Federal Ministry
of Economics
and Technology

FOUNDATION OF THE FEDERAL UNIVERSITY OF PARANA FOR THE DEVELOPMENT OF SCIENCES, TECHNOLOGY AND CULTURE - FUNPAR

INTERNATIONAL TROPICAL TIMBER ORGANIZATION - ITTO

INTERNATIONAL CONFERENCE ON WOOD-BASED BIOENERGY

PROYECT ITTO PD 61/99 REV. 4(I)

INCREASING THE EFFICIENCY IN THE TROPICAL TIMBER CONVERSION AND UTILIZATION OF RESIDUES FROM SUSTAINABLE SOURCES

HANNOVER/GERMANY
17-19 MAY/2007

OBJECTIVES

✓ OVERALL OBJECTIVE

- CONTRIBUTE FOR THE DEVELOPMENT OF THE SUSTAINABLE FOREST BASE IN THE AMAZON.

✓ SPECIFIC OBJECTIVES

- DEMONSTRATE THAT THE FOREST PRODUCT INDUSTRY AND NON-TRADITIONAL CONSUMER CAN CONTRIBUTE FOR FOREST MANAGEMENT.
- INCREASE THE COMPETITIVENESS OF THE INDUSTRIES OPERATIONS.
- TO MAKE FEASIBLE THE SUSTAINABLE FOREST INDUSTRY IN THE AMAZON.

THE PROBLEM

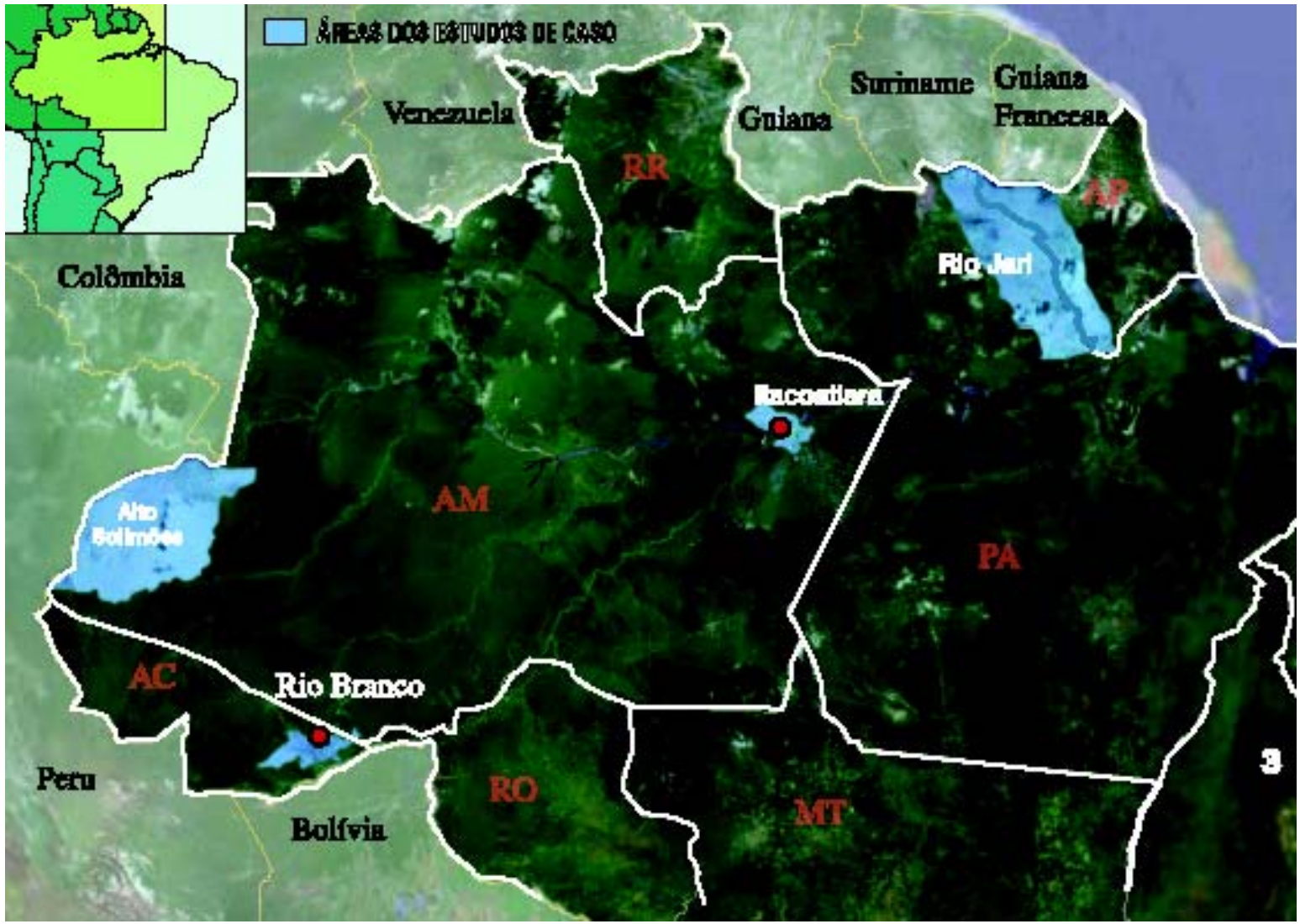
- ✓ **INCREASING FOREST CONVERSION BY OTHER LAND USE SEGMENTS**

- ✓ **RESTRICTION FOR THE IMPLEMENTATION OF THE FOREST MANAGEMENT**
  - ABSORPTION OF 20% OF THE SUSTAINABLE FOREST POTENTIAL
  - ABSENCE OF MARKETS FOR FOREST HARVEST RESIDUES
  - NON USED INDUSTRIAL RESIDUE (ENVIRONMENTAL LIABILITY).

