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Clean Coal Technologies 2009

Third International Freiberg Conference on IGCC and XtL Technologies

Dresden, Germany
May 18-21, 2009

17 YEARS OF EXPERIENCE GAINED FROM THREE GASIFICATION PLANTS OPERATING IN ITALY

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Introduction

Topics:

- “Learning curve” in design, construction and operation
- High Availability of IGCC plants >90%
- Experience & Lesson learned

Introduction

Contract Summary

Client	<u>ISAB</u>	<u>Sarlux</u>	<u>Eni-EniPower</u>
Contract type	LSTK	LSTK	LS
Scope of work	EPC	EPC	EPC
Contractor(s)	SP(50)/FWI(50)	SP(58)/GE(42)	SP
Licensors(s)	GE(Texaco) Dow/Lurgi	GE(Texaco) UOP/Lurgi	Shell Dow/UOP
Detailed eng.	SP/FWI	SP	SP
Construction	SP/FWI	SP	SP
<u>POWER BLOCK</u>	Ansaldo Industria	GE	AnsaldoEnergia

Projects Overview Summary

SARLUX (~550 MWe)

ISAB Energy (~560 MWe)

ENI (~250 MWe)

- Feedstock: VVR(Tar)
- GE(Texaco) “quench”
- “Low” pressure (38 barg)
- “Physical” SRU (Selexol-UOP)
- Sulphur tail gas recycled
- Hydrogen (Membr.+PSA -UOP)
- 3 x STAG109E (GE/NP)
- 3 gasif.trains + 2 LTGC etc.

- Feedstock: Asphalt
- GE(Texaco) “quench”
- “High” pressure (67 barg)
- “Hybrid” SRU (MDEA-Dow)
- Sulphur tail gas to incinerat.
- Expander
- 2 x V94.2 (Siemens/Ansaldo)
- 2 gasif.+ 1 LTGC etc.

- Feedstock: VVR(Tar)
- Shell “radiant cooler”
- “High” pressure (62 barg)
- “Hybrid” SRU (MDEA-Dow)
- Ni-Carbonyls removal
- Hydrogen (Membr.+PSA)
- 1 xV94.2K(Siemens/Ansaldo)
- 2 gasif.+ 1 LTGC etc.

