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Emerging Technologies
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Substantial Reduction in Boiler Steam and Oil Costs at Brazilian VCP-LA Mill through Six Sigma

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Votorantim Celulose e Papel

Votorantim
Celulose e Papel

Agenda

- Background of VCP-LA
- Objective
- Introduction
- Development
- Results
- Activities in development
- Conclusion

Background of VCP - LA

Background of VCP - LA

- **Single pulp production line, 750 adt/d, started up in 1991**
- **Production capacity increased to 1000 adt/d in 1996**
- **Currently produces 1200 adt/d pulp and 950 ton/d paper**
- **Recovery boiler is the major bottleneck**

Objective

- **Mill 2004 target called for a 5% reduction in steam production costs of auxiliary boilers**

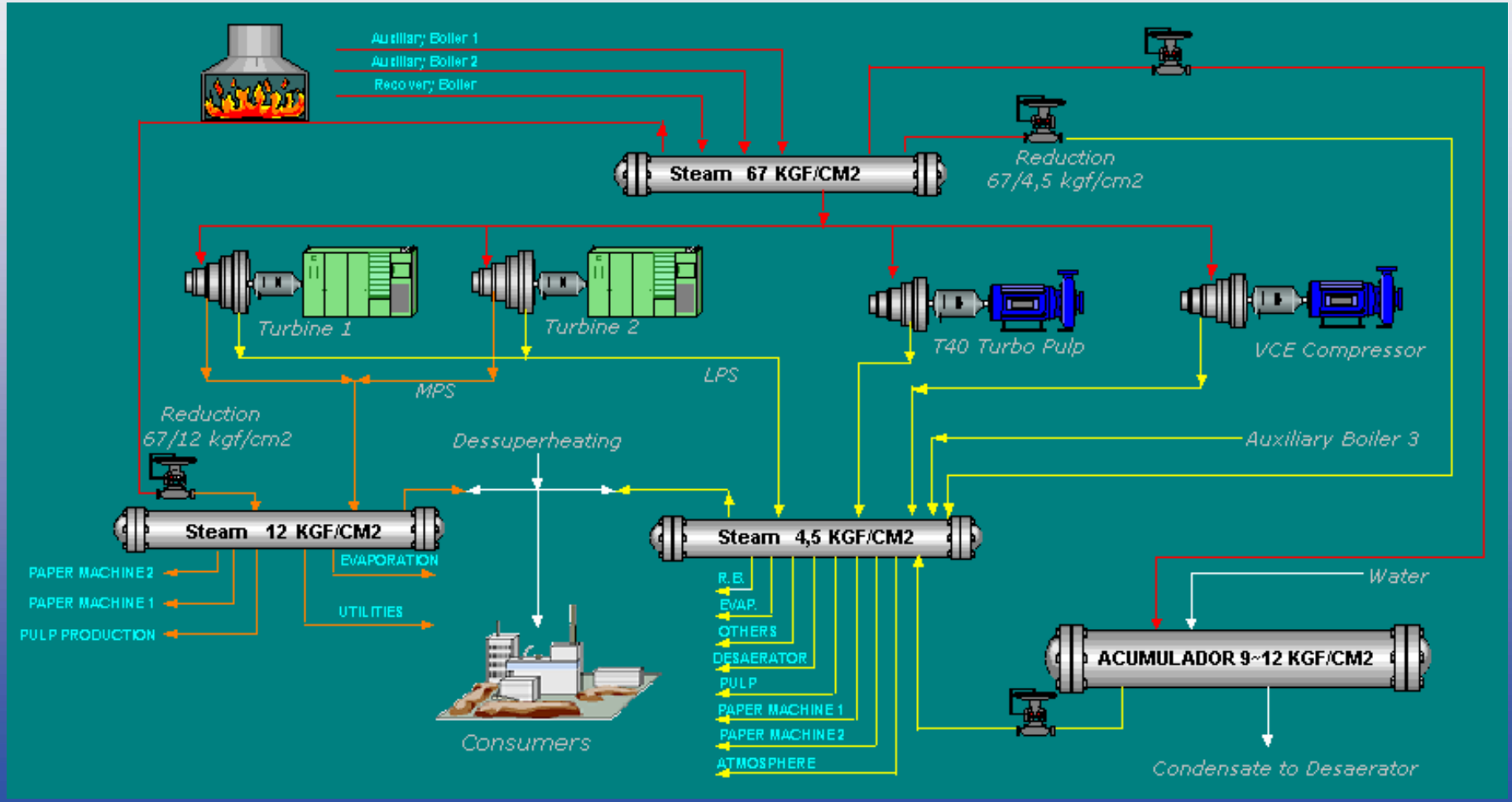
Introduction

Steam Production

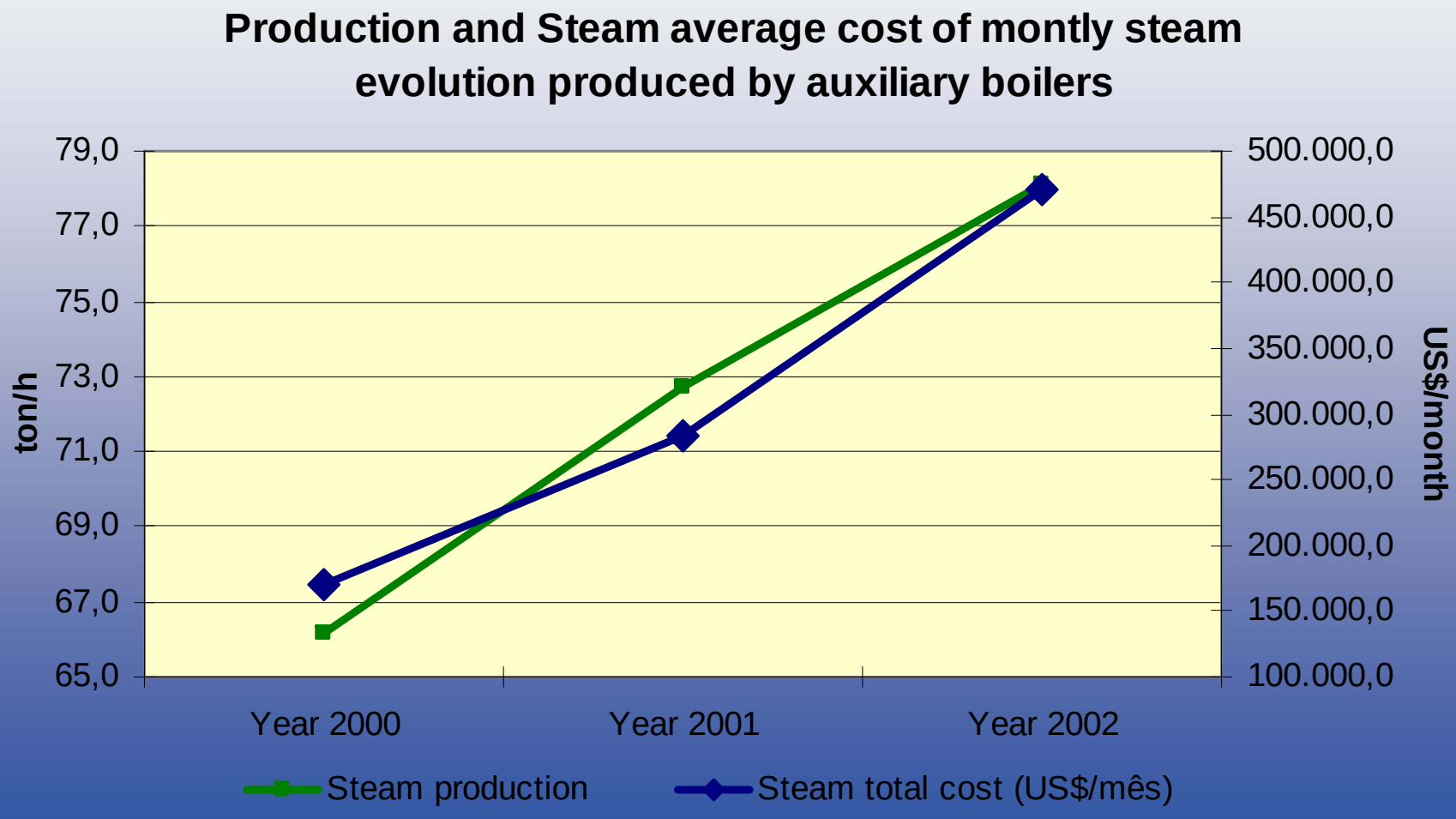
Boilers	Steam Pressure	Fuels	Origin
Recovery Boiler	67 Kgf/cm^2	Black Liquor	Process of Pulp Production
		3A Oil	Mediator
Auxiliary Boilers 1 and 2	67 Kgf/cm^2	Biomass	Process of Pulp Production
		Energetic Chip	Florest / Mediator
		Firewood	Florest / Mediator
		3A Oil	Mediator
Auxiliary Boiler 3	4,5 Kgf/cm^2	3A Oil	Mediator