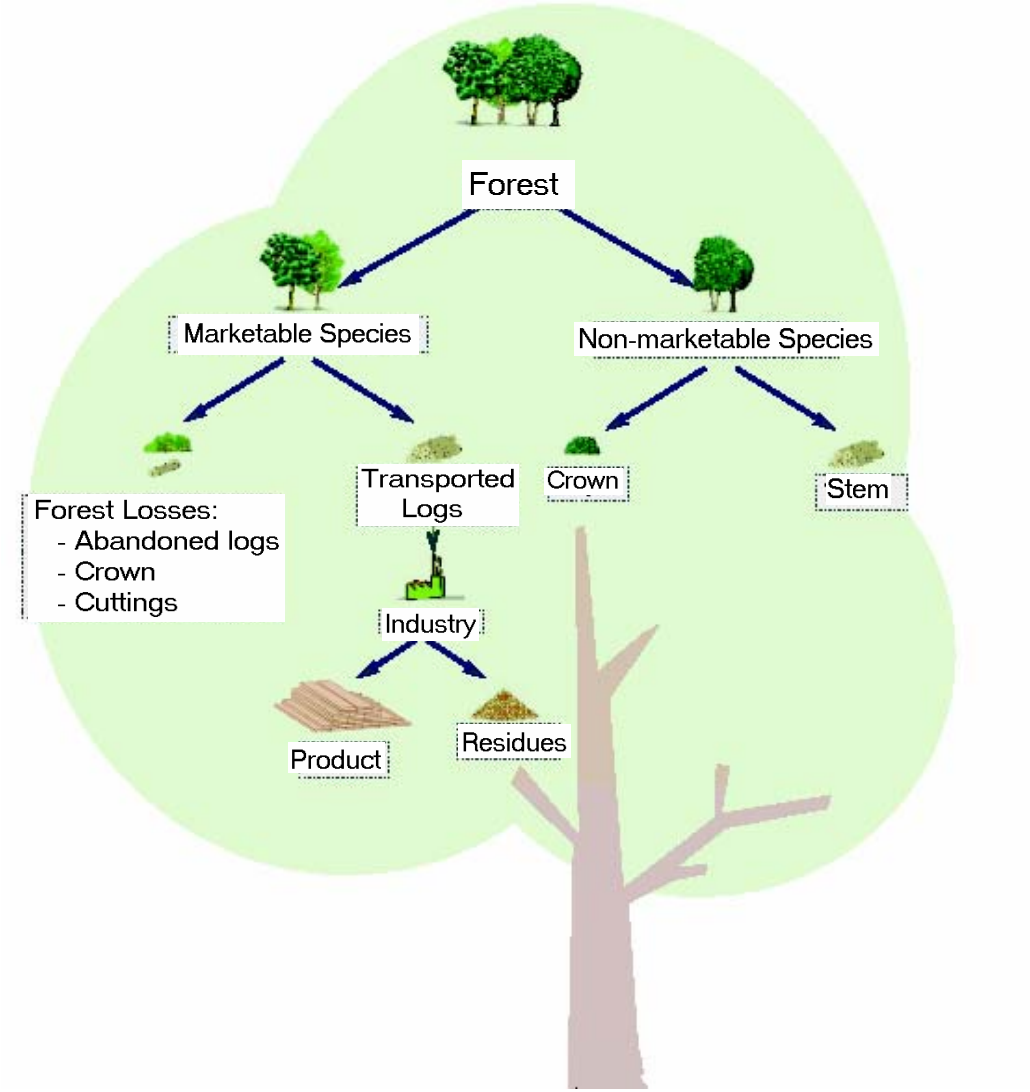
OTHER REASONS

- ✓ **TO WIDEN THE NUMBER OF SPECIES USE**
- ✓ **BENEFICIARIES**
  - GOVERNMENT
  - ENERGY PRODUCERS AND CONSUMERS
  - LOCAL COMMUNITY
  - FOREST BASE INDUSTRY
  - NATURAL RESOURCES CONSERVATION
- ✓ **ENVIRONMENTAL LIABILITY**
- ✓ **FOREST MANAGEMENT PROFIT**

