxes do not pass the test
- Cost and expertise for gearbox testing

High power synchronous motor (oil and gas)
AMZ2500 synchronous motor (SM)

High power low speed synchronous motor
Conventional with air-to-water closed circuit cooling

A fully enclosed motor (IP54) using an air-to-water heat exchanger (IC8A1W7)

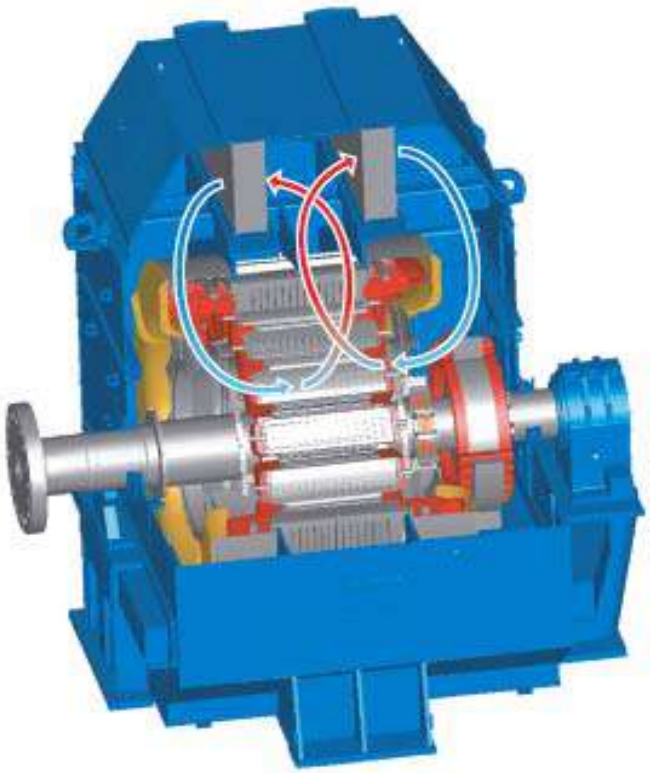
Electrical field excitation in rotor, hence rotor losses



- Typical stator losses: 3%
- Typical excitation losses: 1%
- Typical re-cooling losses: 1%

High power low speed synchronous motor
Conventional with air-to-water closed circuit cooling

A fully enclosed motor (IP54) using an air-to-water heat exchanger (IC8A1W7)



- Closed air cooling circuit through motor's active parts and through air-to-water heat exchanger
- External liquid cooling circuit necessary
- Limited overall energy efficiency

The challenge of medium power conveyors
Mobility and space constraints in many cases

Challenge: Uplifted position of motors and dusty environment

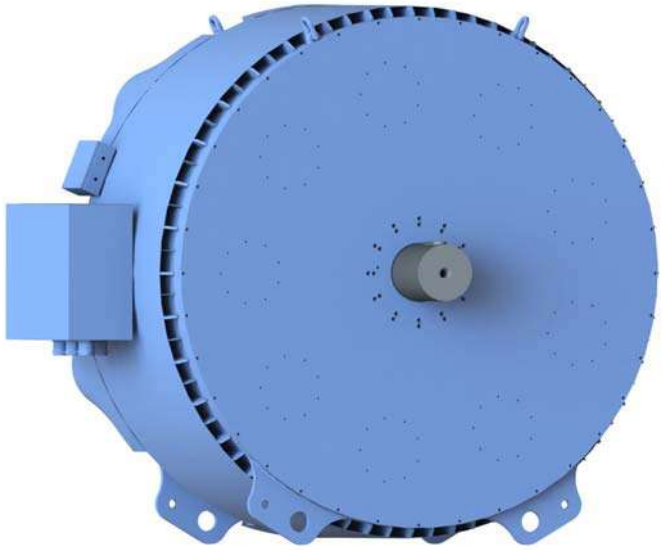
- No rigid concrete foundation possible
- Drive train weight restrictions
- Liquid cooling difficult in Open Pit Mines