Introduction

Steam and Energy Generation and Distribution



Introduction



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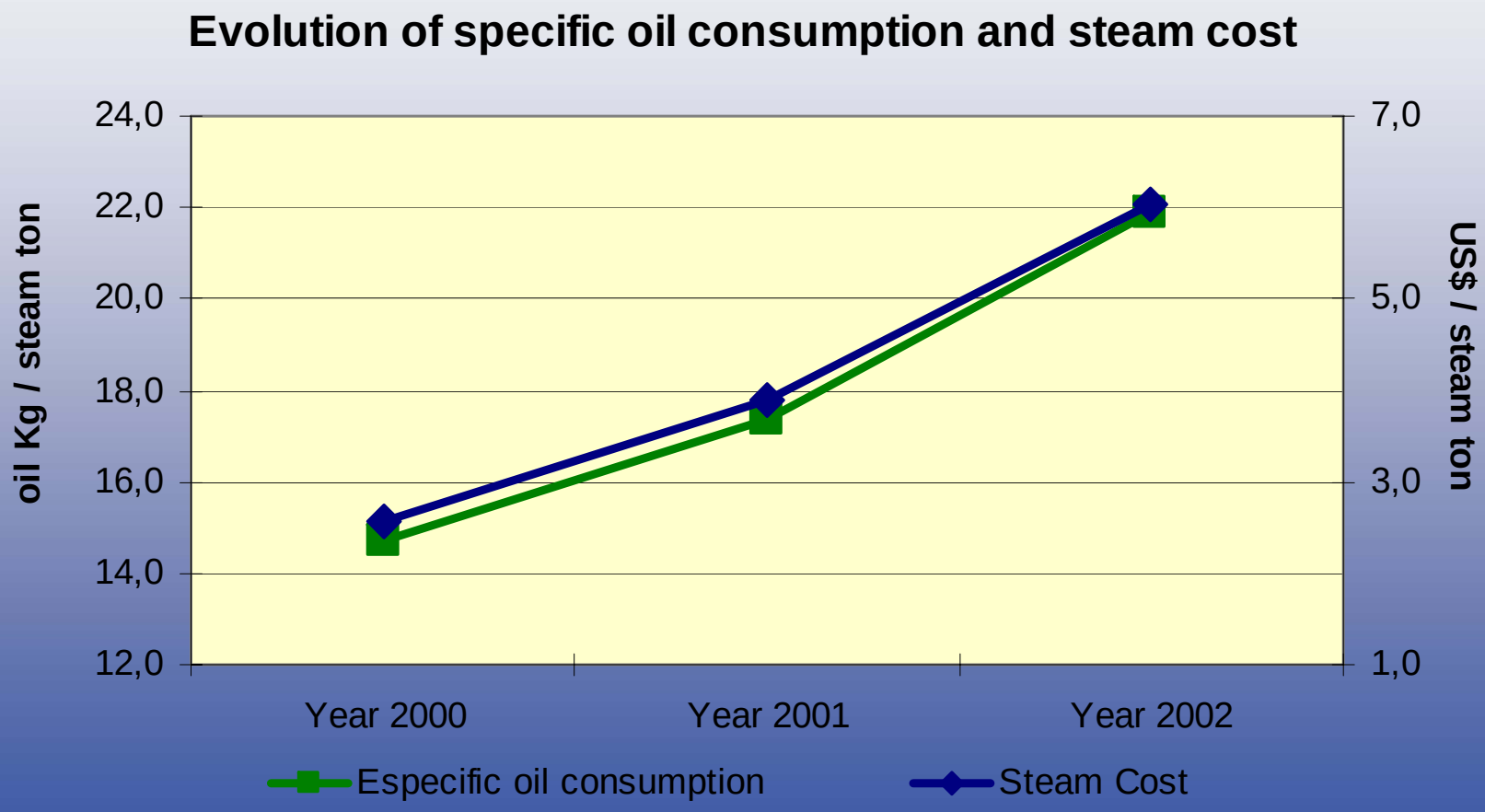