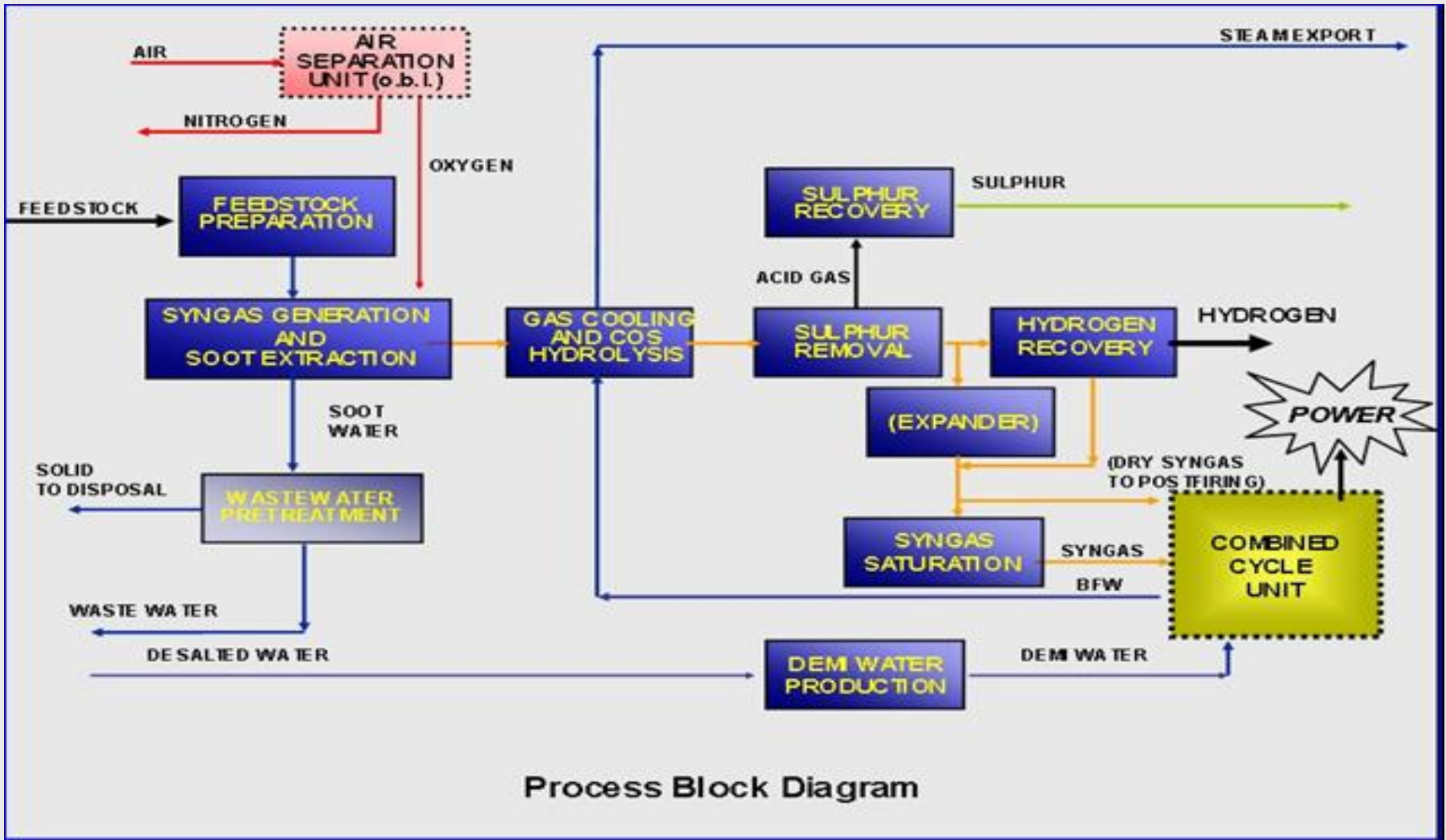
- *Comm.op.: Jan.2001*

- *Comm.op.: April 2000*

Comm. op.: July 2006

Projects Overview

SARLUX IGCC – ISAB IGCC



Projects Overview

SARLUX IGCC – ISAB IGCC



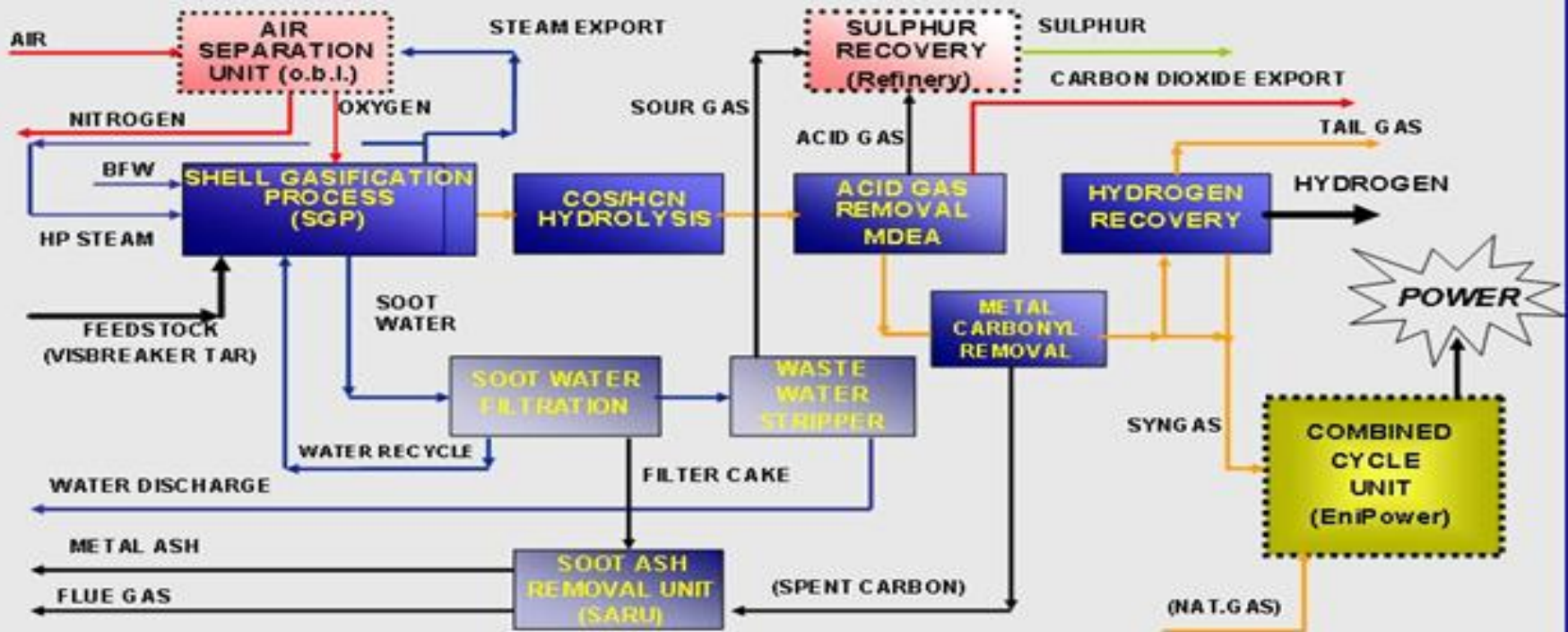
SARLUX IGCC PLANT



ISAB ENERGY IGCC PLANT

Projects Overview

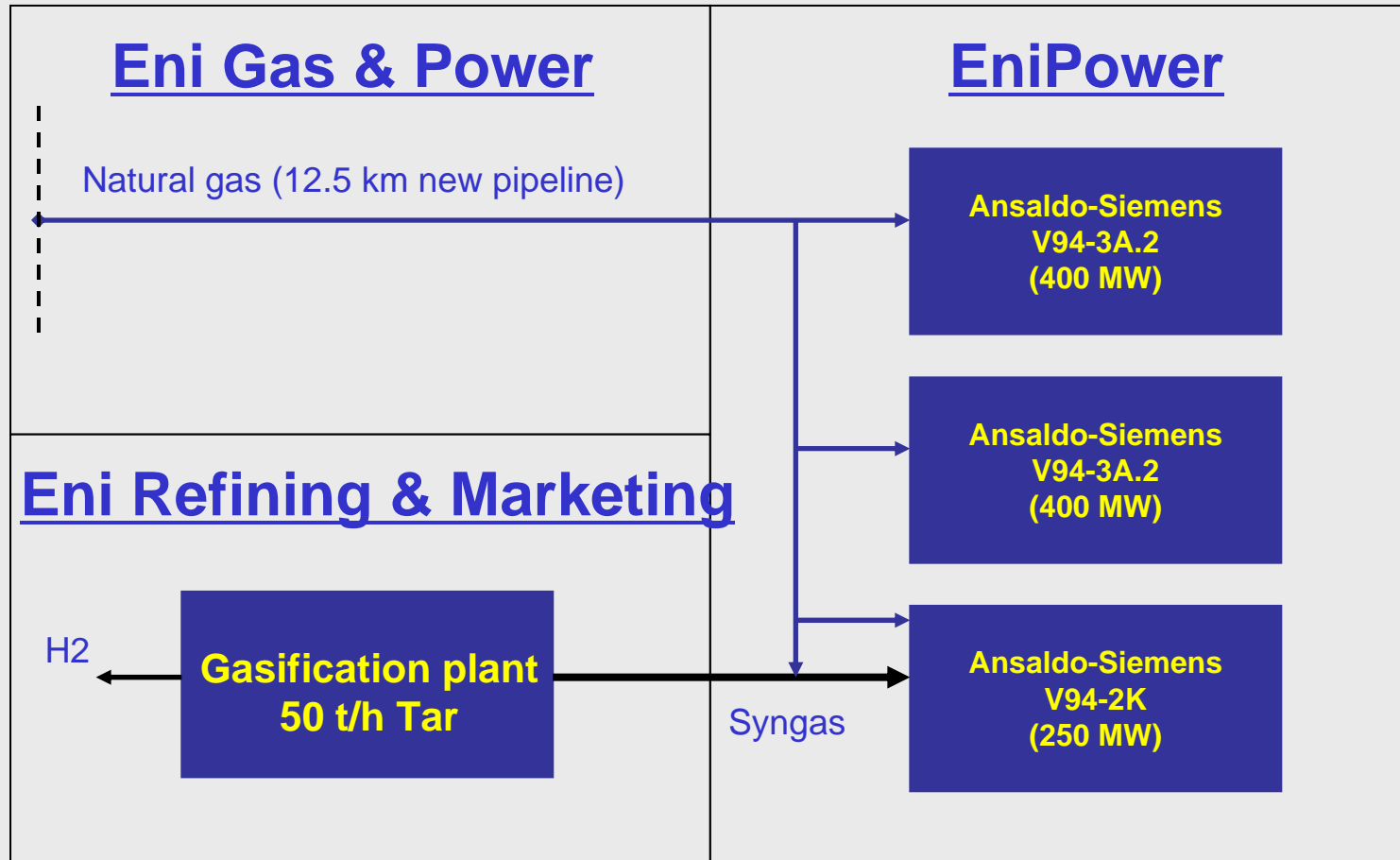
ENI IGCC