The challenge of medium power conveyors
Drive train requirements

- Compact motor size
- Low weight drive train
- Air to air cooling
- Lean motor design
- Easy to align
- Overall cost effective

- **Conventional low speed SM cannot meet all of these requirements in the medium power range**
- **Another type of motor is needed**

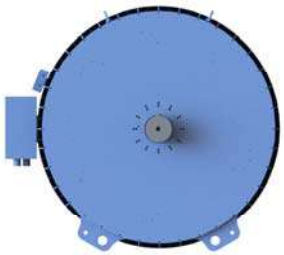
Permanent magnet (PM) motor
Tailor made for gearless conveyor drives

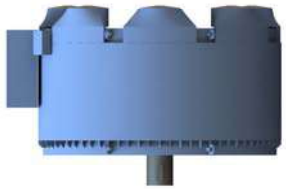


- Permanent magnet motor
- No rotor losses, hence
  - No internal cooling
  - No heat exchanger
  - Lighter and slimmer design
  - Compact in dimensions
  - Less effort for cooling
  - Higher efficiency

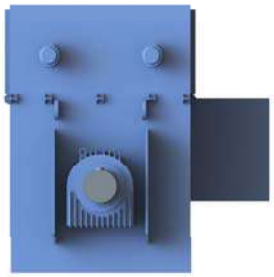
Comparison of dimensions
Synchronous vs. permanent magnet motor