Development

Steam Cost Components of Auxiliary Boilers

- Oil 3A
- Firewood
- Wood waste
- Cane Trash
- Energetic Chip
- Diesel

Fuels

- Water
- Boilers Feedwater

Water

- Electrical Energy

Electrical Energy

- Ash Transportation

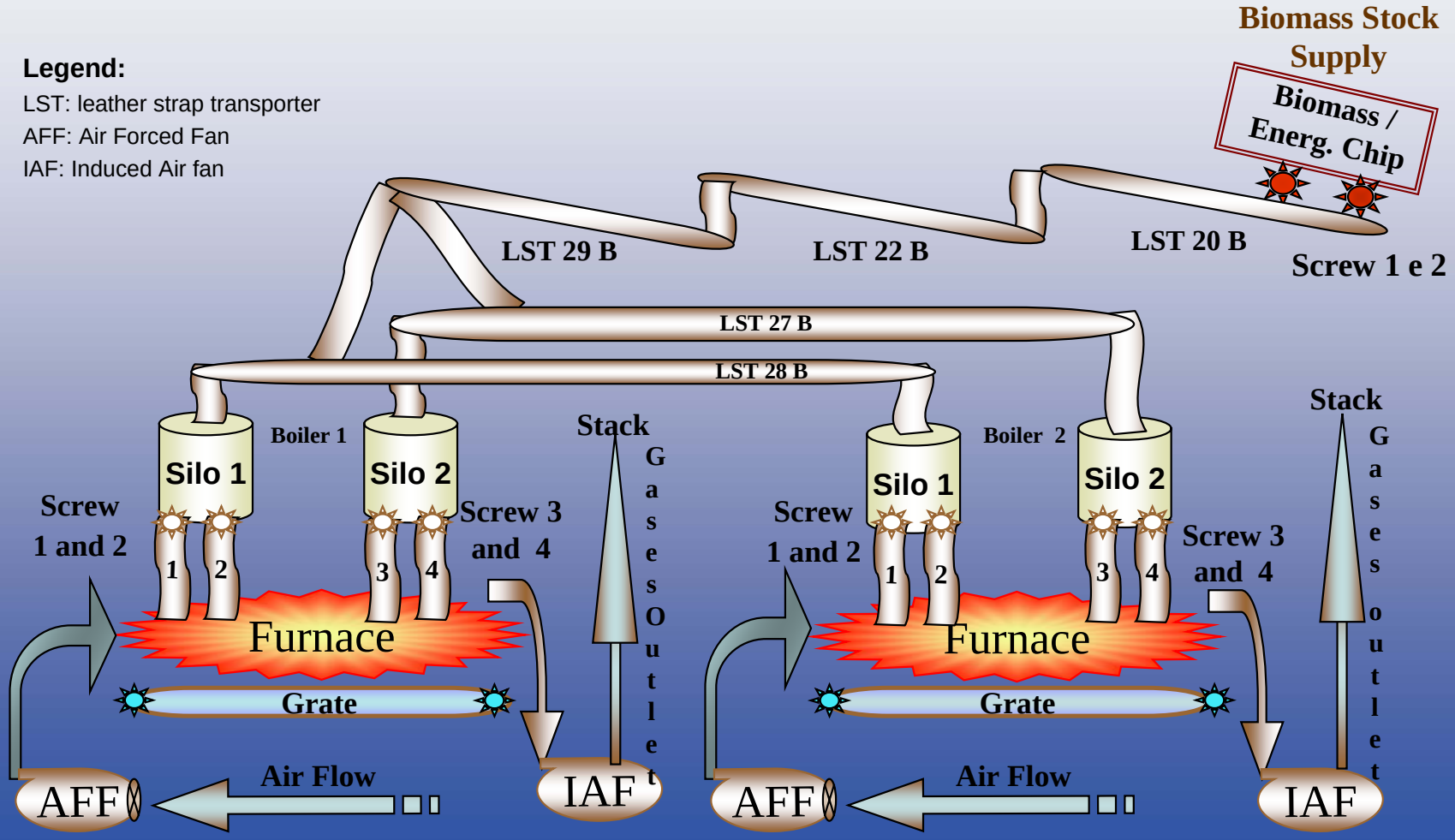
Transportation

- Operation materials

Operation Materials

Development

Ilustrative Fluxogram for Fuels Feed System to Auxiliary Boilers 1 and 2



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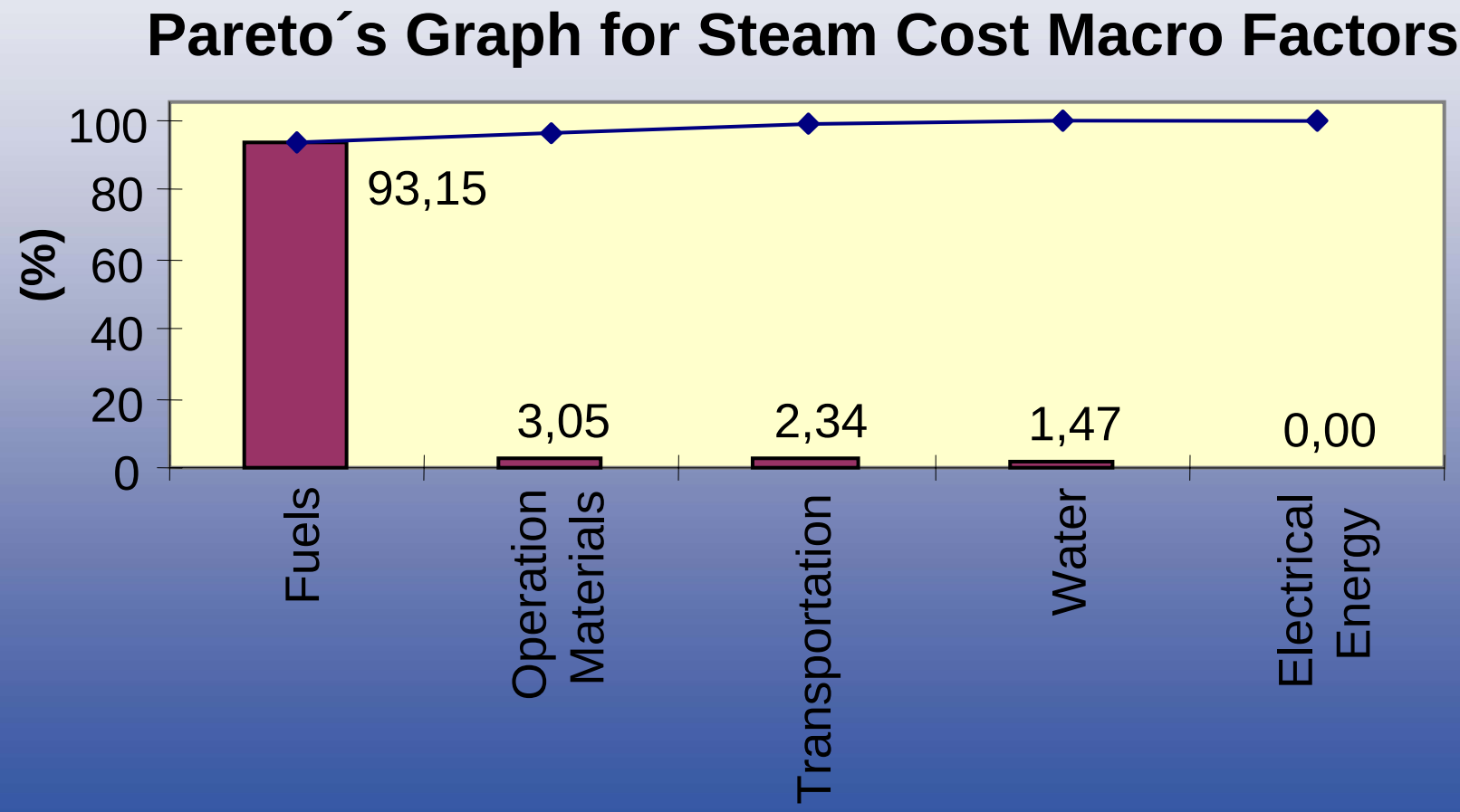

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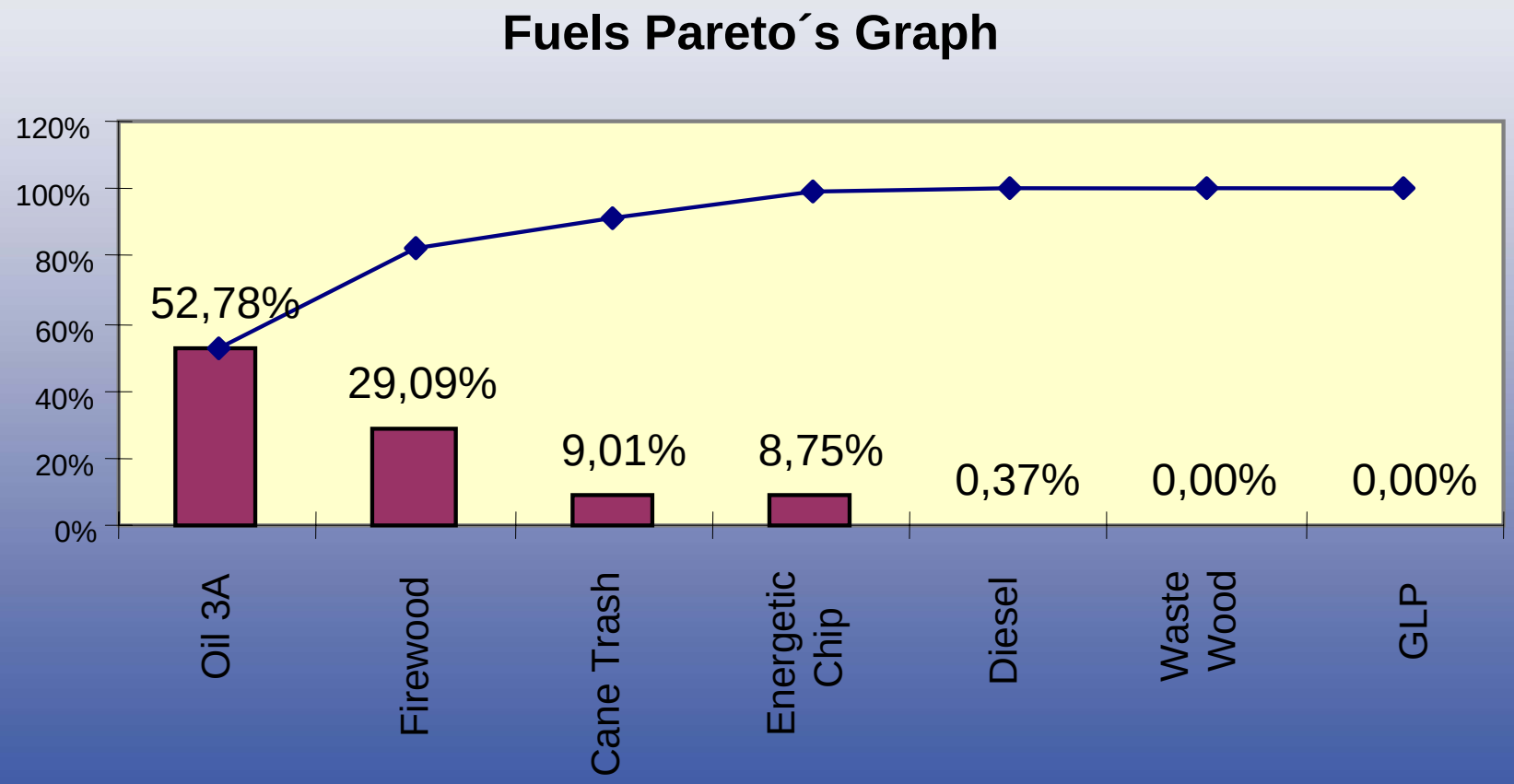