CASE STUDY AREAS



RESIDUES AND BY-PRODUCT GENERATION



BIOMASS AVAILABILITY

- ✓ **COMPOSITION OF STEM VOLUME**

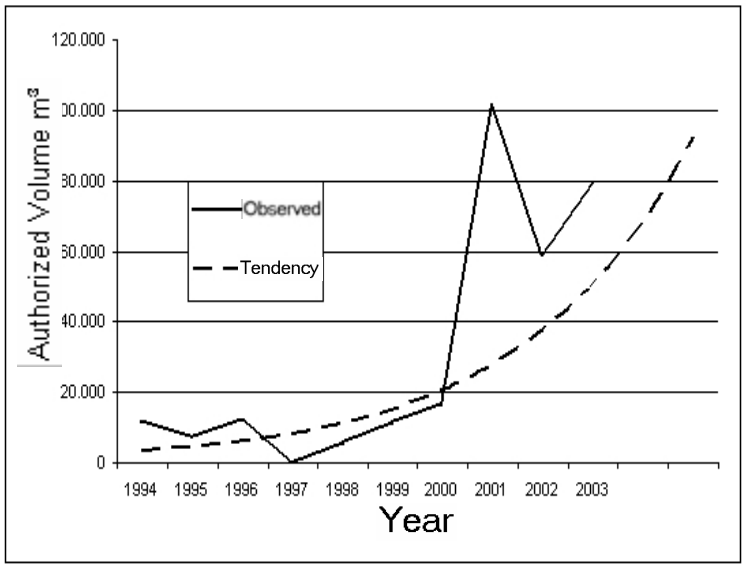
COMPONENT	%
LOG (COMMERCIAL VOLUME)	**48.1**
RESIDUE	51.9
Stem residue	17.7
Crown residue	34.2
Ø < 35 cm	20.5
Ø ≥ 35 cm	13.7
TOTAL	**100**

Source: Higuchi et al, 1998

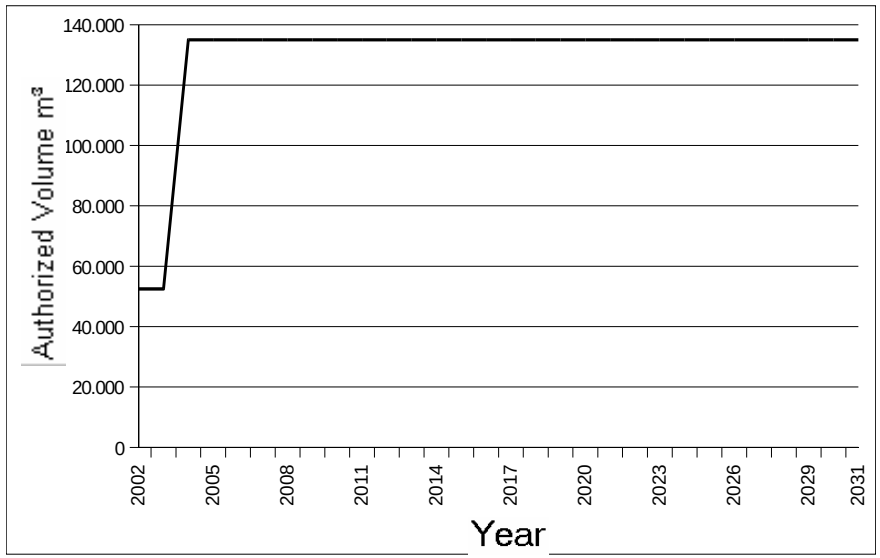
BIOMASS AVAILABILITY

- ✓ **FOREST**

Rio Branco



Jari/Orsa



- ✓ **Alto Solimões:**

19,000 m³/year

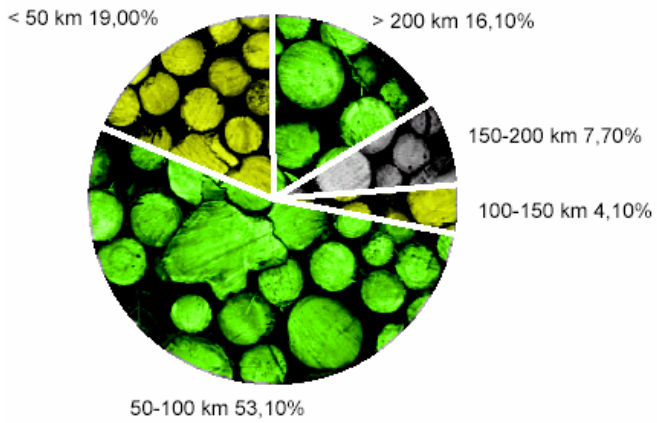
BIOMASS AVAILABILITY

✓ **VOLUME (M^3/YEAR)**

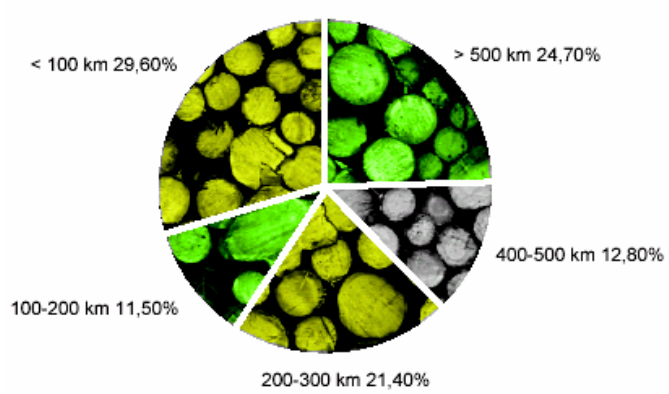
TYPE	Rio Branco	Alto Solimões	Jari
Forest Harvest Residue	**86,287**	**20,845**	**145,665**
Stem	29,428	7,109	49,678
Crown	56,859	13,736	95,987
Non-Marketable Species	**153,679**	**43,538**	**256,153**
Stem	101,121	28,648	168,549
Crown	52,558	14,890	87,604
Industrial Residue	**96,808**	**10,625**	**94,500**
TOTAL	**336,774**	**75,008**	**496,318**