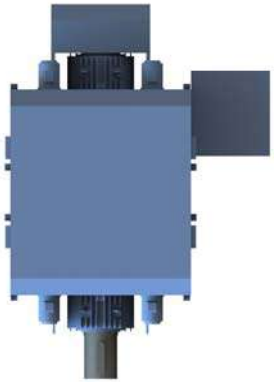
Sync PM

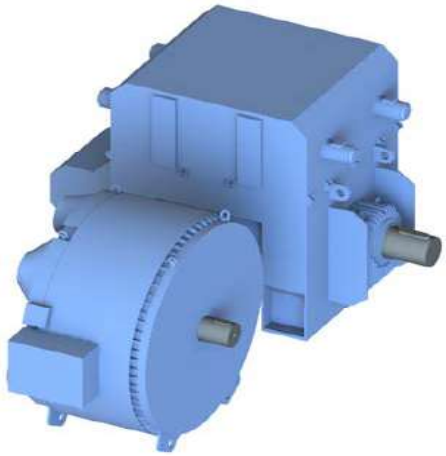




Synchronous

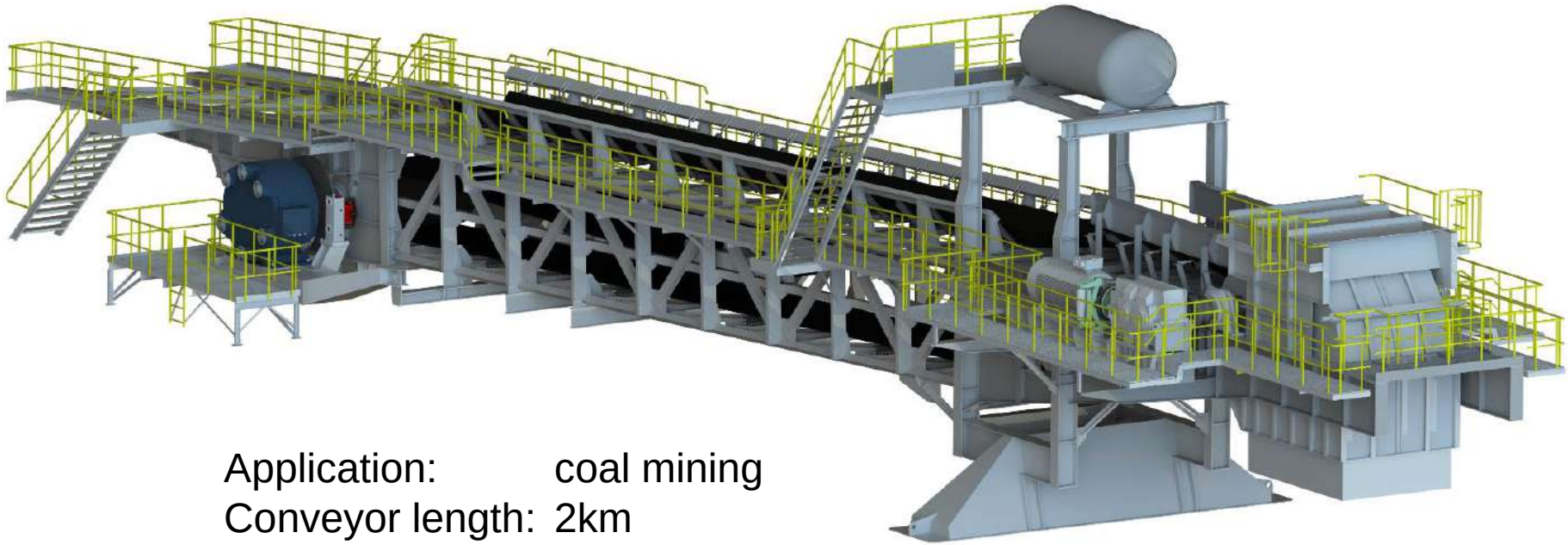