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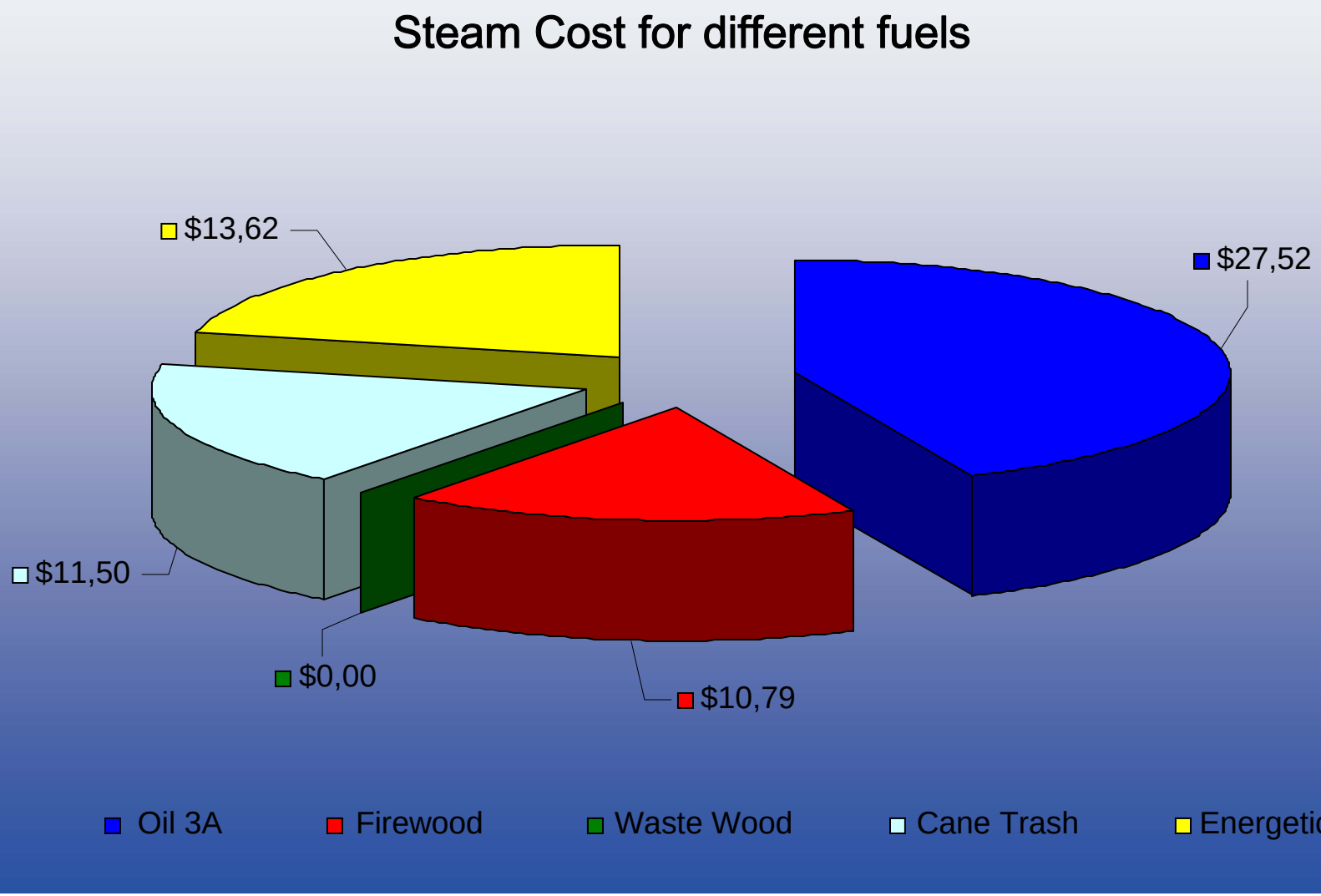

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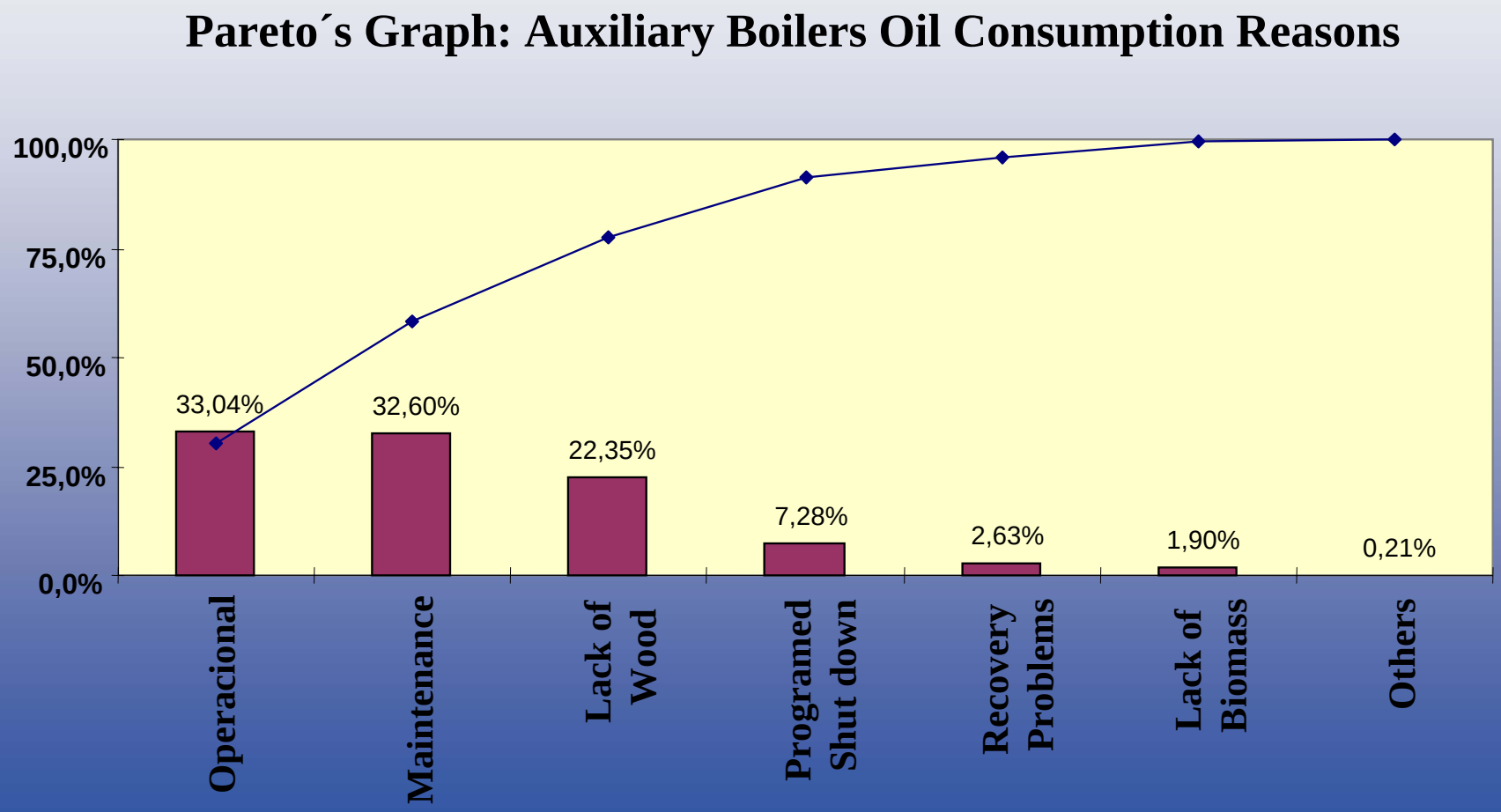

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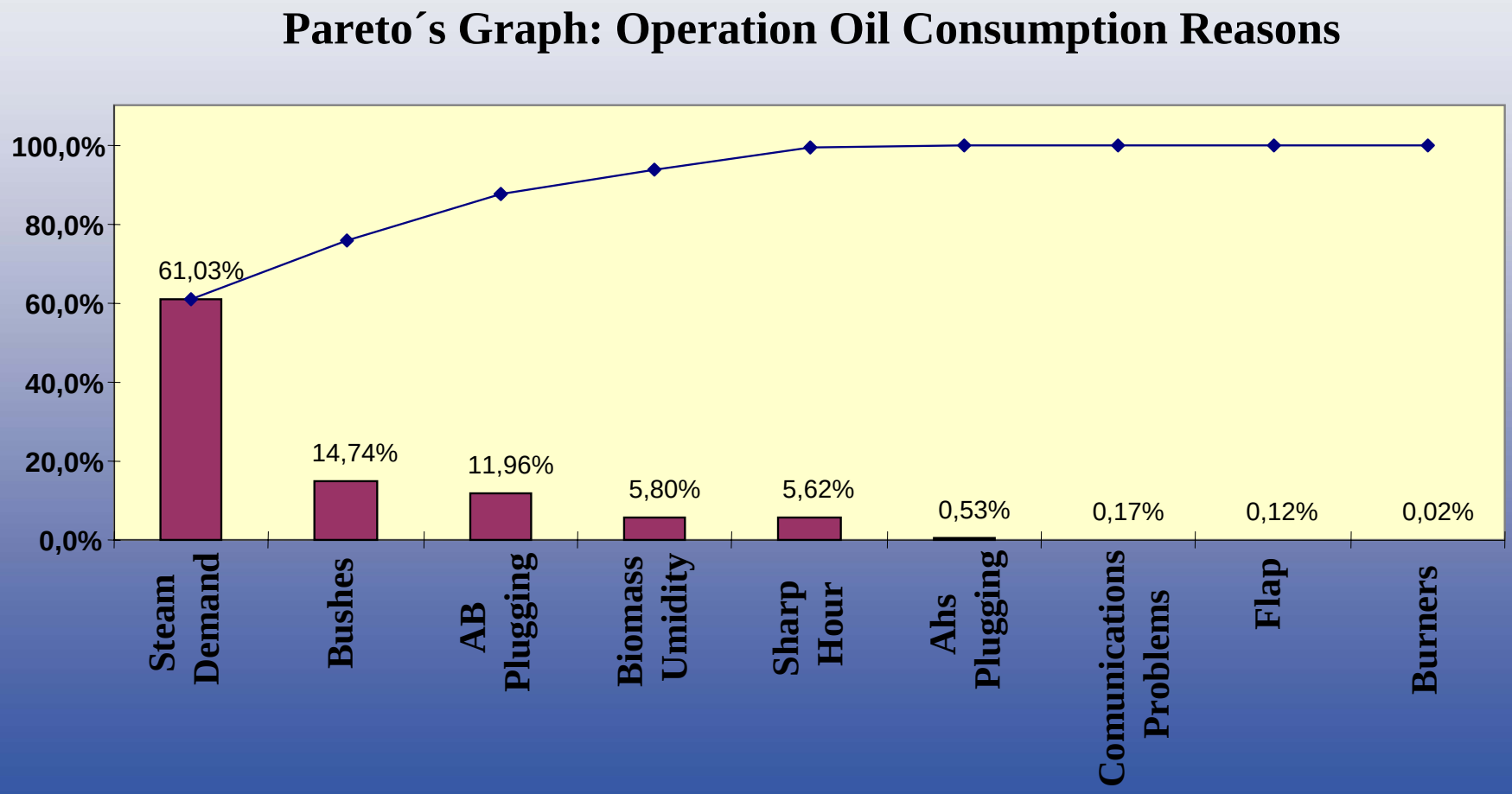