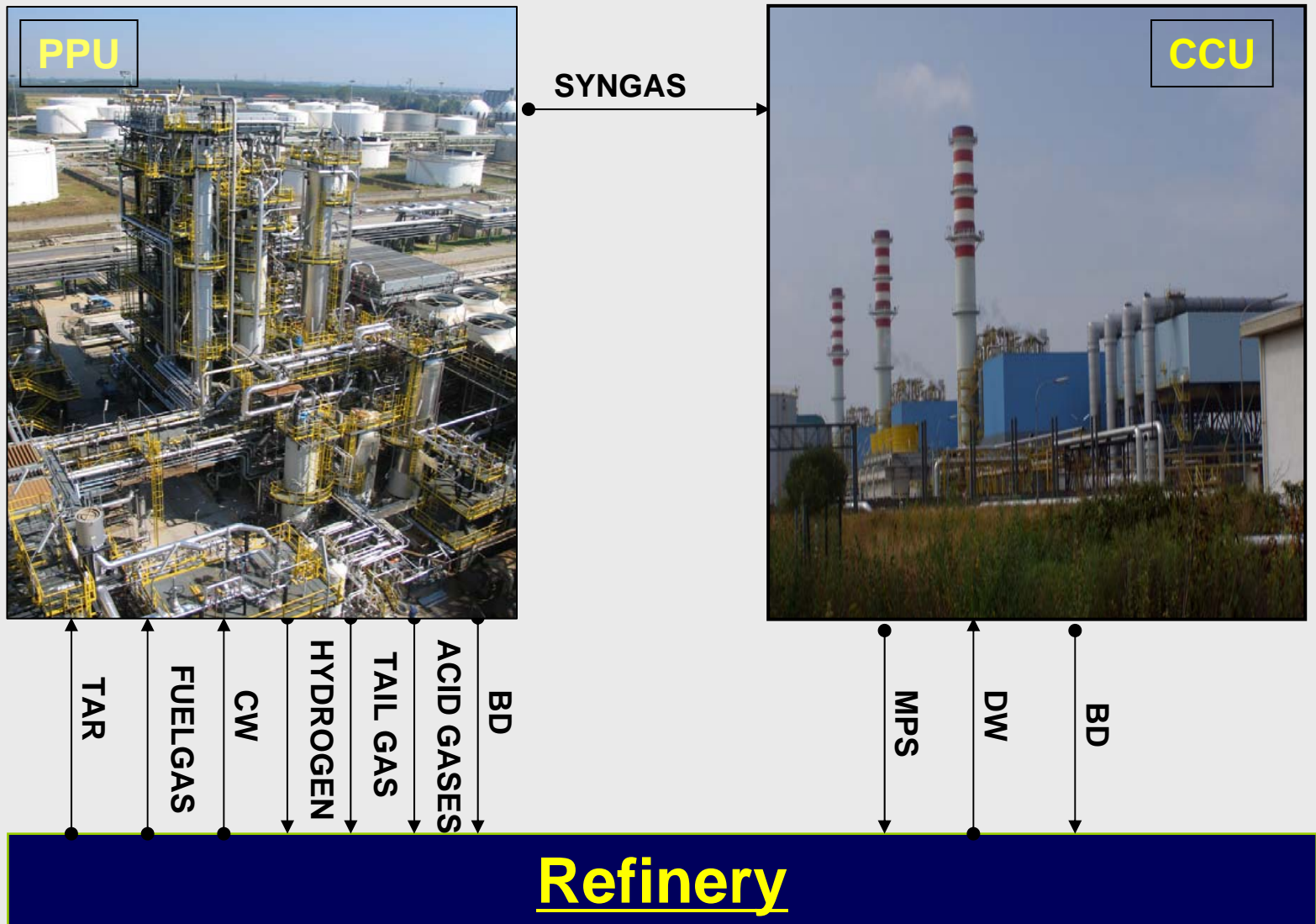
Process Block Diagram

Projects Overview

ENI IGCC



Projects Overview ENI IGCC



(FIRE WATER, IW, WATER TREAT., IA, SIGNAL EXCH., etc.)



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Projects Overview

Feed

		ENI	ISAB	SARLUX
Element composition (dry basis)		VVR TAR	ASPHALT	VVR TAR
Carbon	%wt	85.73	84.33	85.07