BIOMASS DISTRIBUTION BY DISTANCE CLASSES

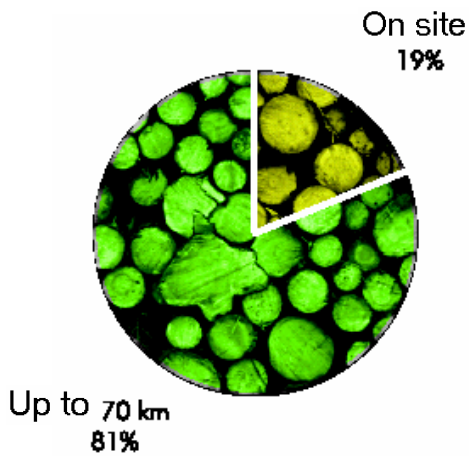
Rio Branco



Alto Solimões

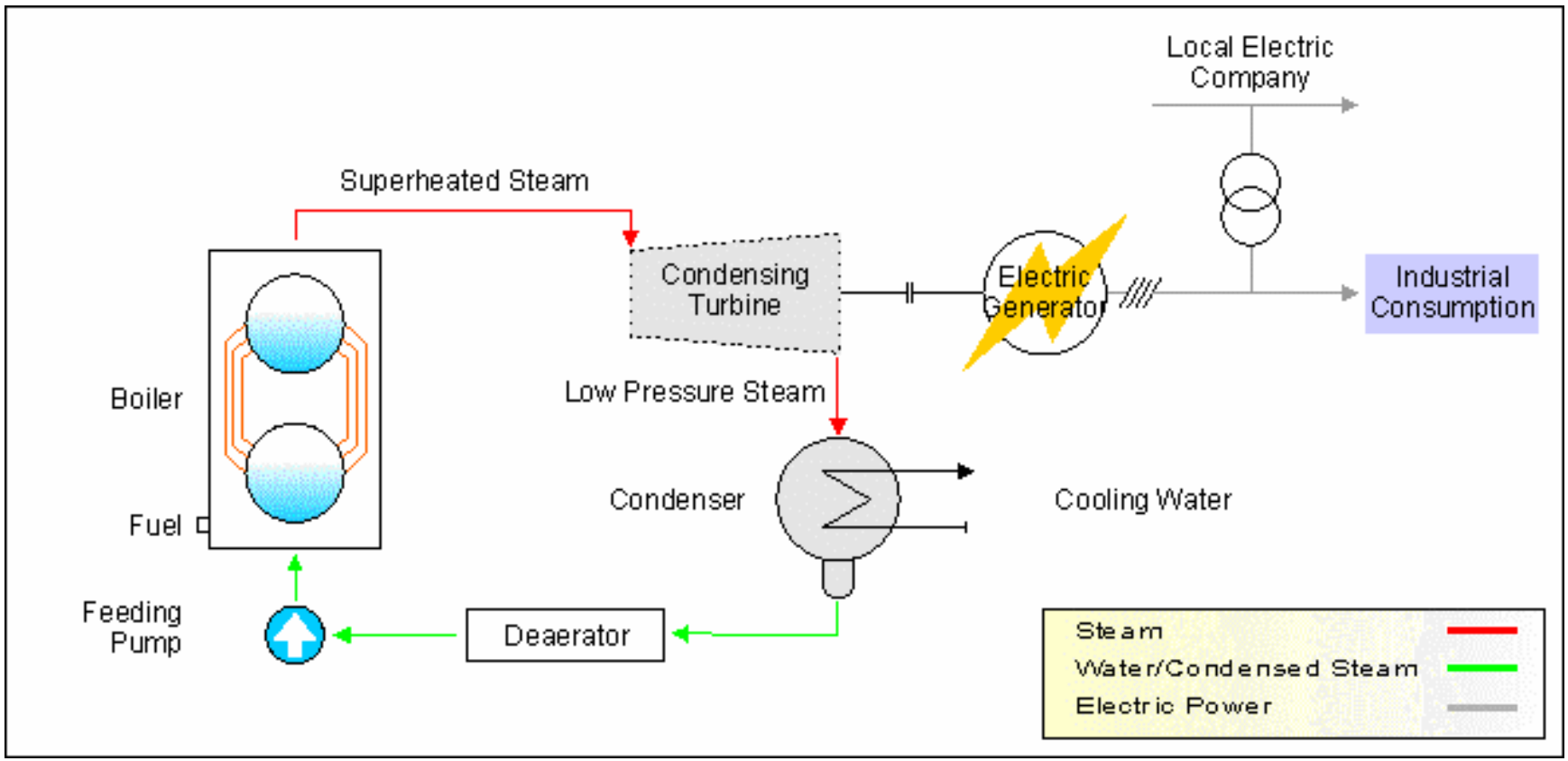


Jari/Orsa



ALTERNATIVE SELECTED

✓ **BASIC SYSTEM FLOWCHART USING A CONDENSATION TURBINE**

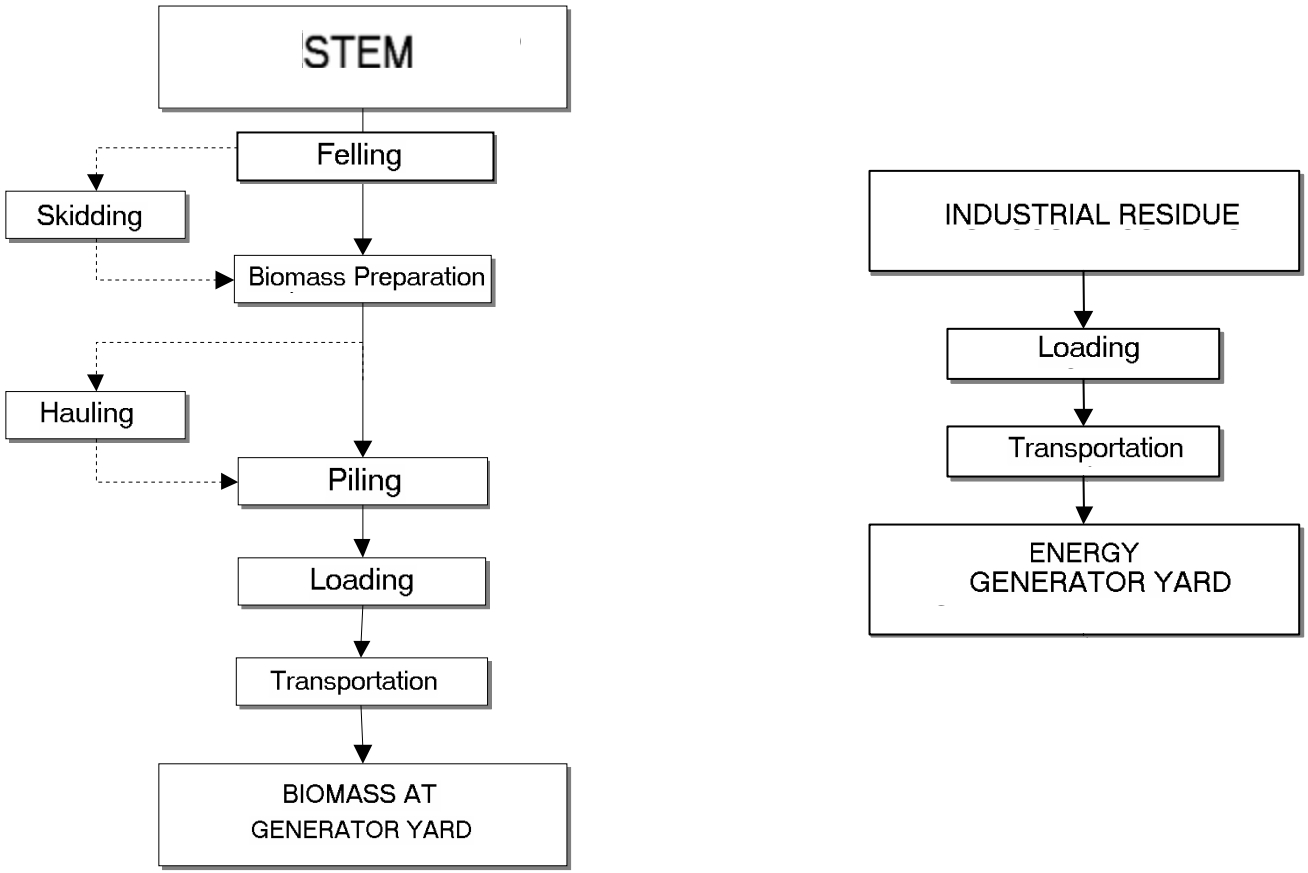


DESIGN CONCEPTION

REGION	RIO BRANCO	ALTO SOLIMÕES	JARI/ORSA
ASSUMPTIONS			
CATEGORY	Independent Producer	Independent Producer	Self-producer
RAW MATERIAL	Market purchases	Market purchases	Own procurement
TYPE	Energy Generation	Energy Generation	Co-generation (energy and steam)
REVENUE	Energy Sale	Energy Sale	Own consumption and sale of excess
CHARACTERIZATION			
TECHNOLOGY	Multistage condensation turbine, one of the more recommended as it has a larger thermal efficiency in relation to the others	Multistage condensation turbine, one of the more recommended as it has a larger thermal efficiency in relation to the others	Controlled extraction turbine, the most recommended for cogeneration plants
POWER MWH	2.0 MWH 10.0 MWH	2.0 MWH 10.0 MWH	3.5 MWH 5.6 MWH