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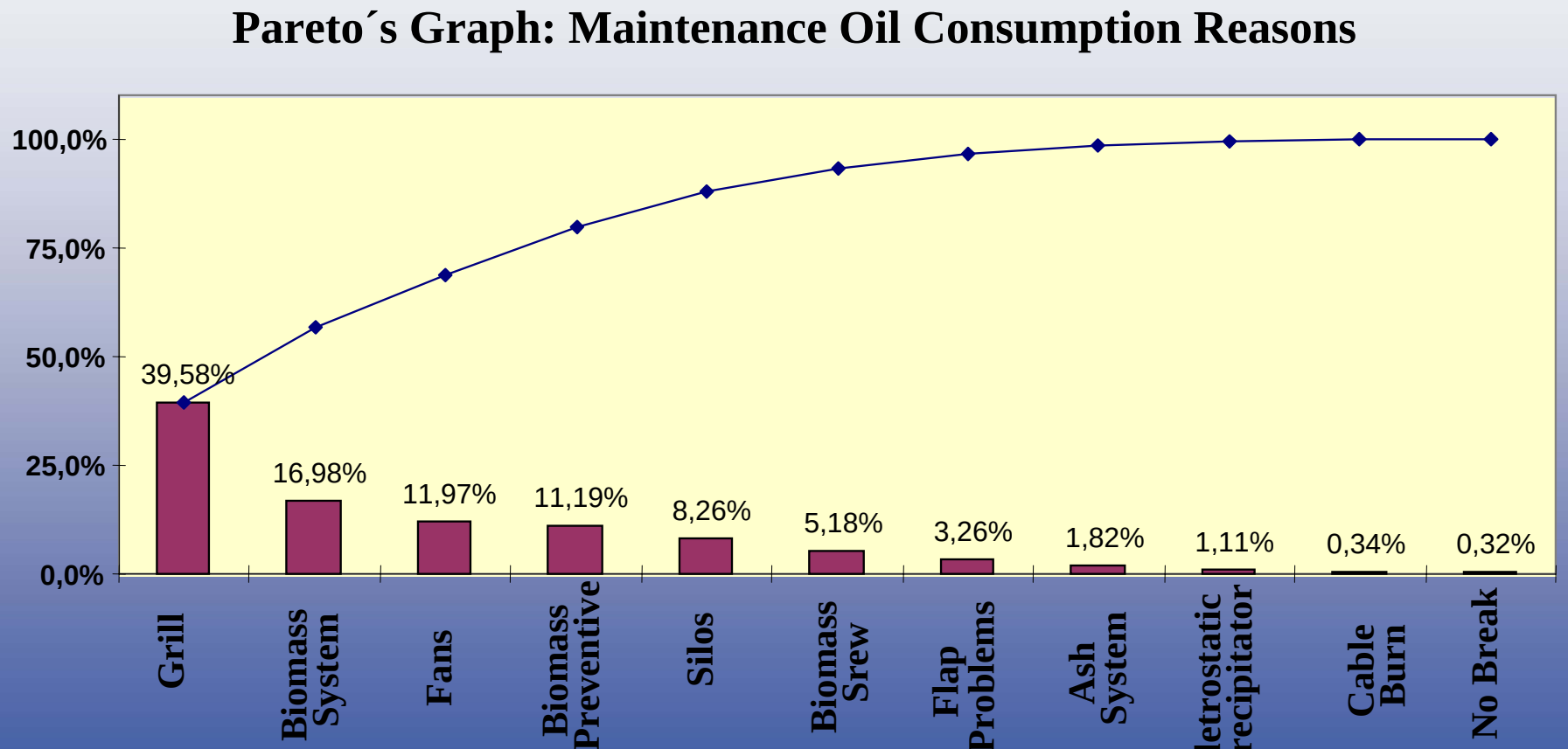

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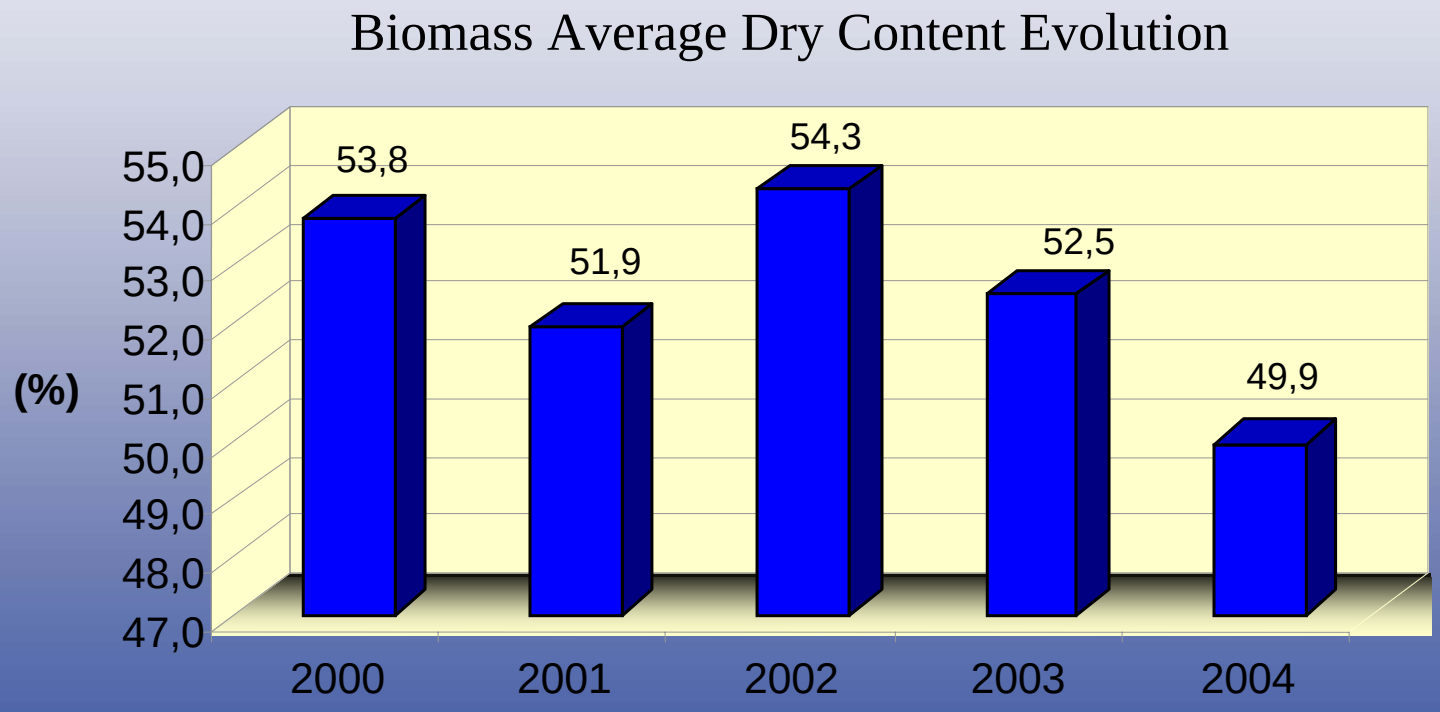