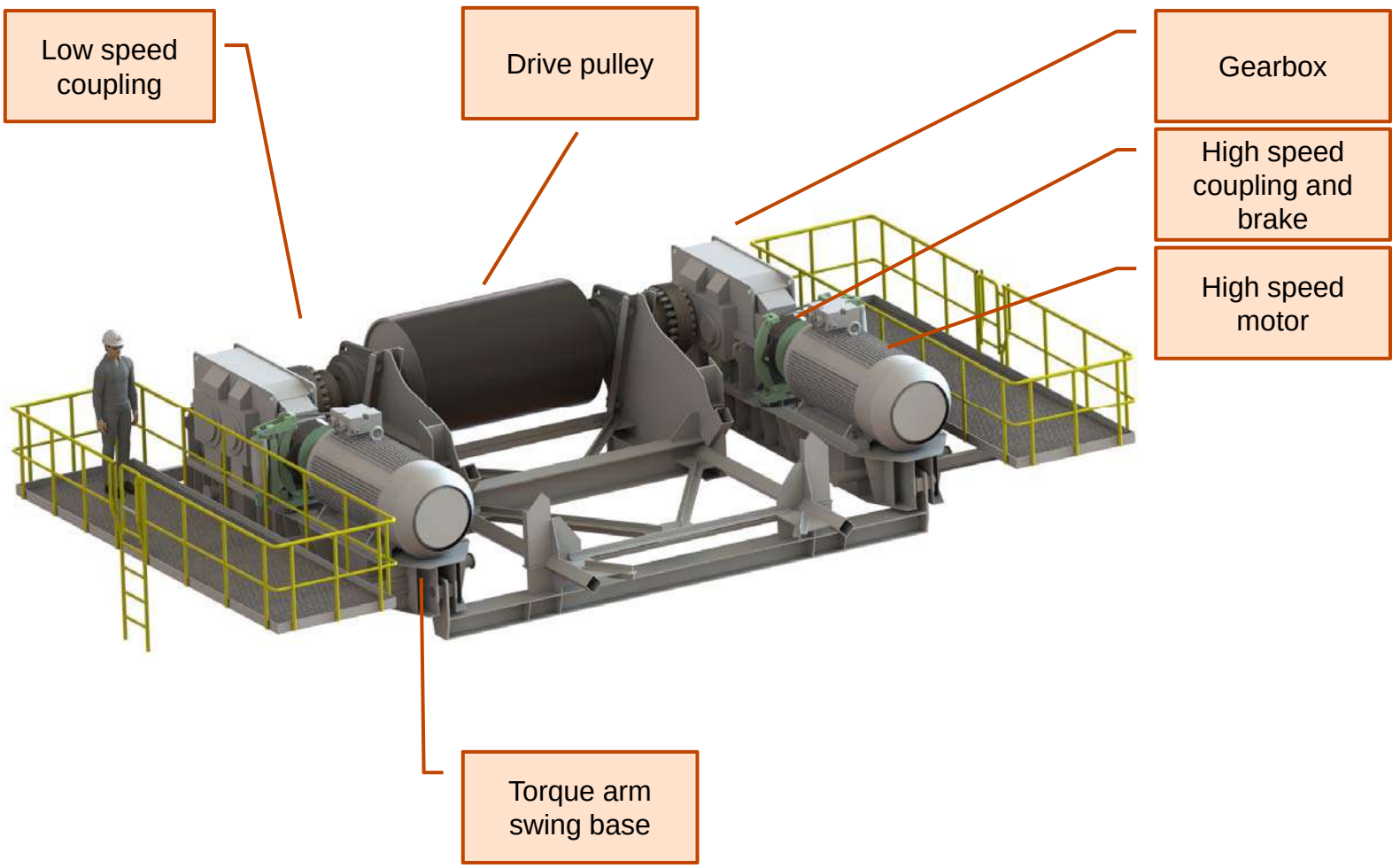
	SyncPM	Sync
Power	1250KW	1250kW
Speed	54rpm	54rpm
Weight	20 tons	38 tons
Lenght	1900mm	4800mm
Width	3500mm	3300mm
Height	3100mm	3400mm