Hydrogen	%wt	9.05	7.77	9.15
Sulphur	%wt	3.54	6.0	5.00
Feed flowrate	t/h	50.0	140.0	147.0
HHV	MJ/kg	41.28	38.73	42.47 *
LHV	MJ/kg	39.30	n.a.	38.52

* Calculated value based on element analysis, Dulong formula (ref. Perry and Chilton 1973, par. 9-4).



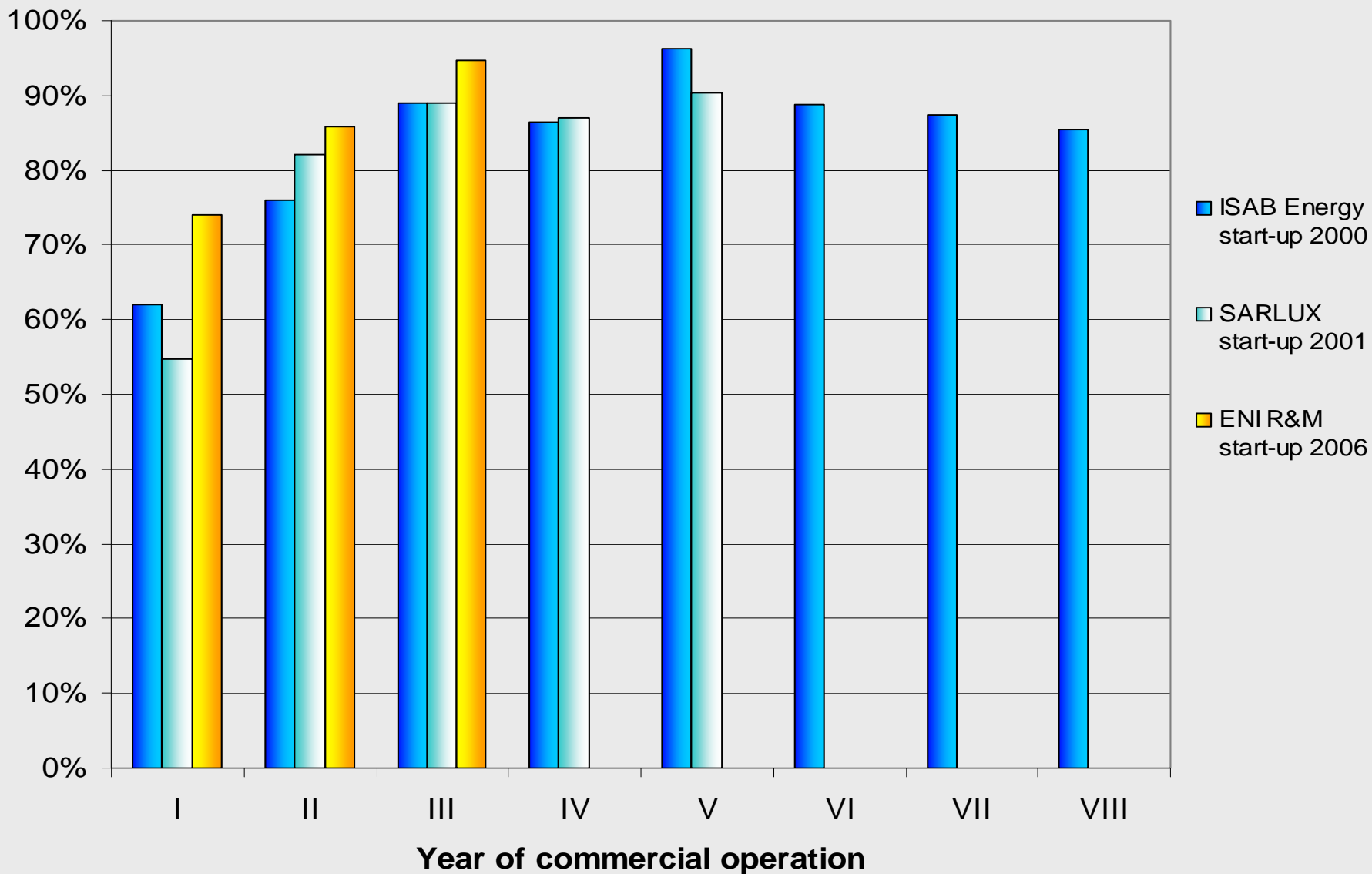
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Projects Overview Products