Specifics and General Goals

Goal: 5,0% / steam ton

Average Steam Production expected to 2004: 84.386 **tons/month**

Average Steam cost expected to 2004: **US$ 11,24**

Economy to be reached: **US$ 569.123** **US$ 10,68**

Lack of Biomass Reduction:

	Since April	Reduction Goal		Oil Reduction (ton)	Oil 3A Cost	Gain with reduction
Oil Consumption (ton):	2.869,44	90,0%	382,59	3443,33	US$ 292,54	**US$ 1.007.323,6**
	3.825,92					

Maintenance Reduction:

		Reduction Goal		Oil Reduction (ton)	Oil 3A Cost	Gain with reduction
Oil Consumption (ton):	**5.144,91**	14,0%	4.424,62	720,29	US$ 292,54	**US$ 210.715,5**
April to December	2.343,65	21,3%	4.047,91	1097,00	Projeto BB	*US$ 531.635,8*
January to March	2.801,26		3.327,62		US$ 320.920,3	

Operation Reduction:

		Reduction Goal		Oil Reduction (ton)	Oil 3A Cost	Gain with reduction
Oil Consumption (ton):	**5.213,57**	5,2%	4.942,47	271,11	US$ 292,54	**US$ 79.310,2**
Bushes	**768,72**	35,3%	497,61	271,11		

Increase by Operating:

		Increase Forecast		Oil consumption enlargement	Oil 3A Cost	Loss with the Enlargement
Oil Consumption (ton):	**5.213,57**					
January to March	3.583,25	25,0%	6.516,96	1.303,39	US$ 292,54	**US$ 381.299,3**
April to December	1.630,32		6245,85			

Others factors whose consumed oil:

		Reduction Goal		Oil Reduction (ton)	Oil 3A Cost	Gain with reduction
Oil Consumption (ton):						
Programed shut down,	**1.596,92**	0,0%	0,00	0,00	US$ 292,54	**US$ 0,00**
Recovery Boiler problems and others			1.596,92			

Total Oil Economy:	4.228,33	Tons / year
Production that would be reached with oil:	50.739,99	Steam tons
Oil Substitution by Chip:	21.141,66	Chip tons

Real oil Consunmption in 2003:	**15.781,32**	**Total gain with oil reduction:**	**US$ 1.236.971,7**
Oil consumption forecast to 2004:	**11.552,99**	**Firewood + Energetic Chip costs:**	**US$ 25,63**
Oil economy forecast to 2004:	**4.228,33**	**Oil Substitution Costs by Energetic Chip / Firewood:**	**US$ 541.940,93**

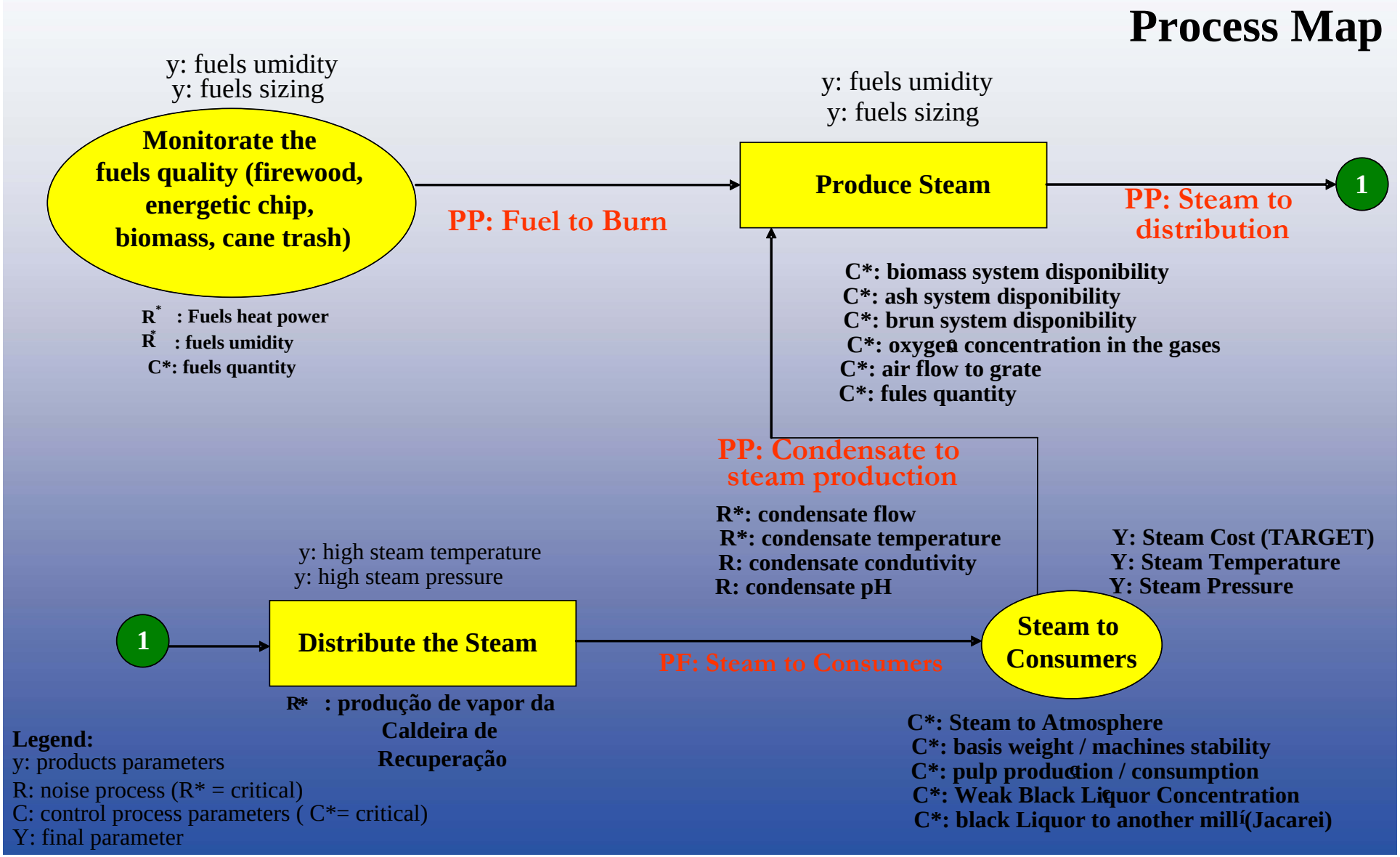
Estimated project real gain : **US$ 695.030,75**

Steam Cost reduction / ton: **US$ 0,69**

Final Steam Cost Price: **US$ 10,55**

Development

Process Map



Development

Matrix Diagram

Causes \ Effect	Reduction in 5% of Steam Auxiliary Boilers Costs in respect to the 2004
Fuel quantity	◎
Biomass System isponibility	◎
Ash System disponibility	□
Burner System disponibilty	◎
Gases Oxigen concentration	□
Grate Air flow	□
Steam to Atmosphere	◎
Basis Weight / Pulp Machines Stability	□
Pulp production and consumption	□
Weak Black Liquor Concentration	□
Black Liquor to another Mill (Jacareí)	□

Legend:

◎ **High Correlation**

□ **Medium Correlation**

△ **Low Correlation**

Development

Action Plan

5 W
- What
- Who
- When
- Why
- Where

2 H
- How
- How Much

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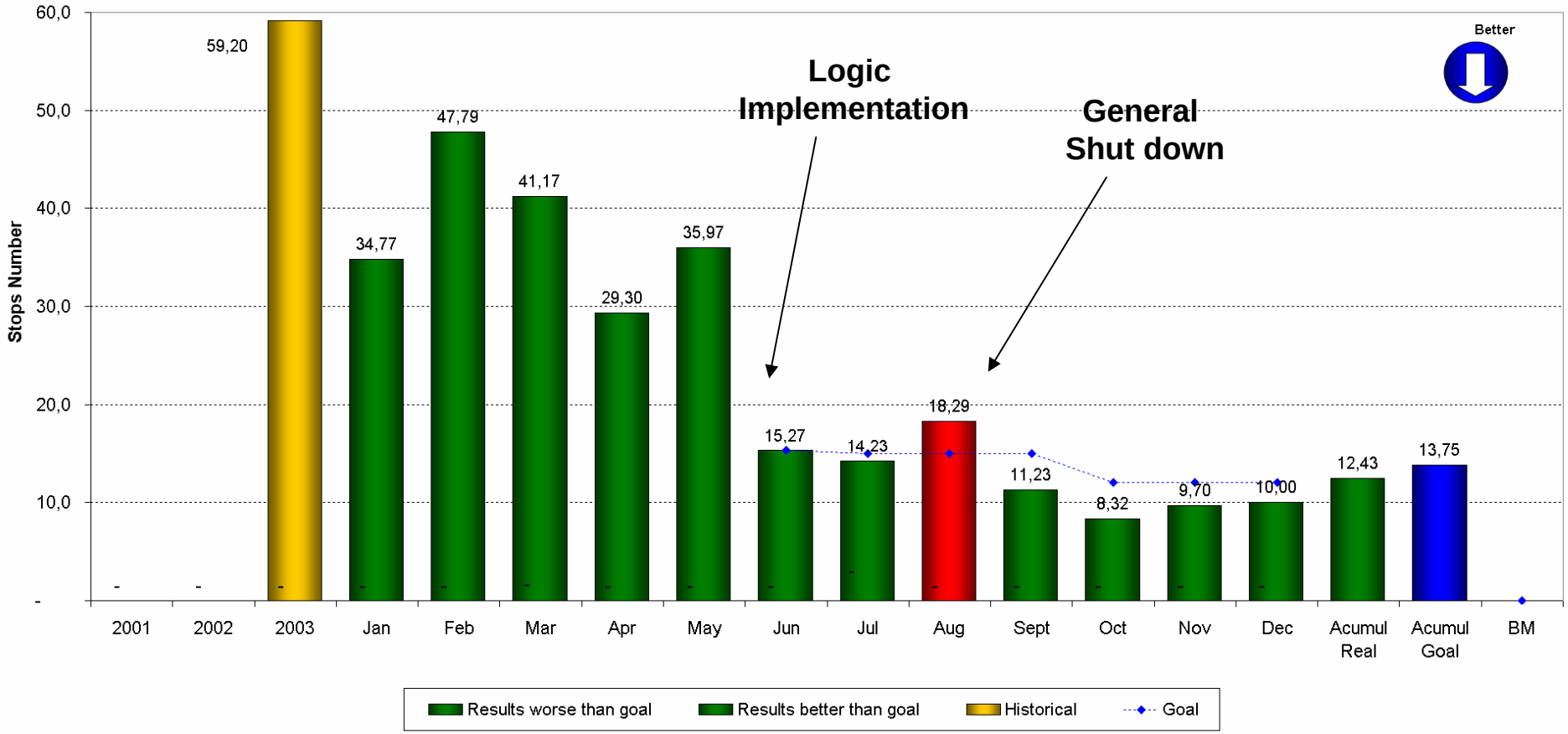
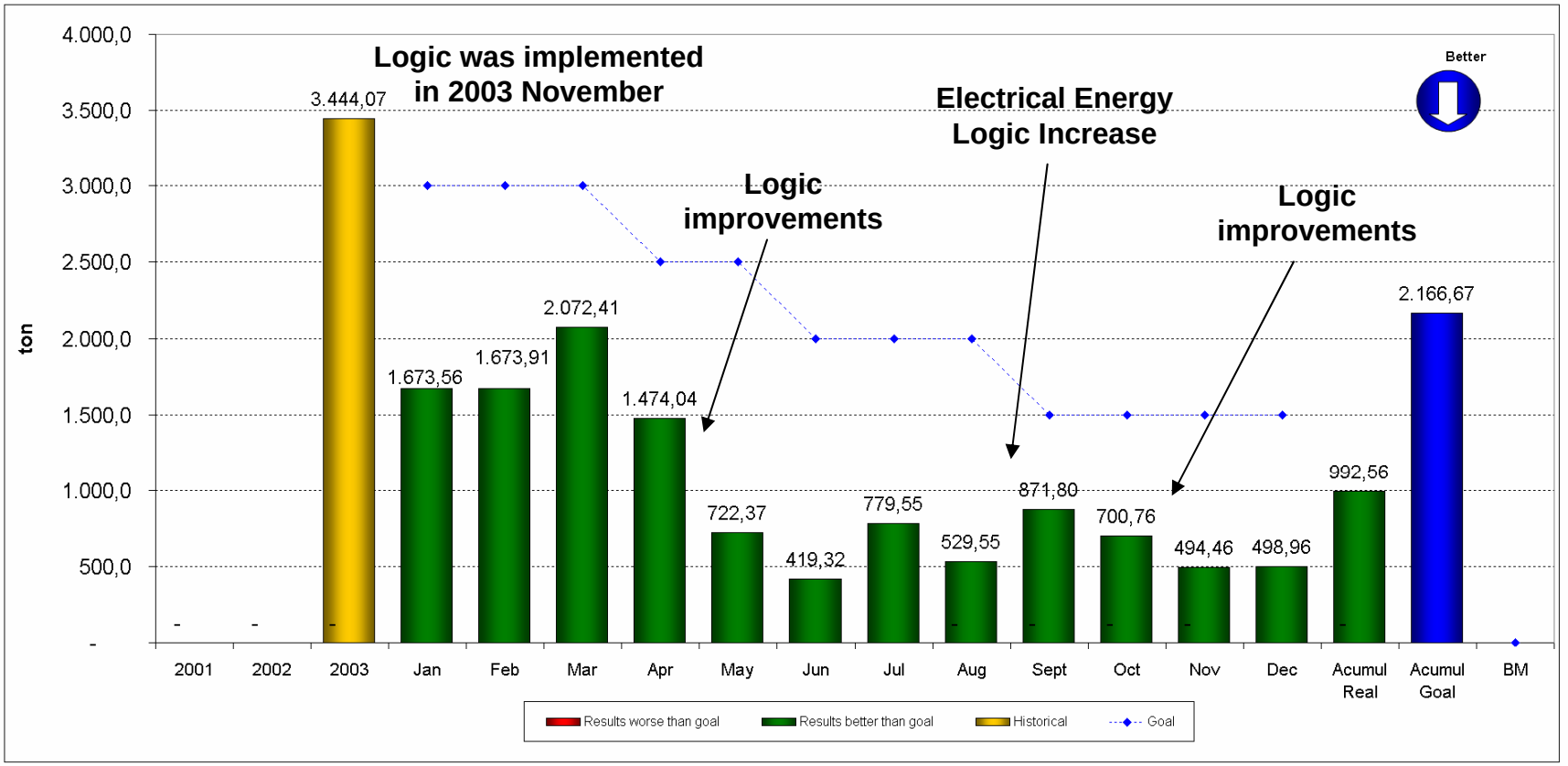
Total Quality - Goal Graph	UNITY / PROCESS: LA	DATE: 12/4/2006
	CELL / TEAM: CPU/UT	RESPONSABLE: Thiago Gazoni
META: Reduce the biomass system average stops from 35,57 (April and May average) to 12 a day unti 12/31/2004	Control Item: Biomass System Stop	



Development

Votorantim Celulose e Papel	Total Quality - Goal Graph	UNITY / PROCESS: LA	DATE: 12/4/2006
		CELL / TEAM: CPU/UT	RESPONSABLE: Thiago Gazoni
	GOAL: Reduce the steam flow to atmosphere to 1500 ton/month until 12/31/2004	Control Item: Steam to Atmosphere	