BIOMASS CONSUMPTION (t/year)	36,300 t/year 132,200 t/year	36,300 t/year 132,200 t/year	79,500 t/year 121,000 t/year
LOCATION	Rio Branco	Benjamim Constant	Monte Dourado

DESIGN CONCEPTION

✓ PROCUREMENT LOGISTICS



FEASIBILITY STUDY

✓ CASH FLOW – RIO BRANCO (R$)

ITEM	2.0 MWH MARKET	2.0 MWH SUBSTITUTION	10,0 MWH MARKET	10,0 MWH SUBSTITUTION
CASH INFLOW	**32,805,002**	**89,357,022**	**154,598,426**	**444,176,005**
Energy Sales Revenue	25,946,250	25,926,250	129,729,600	129,729,600
CCC or Fuel Savings	5,655,980	62,208,000	21,462,421	311,040,000
Residual Value	1,202,772	1,202,772	3,406,405	3,406,405
CASH OUTFLOW	**34,484,347**	**34,484,347**	**176,180,120**	**176,180,120**
Fixed Asset Investment	7,541,306	7,541,306	28,616,561	28,616,561
Working Capital Investment	90,716	90,716	439,944	439,944
Production Cost	22,036,725	22,036,725	123,045,915	123,045,915
Revenues Taxes	4,815,600	4,815,600	24,077,700	24,077,700
Income Taxes	-	-	-	-
NET CASH FLOW	**-1,679,345**	**54,872,675**	**-21,581,694**	**267,995,885**

