JOURNEY OF COGEN IN INDIA

INTRODUCTION

The increasing price of fossil fuels, the increasing need for the power supply reliability and security and the increasing demand for energy-efficient technologies are tending to favor the application of small power generation solutions.

An excellent approach to these solutions is to install combined heat and power systems that can be configured to operate under normal conditions to supply local power needs but with grid back up. Cogeneration is also called 'total energy' or 'combined heat and power'.

A significant potential exists for generating electricity from various products such as bagasse, a waste product of the cane milling process, agricultural, animal, municipal solid waste etc.

CHRONOLOGY OF EVENTS IN BAGASSE COGEN

Dalmia Bharat Sugar

1992
- National program on promotion of biomass power/bagasse based cogeneration

1998-99
- 14 state announce Power purchase policies

2002
- Maharashtra Electricity Regulatory Commissions issues incentive tariffs for the buy-back of electricity from bagasse

2006
- Tariff policy

2010
- REC

PREAMBLE

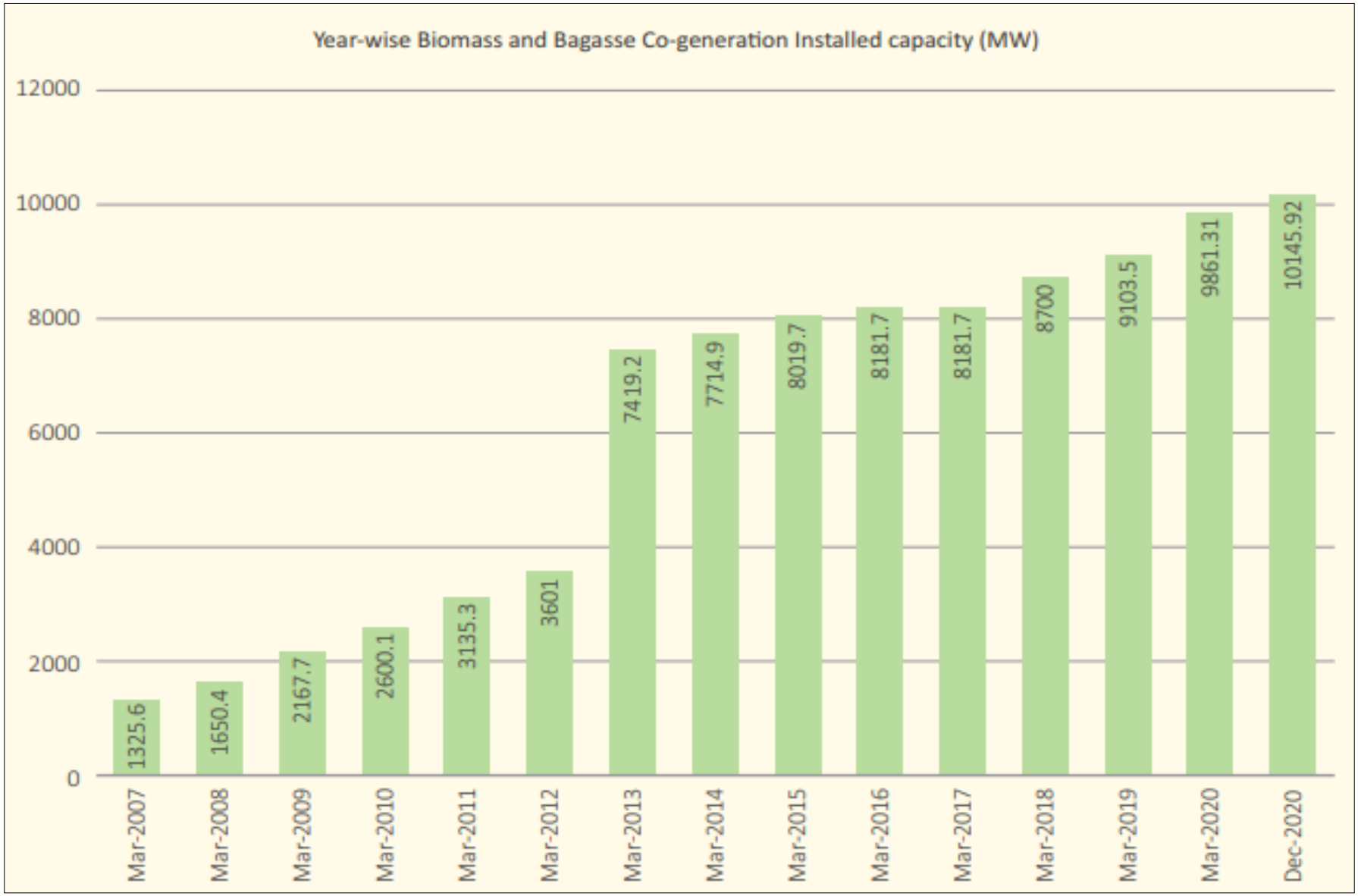
Cogeneration for the sugar industry has been a very attractive option in view of the potential for increasing the financial health of the sugar mill on one hand, and reducing the ecological damage by promoting the use of renewable fuels like bagasse for power generation, on the other hand.