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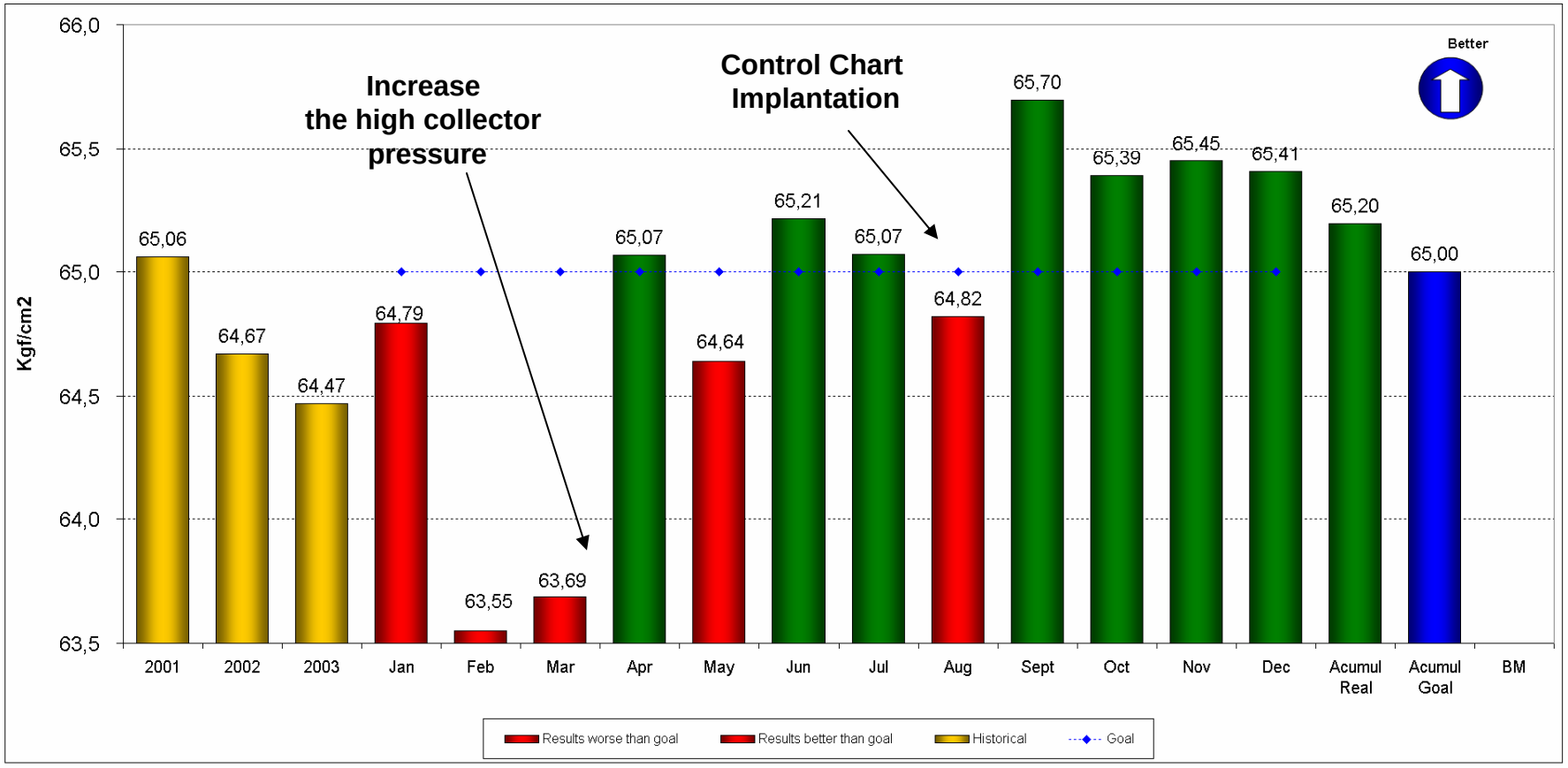
Total Quality - Goal Graph

UNITY / PROCESS:	LA	DATE:	12/4/2006
CELL / TEAM:	CPU/UT	RESPONSABLE:	Thiago Gazoni

GOAL: **Maintain the high collector pressure in 65,0 Kgf/cm^2 from April to December**

Control Item: **High Collector Pressure**



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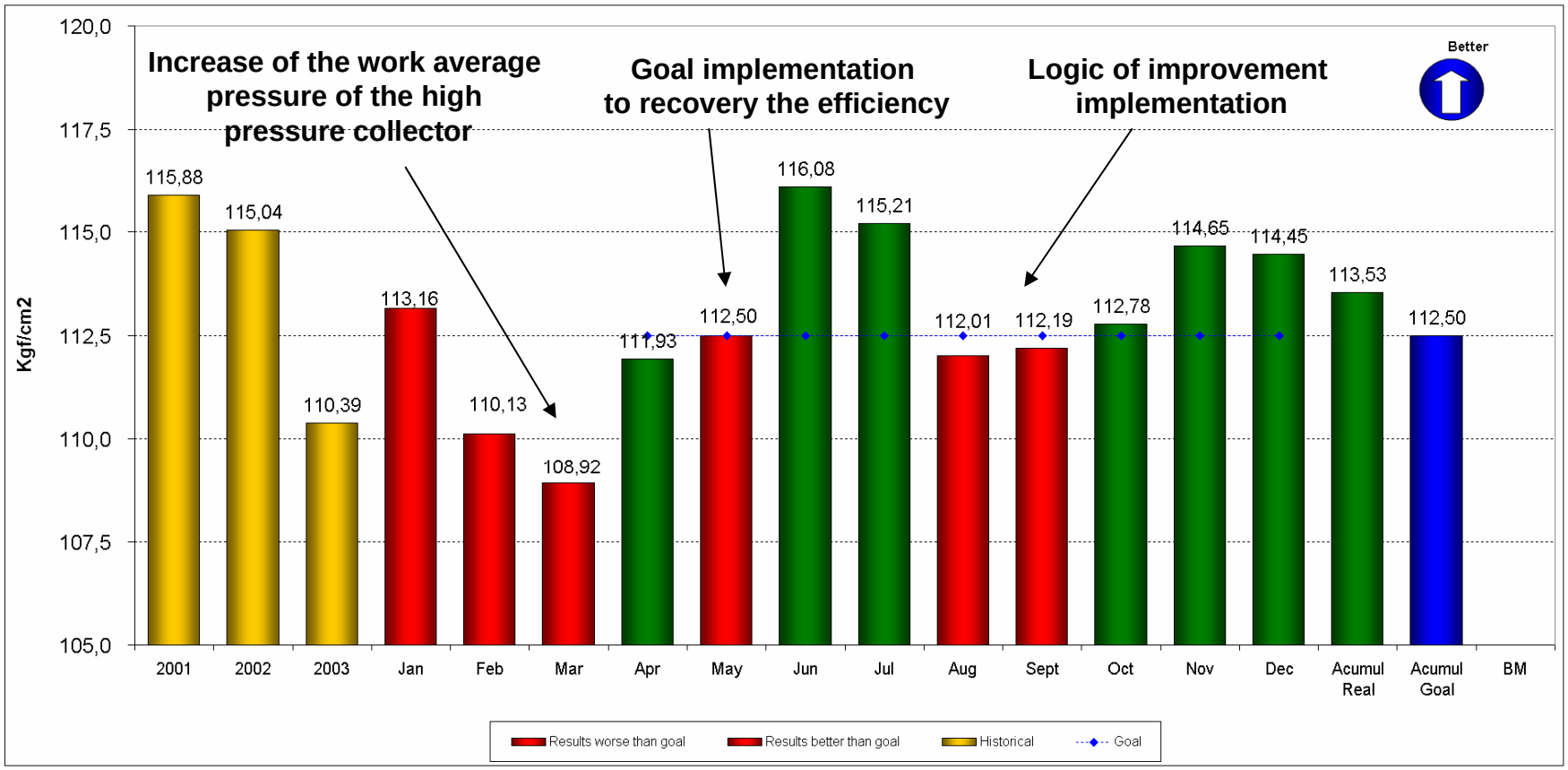
Total Quality - Goal Graph

UNITY / PROCESS:	LA	DATE:	12/4/2006
CELL / TEAM:	CPU/UT	RESPONSABLE:	Thiago Gazoni

GOAL: **Increase the electric energy generation efficiency from 110,39 to 112,5 KWh/ steam ton ftom April to 12/31/2004**

Control Item: **Electric Energy Generation Efficiency**



Results

Examination of Specific and General Goals					
Item	**Oil Consumption (ton)**	**Goal Reduction**	**Real Reduction**	**Real Oil Consumption (ton)**	**Gain / Loss With Reduction**
Lach of Biomass	3.825,92	90,00%	**95,2%**	183,64	**US$ 1.065.525,8**
Maintenance Reduction	5.144,91	35,32%	**52,1%**	2.678,57	**US$ 721.512,02**
Operation Reduction (Bushes)	768,72	35,27%	**61,7%**	294,1	**US$ 138.855,83**
Increase by Operating	5.213,57	-25,00%	**-35,8%**	7.027,50	**US$ 530.653,18**
Others factors whose consumed oil	2.617,76	0,00%	**0,0%**	0	**US$ 0,00**

Average Steam Cost Expected to 2004:	**US$ 11,24**
Economy to be Reached:	**US$ 10,68**
Final Price of Steam Cost (based on 2003 real oil consumption):	**US$ 10,51**
Project Estimated Gain:	**US$ 695.030,75**
Project Real Gain:	**US$ 731.643,69**

Results

Year:	Steam Production (ton)	Economy Goal	2004 Steam Cost Estimated	Real Steam Cost	Real Goal Reached
2004	1.012.632	5,00%	$11,24	$8,16	27,45%
Total estimated by the project				$569.122,73	

Real Payback reached by the project based on oil consumption in 2003	US**$731.643,69**

Real payback reached by the project compared to the budget of 2004	US **$3.124.087,47**

Conclusion

- **The cost of steam production by oil-fired boilers was lowered by 27,5%;**
- **The oil consumption was lowered by 43,8%;**
- **The power generation was increased by 2,8%;**
- **The project led to development of a new energy management concept;**

Activities in Development

- **Study to reduce the medium steam pressure flow in the pulp line;**
- **Optimize the steam to the atmosphere and electric energy generation logics;**
- **Planning the demand electric energy reduction in the peak hour in 2,0 MW**
- **Electrical energy consumption management by areas**

Thank You

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