FEASIBILITY STUDY

✓ CASH FLOW – ALTO SOLIMÕES (R$)

ITEM	3.0 MWH MARKET	2.0 MWH SUBSTITUTION
CASH INFLOW	**32,857,470**	**89,409,490**
Energy and Steam Sales	25,946,250	25,946,250
CCC	5,655,980	62,208,000
Residual Value	1,255,240	1,255,240
CASH OUTFLOW	**52,485,185**	**52,485,185**
Fixed Asset Investment	7,541,306	7,541,306
Working Capital Investment	143,184	143,184
Production Costs	39,985,095	39,985,095
Revenues Taxes	4,815,600	4,815,600
Income Taxes	-	-
NET CASH FLOW	**-19,627,715**	**36,924,305**

FEASIBILITY STUDY

✓ CASH FLOW – ORSA/JARI (R$)

ITEM	2.0 MWH MARKET	2.0 MWH SUBSTITUTION	10,0 MWH MARKET	10,0 MWH SUBSTITUTION
CASH INFLOW	**76,431,781**	**120,406,921**	**111,427,554**	**252,625,202**
Energy Sales	65,059,200	19,440,000	92,145,600	92,145,600
CCC	9,954,139	99,532,800	17,428,537	158,630,400
Residual Value	1,418,442	1,434,121	1,853,417	1,849,202
CASH OUTFLOW	**64,959,812**	**55,019,456**	**124,348,927**	**126,620,797**
Fixed Asset Investment	13,272,185	13,272,185	23,238,049	23,238,049
Working Capital Investment	162,647	178,326	341,418	337,203
Production Costs	37,960,890	37,960,890	83,667,315	83,667,315
Revenues Taxes	12,074,925	3,608,055	17,102,145	19,378,230
Income Taxes	1,489,165	-	-	-
NET CASH FLOW	**11,471,969**	**65,387,465**	**-12,921,373**	**126,004,405**

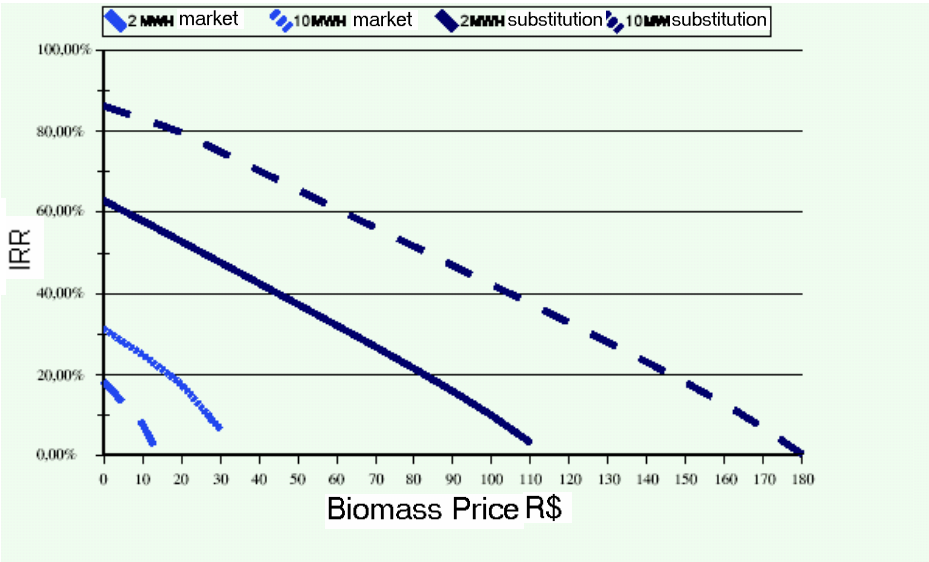
FEASIBILITY STUDY

✓ ECONOMIC AND FINANCIAL INDICES

REGION/ ALTERNATIVE	POWER MWH	NPV (R$) (MDR 12%)	IRR %	INVESTMENT RECUPERATION (years)
RIO BRANCO				
Market	2.0	-2,840,301	-	8.6
	10.0	-17,550,577	-	15.0
Substitutioon	2.0	20,432,046	53.7	1.8
	10.0	104,945,170	67.8	1.4
ALTO SOLIMÕES				
Market	2.0	-11,167,087	-	-
Substitution	2.0	12,245,191	37.5	2.4
JARI/ORSA				
Market	3.5	1,824,220	16.6	1.9
	5.6	-12,315,574	-	10.9
Substitution	3.5	38,512,790	57.0	1.9
	5.6	43,876,860	41.7	2.3