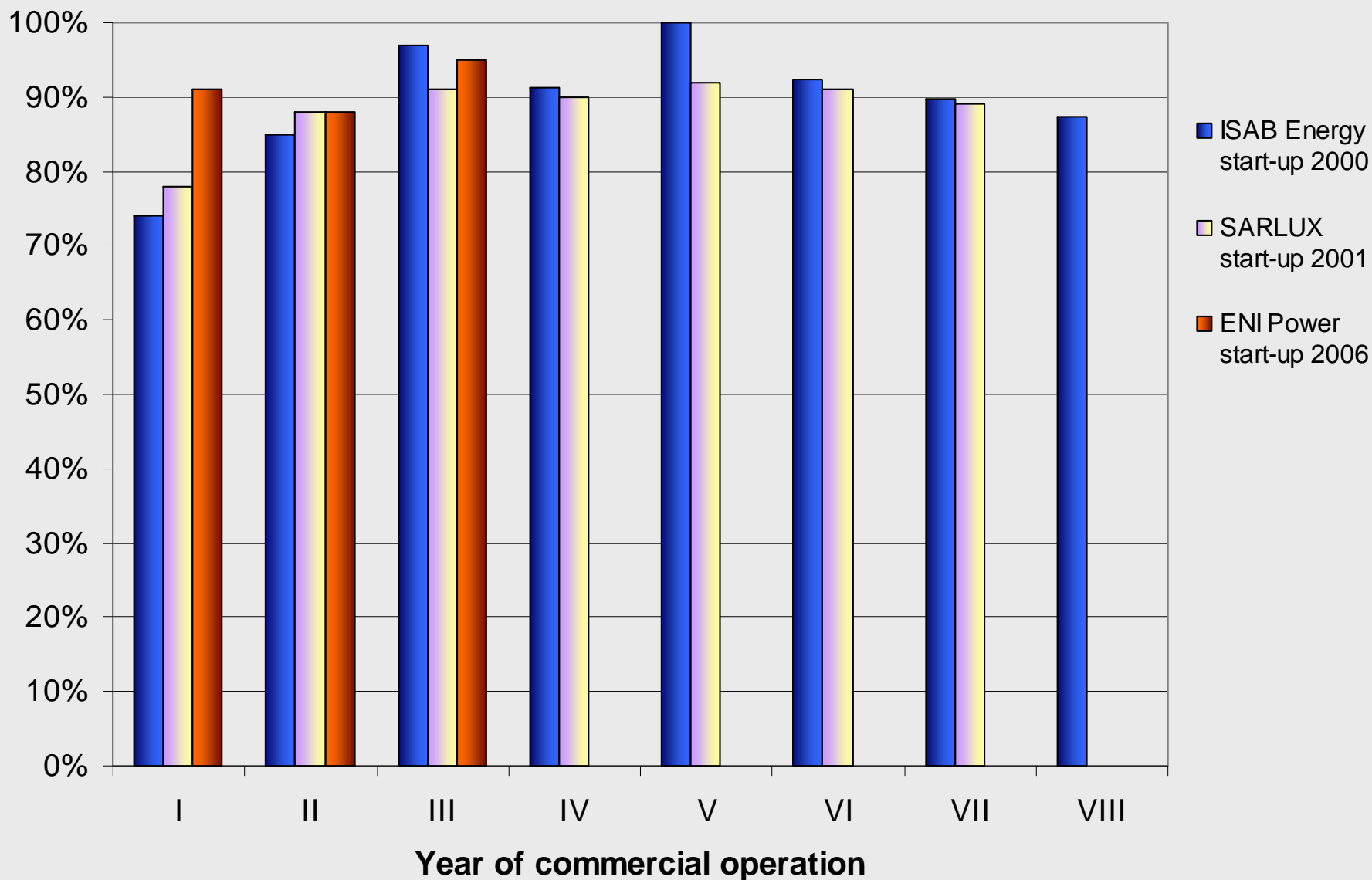
Plant Output		ENI	ISAB Energy	SARLUX
Syngas (no hydrogen production)	t/d t/d	2 280 (2 560)	17 988	12 910
Gross Power	MWe	250	560	550
Hydrogen recovery	Nm ³ /h	38 000	none	60 000
Steam Export	t/h	73 (HP)	n.a.	150 (MP+LP)