Case study – Medium Power GCD
Retrofit of conveyor drive with GCD

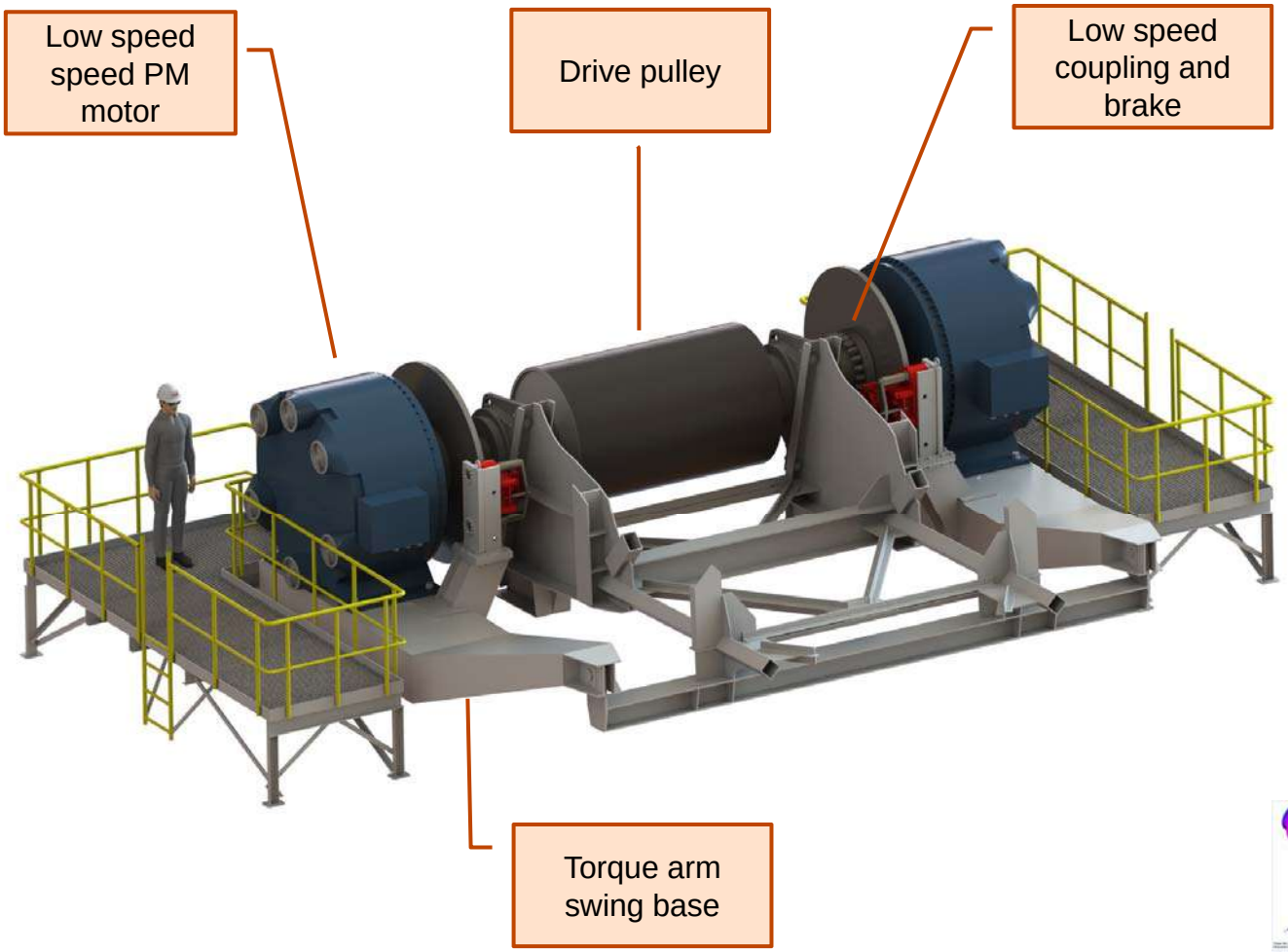


Application:	coal mining
Conveyor length:	2km
Rated power:	4 x 900kW
Belt width:	2m
Pulley speed:	~80rpm
Belt speed:	6,6m/sec
Capacity:	8.000tph

Case study – Medium Power GCD
Retrofit of conveyor drive – existing drive



Case study – Medium Power GCD
Retrofit of conveyor drive – new gearless with PM



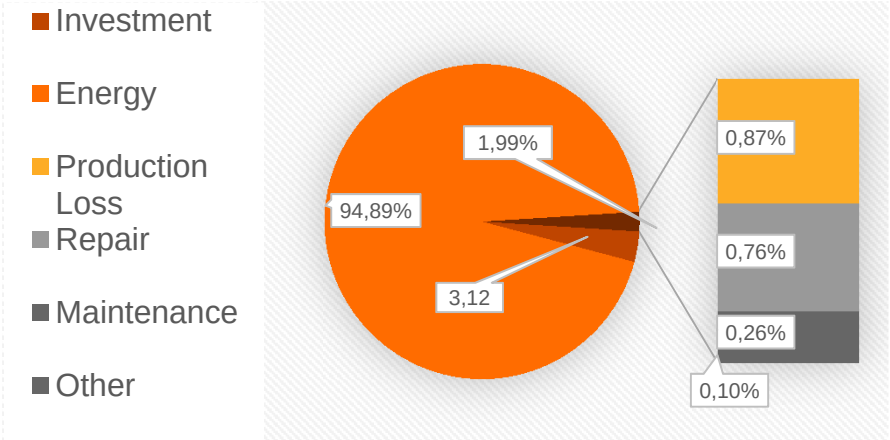
Case study – Medium Power GCD Summary

- Elimination of gearbox possible without major structural reinforcement or modification
- Increased efficiency from ~ 90% up to 94% (electrical + mechanical)

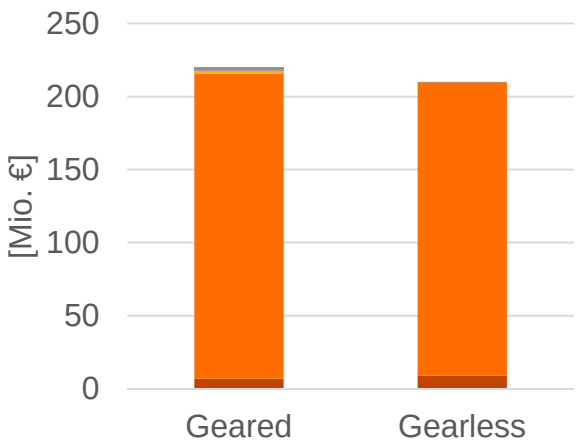
Medium Power GCD vs. Geared conveyor drive
Indicative comparison – total cost of ownership (TCO)