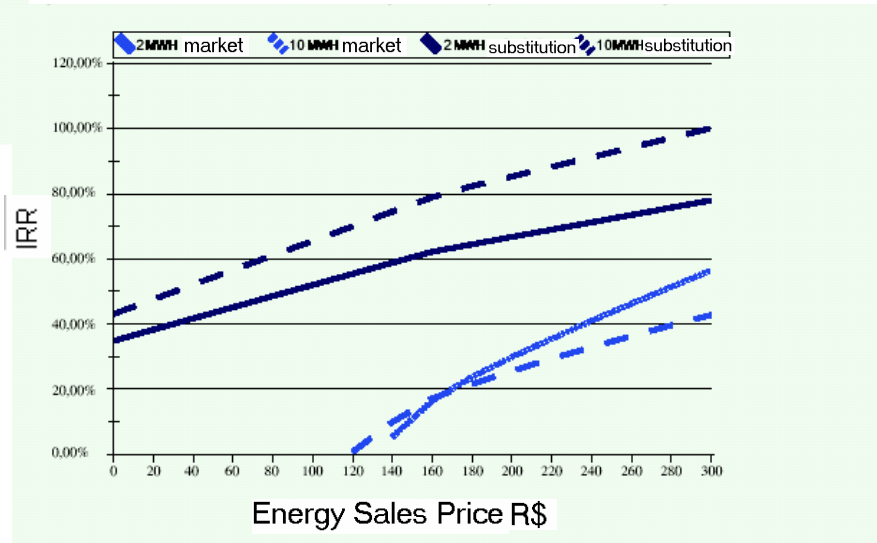
FEASIBILITY STUDY

- ✓ **RIO BRANCO – IRR SENSITIVITY TO:**



- ✓ **BIOMASS SALES PRICES VARIATION**

- ✓ **ENERGY SALES PRICE VARIATIONS**



FEASIBILITY STUDY

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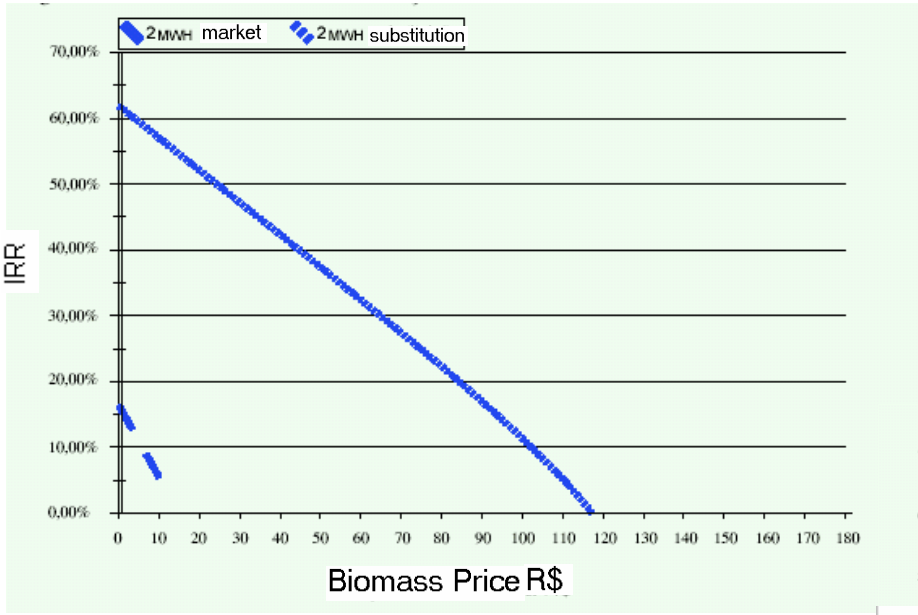

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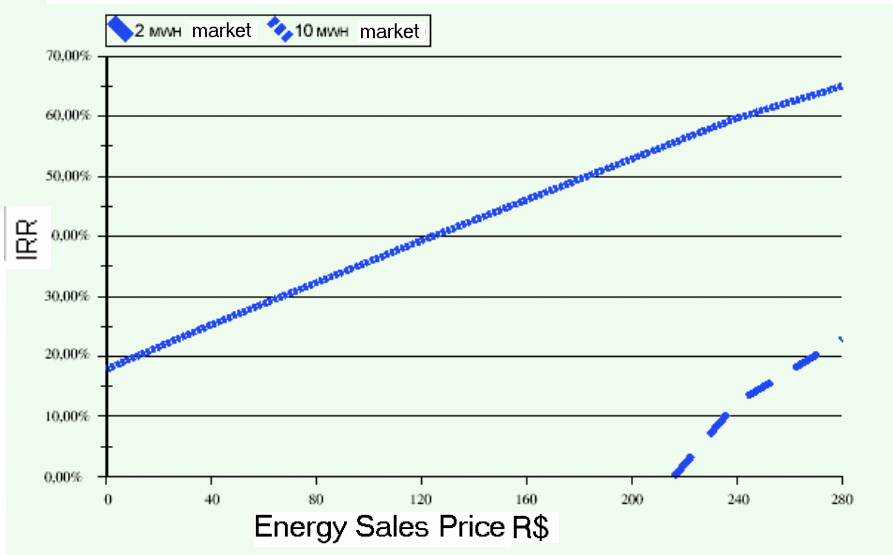
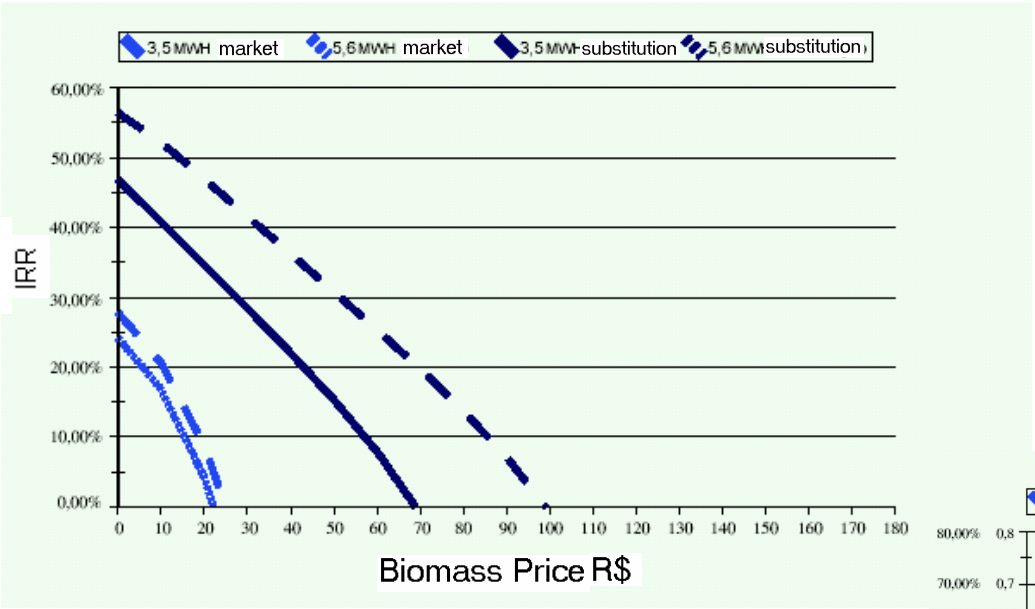