Availability

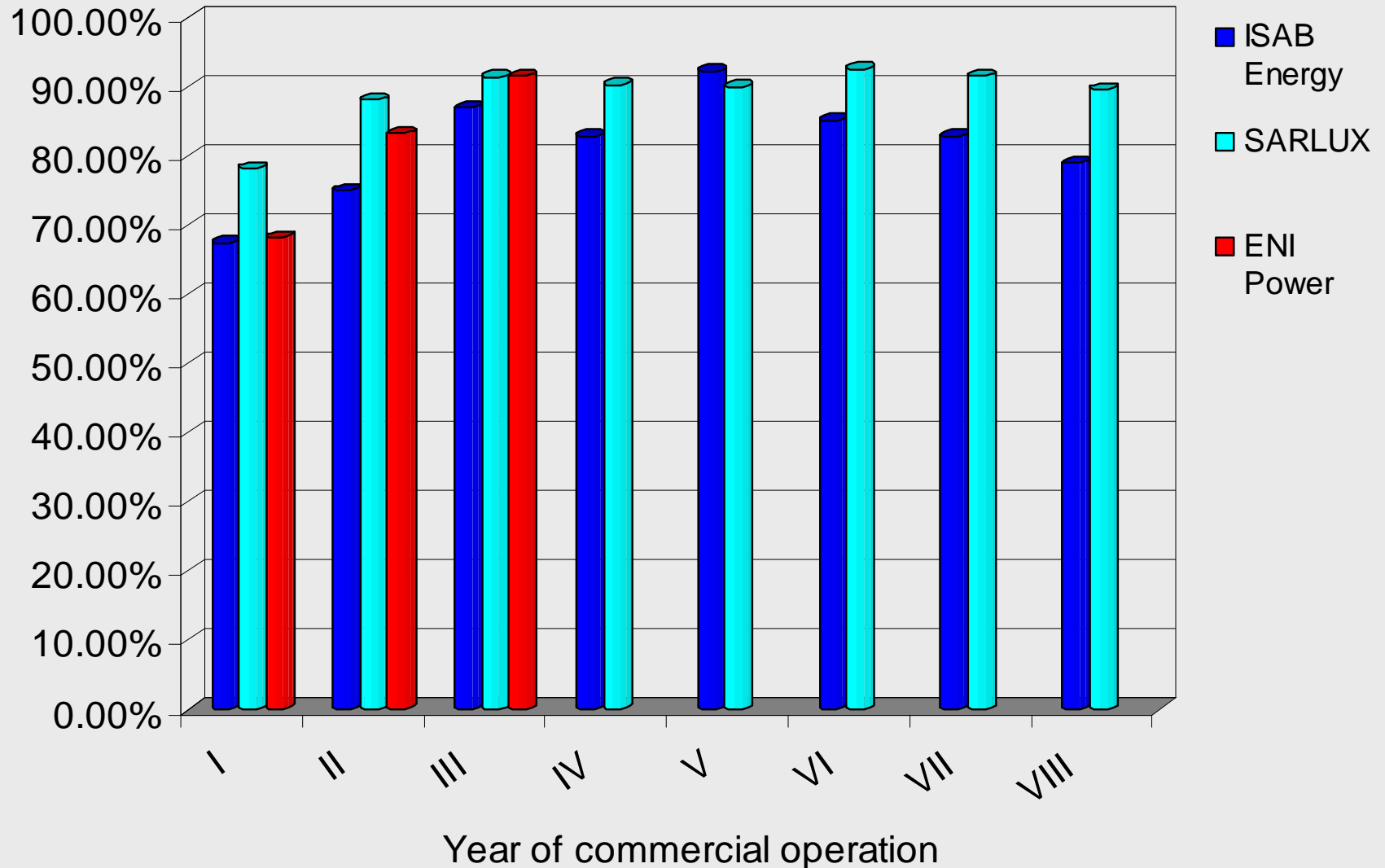
Plant Availability Syngas production



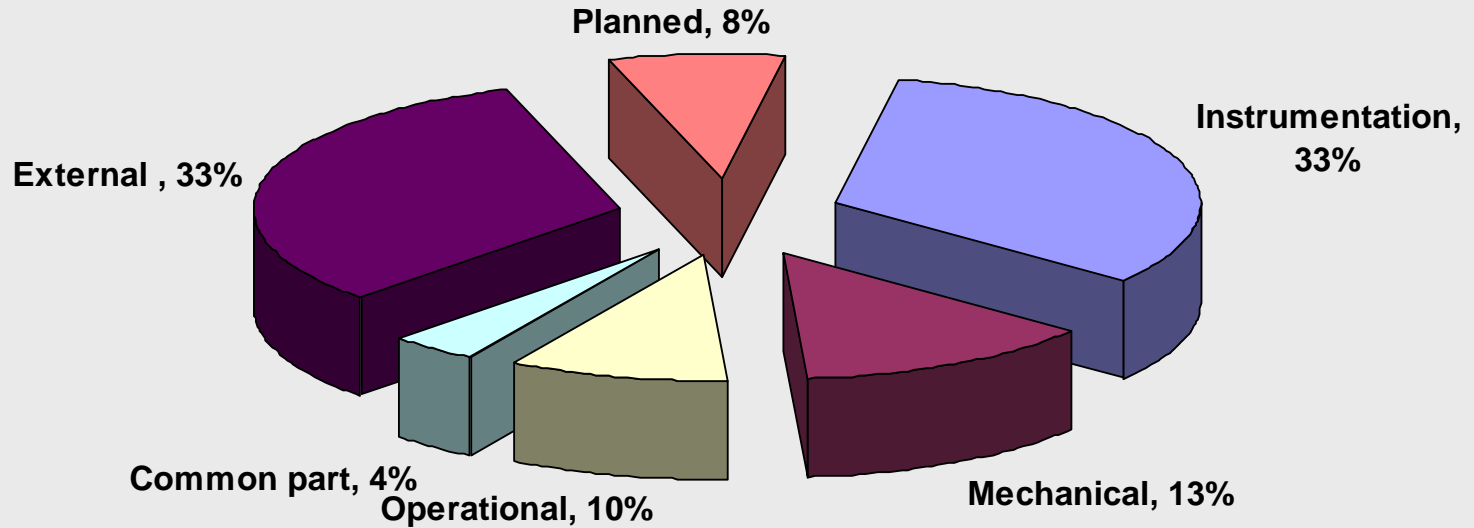
Plant Availability Power production



Power Capacity Factor

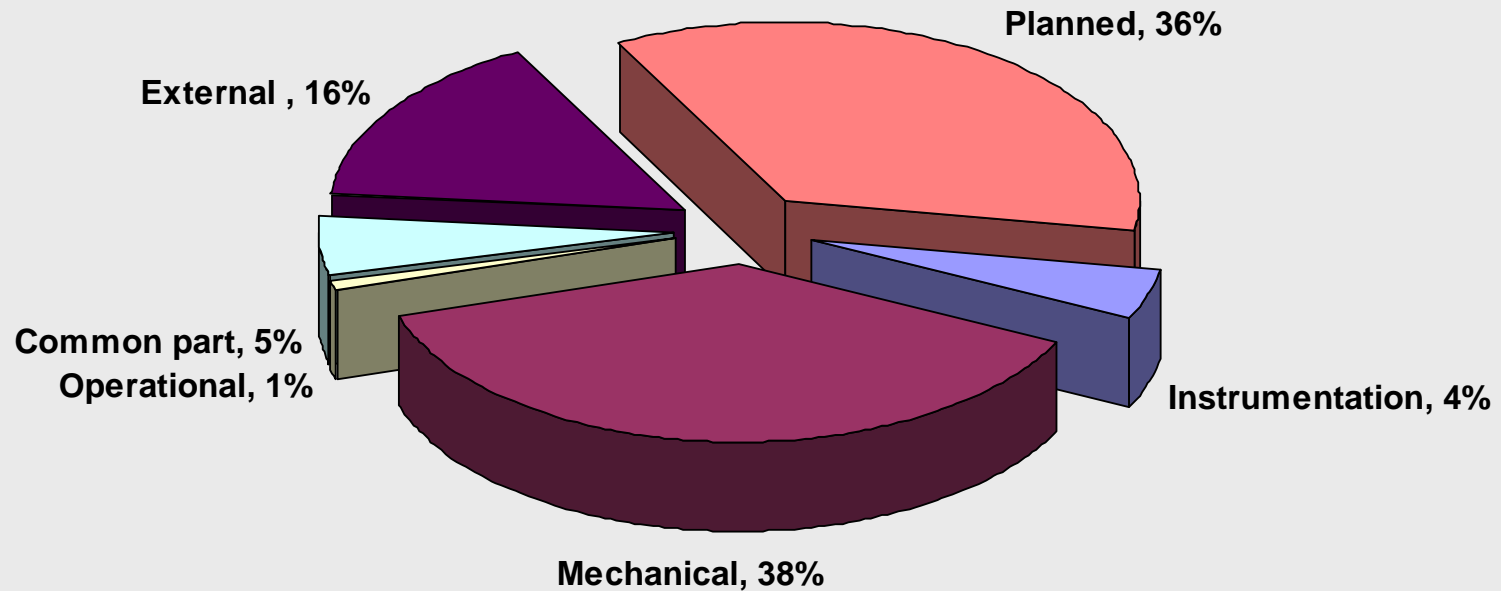


Cause of shutdown distribution ENI R&M Gasification Plant



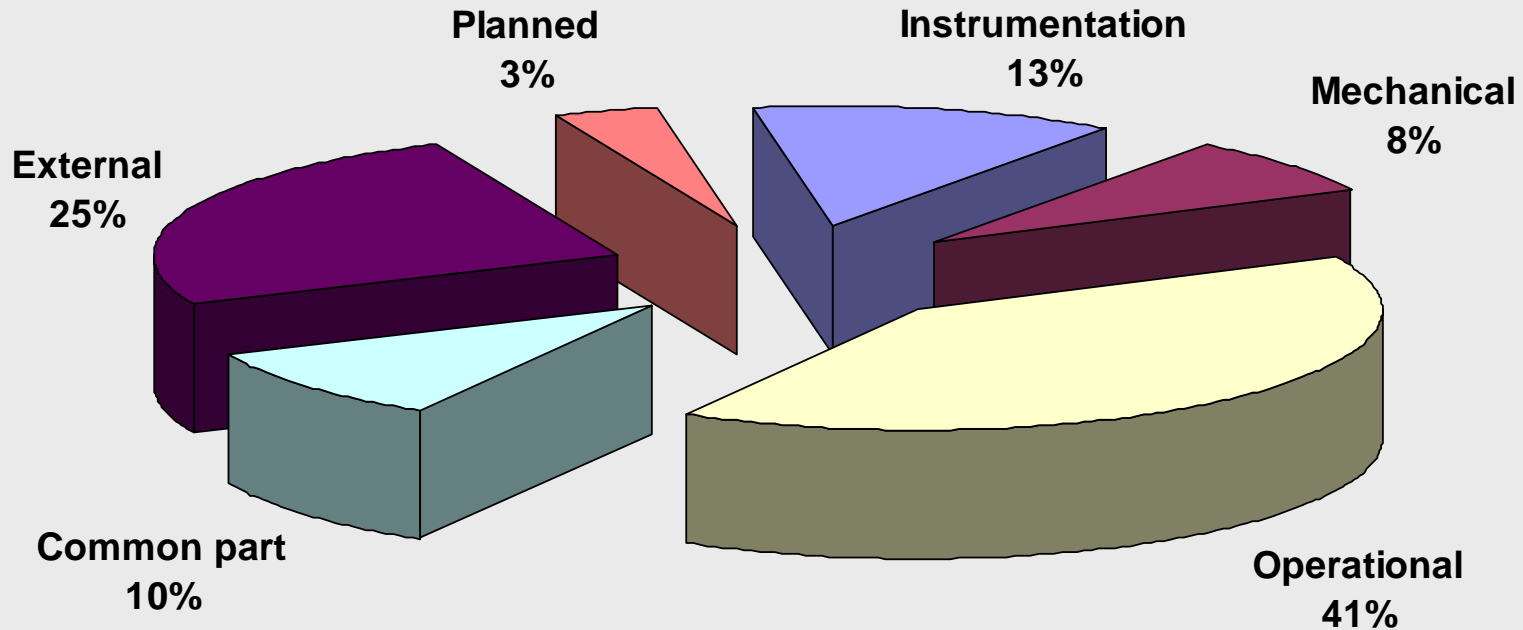
period: 2006 -2008

Duration of shutdown distribution ENI R&M Gasification Plant



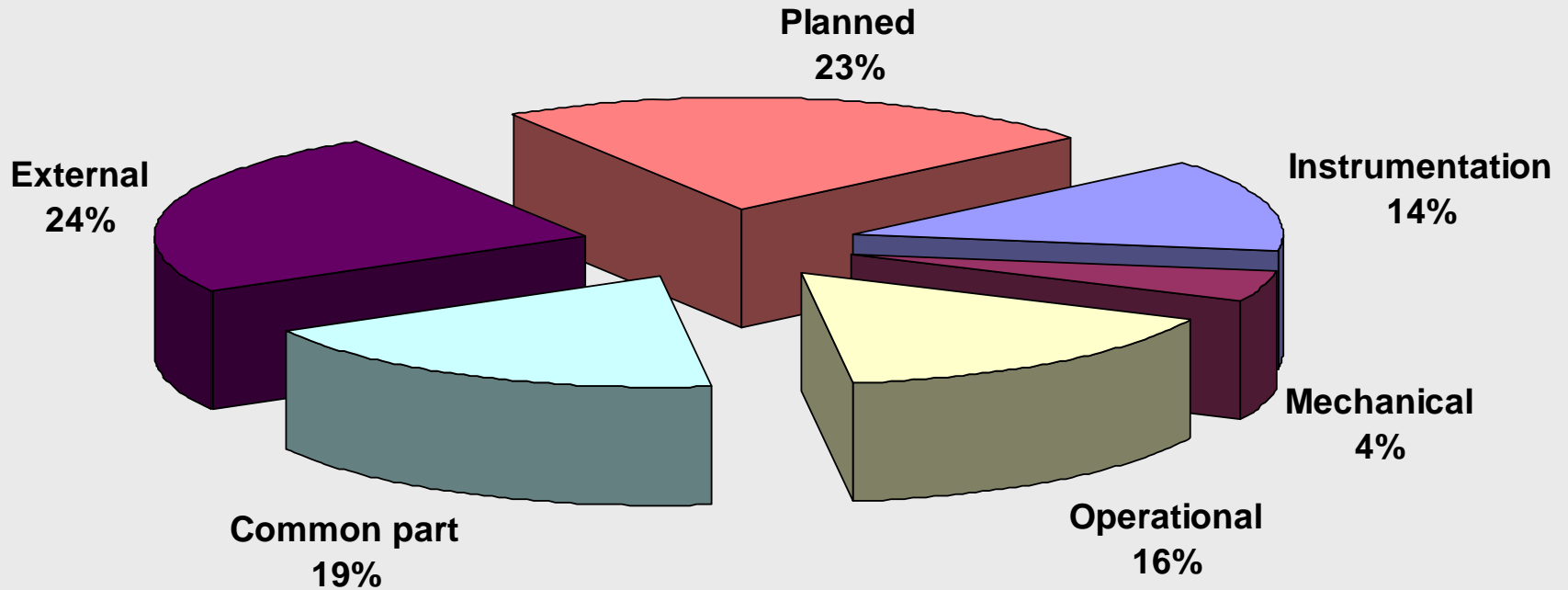
period: 2006 -2008

Cause of shutdown distribution ISAB Energy Gasification Plant



period: 2003 -2008

Duration of shutdown distribution ISAB Energy Gasification Plant



period: 2003 -2008

Conclusion

- **Lack of gasification plant availability has been a significant hindrance for the power industry in the past years. The data presented in this work confirm once again that the technology has reached high levels of performance and great strides have been made in the design of reliable systems.**
- **The substantial experience thus gained in heavy oil residue gasification can be extended to identify bottlenecks also in coal gasification, and can be used to guide the design and implementation efforts of technology licensors, equipment suppliers, engineering and construction contractors, as well as project Owners and developers.**

THANK YOU

S a i p e m SpA

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