Cost structure

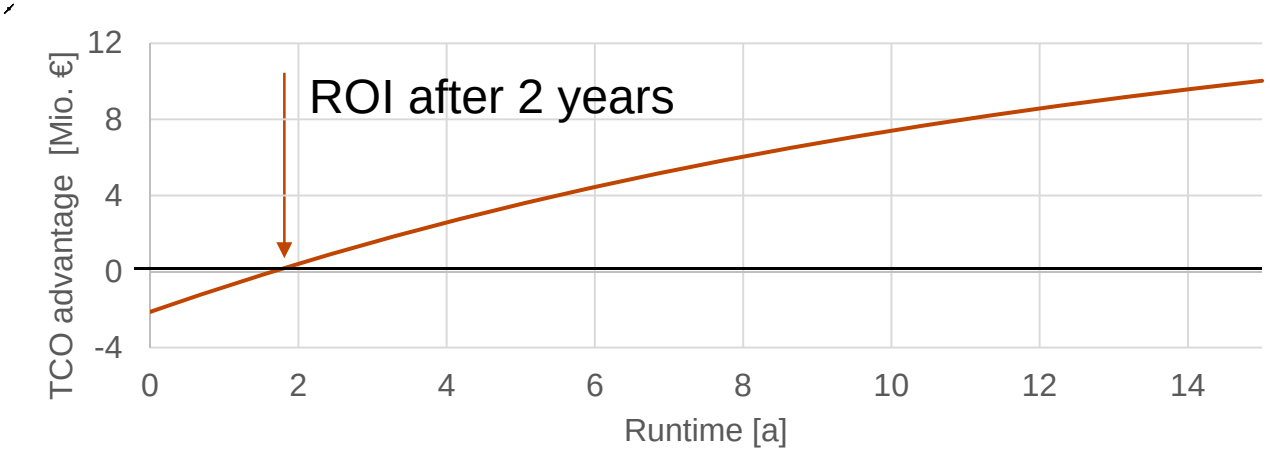
over 15 years



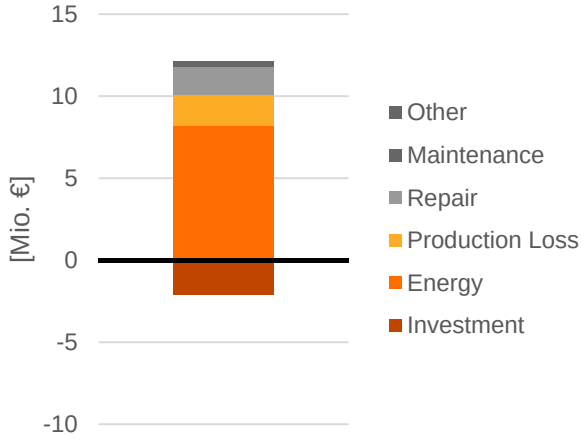
- Example 12 x 1.500 kW drives/ 4 conveyor flights
- 6.987 operating hours/a
- Cost of lost production = 50k€/hour
- Energy = 6ct/kWh



Medium Power GCD vs. Geared conveyor drive
Indicative comparison – Return on Investment



- Total cost of ownership advantage over 15 years:



Summary
Medium power GCD

- Permanent magnet technology allows efficient drive system design

→ l**ess upfront investments than with conventional SM**

- Gearless technology eliminates the need for gear boxes which often cause maintenance downtime

→ **savings in Life Cycle Costing**

- Lean drive configuration and less wear and tear parts increase the availability

→ **reduction of production losses**

- **Return on Investment after few years**

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