FEASIBILITY STUDY

✓ **JARI/ORSA – IRR SENSITIVITY TO:**



BIOMASS SALES PRICE VARIATIONS

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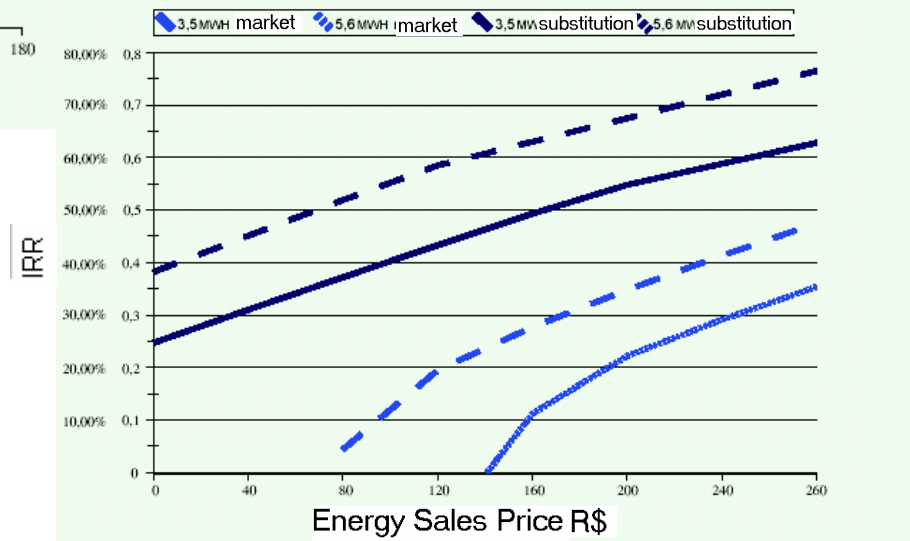

CONCLUSIONS

Public Policies

- ✓ **RAW MATERIAL**
  - **Authorization by IBAMA and State institute is needed.**
  - **The wood procurement is instable (production seasonality).**
  - **The creation of National and State Forest (sustainable production) will easy up the biomass availability**

- ✓ **FEASIBILITY AND CONTRIBUTION TO FOREST MANAGEMENT AND COMPETITIVENESS**
  - **Subsidies for energy generation (R$ 3 billon/year-Rio Branco) limit the competitiveness.**
  - **The forest replacement cost requires for utilizing forest harvest residue is a limiting factor to the biomass energy generation.**
  - **The use of forest residue add value for the managed area units.**
  - **Improvements of the transport infrastructure is essential for increasing competitiveness.**

CONCLUSIONS

Public Policies

✓ **ECONOMIC, SOCIAL AND ENVIRONMENTAL IMPACT**

- **There are local initiatives for energy generation from forest residues.**
- **Embrapa not recommend the removal of the non-commercial specie's residues for purpose of energy generation.**
- **Transfering decision making to local authorities makes the action of implementation easier.**
- **Direct benefits include: income generation, local employment, etc.**
- **Biomass energy generation is an opportunity for the State to develop policies to face growing costs for diesel energy generation.**

CONCLUSIONS

✓ FEASIBILITY

- **The biomass energy production is feasible, however, it losses competitiveness due to large subsidies received by thermoelectric producers (for oil based derivatives)**

- **Currently, only the industrial residues have competitiveness. The transportation costs make difficult the feasibility of using forest harvest residue as a source for energy generation.**

- **The best option for biomass energy generation is using industrial residues and the worst is using non-marketable species.**

CONCLUSIONS

✓ FEASIBILITY

- **The use of industrial and/or forest harvest residue is a way of adding value to wood products, and improving the company profitability. The co-generation produce steam generation for drying process that aggregate value and quality to the final product (wood).**

- **The energy generated through the use of biomass is a big employer of labor and highly feasible when part of the subsidies tied to fossil fuel generation are granted to generation biomass-based processes.**

THANK YOU

JOÉSIO DEOCLÉCIO PIERIN SIQUEIRA

Project's Coordinator PD 61/99 VER. 4 (I)

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