In the mid eighties it was realized that by making maximum use of potential for co generating steam and electricity from bagasse, generation of electricity could be increased not only to fully meet the captive requirements but also to have exportable surplus that could bring in additional profit.

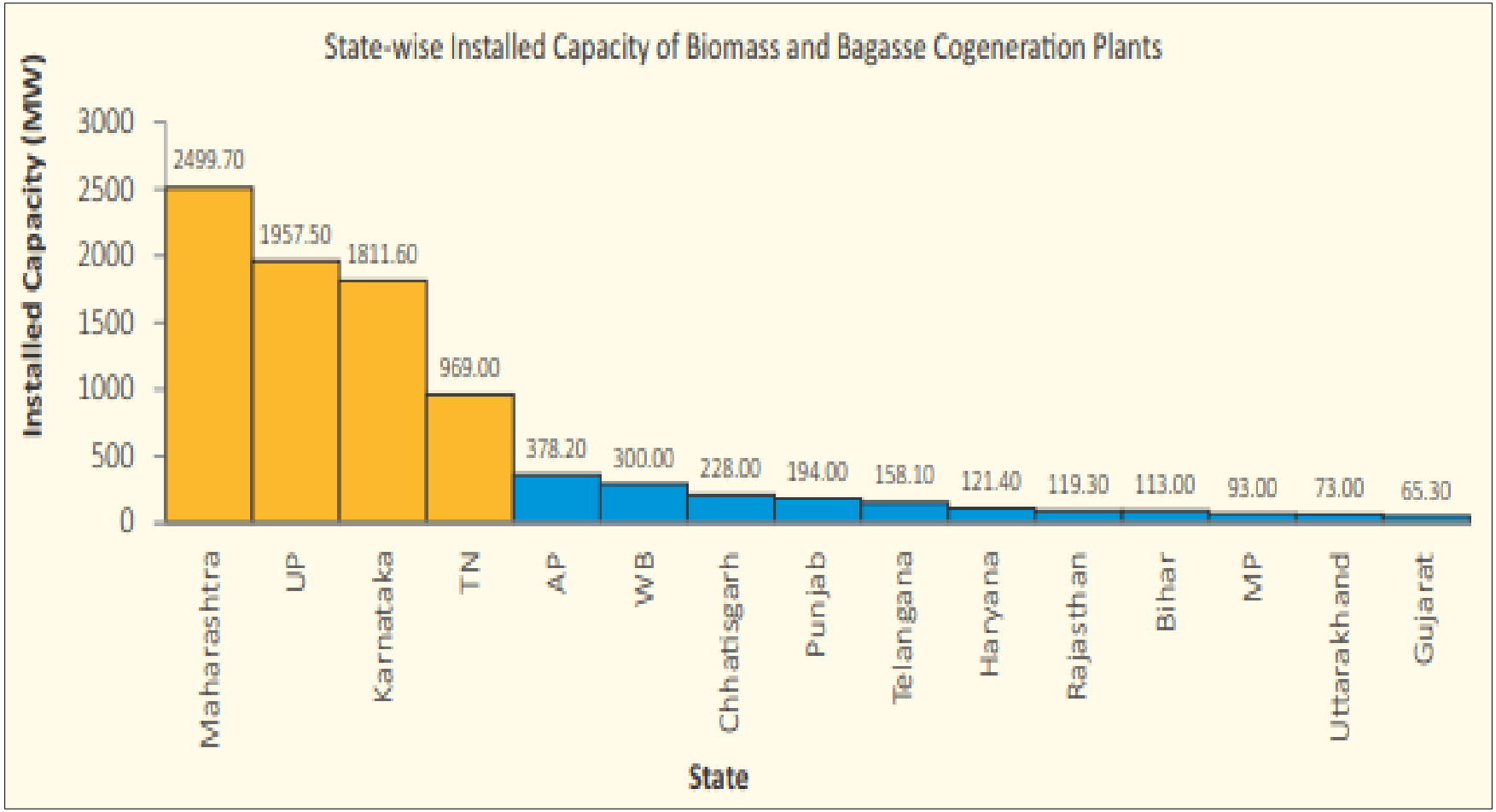
COGEN (COMBINED HEAT & POWER or CHP)

- A process in which an industrial facility uses its waste energy to produce heat or electricity
- Cogeneration is an energy-efficient, environmentally-friendly method of producing electricity (power), steam and/or hot water at the same time, in one process, with one fuel.
- Is the use of power station to simultaneously generate both heat and electricity
- Cogeneration is typically two to three times more efficient than major conventional, coal fired, centralized power station
- On an average it produce one third the greenhouse gas emission of conventional power production

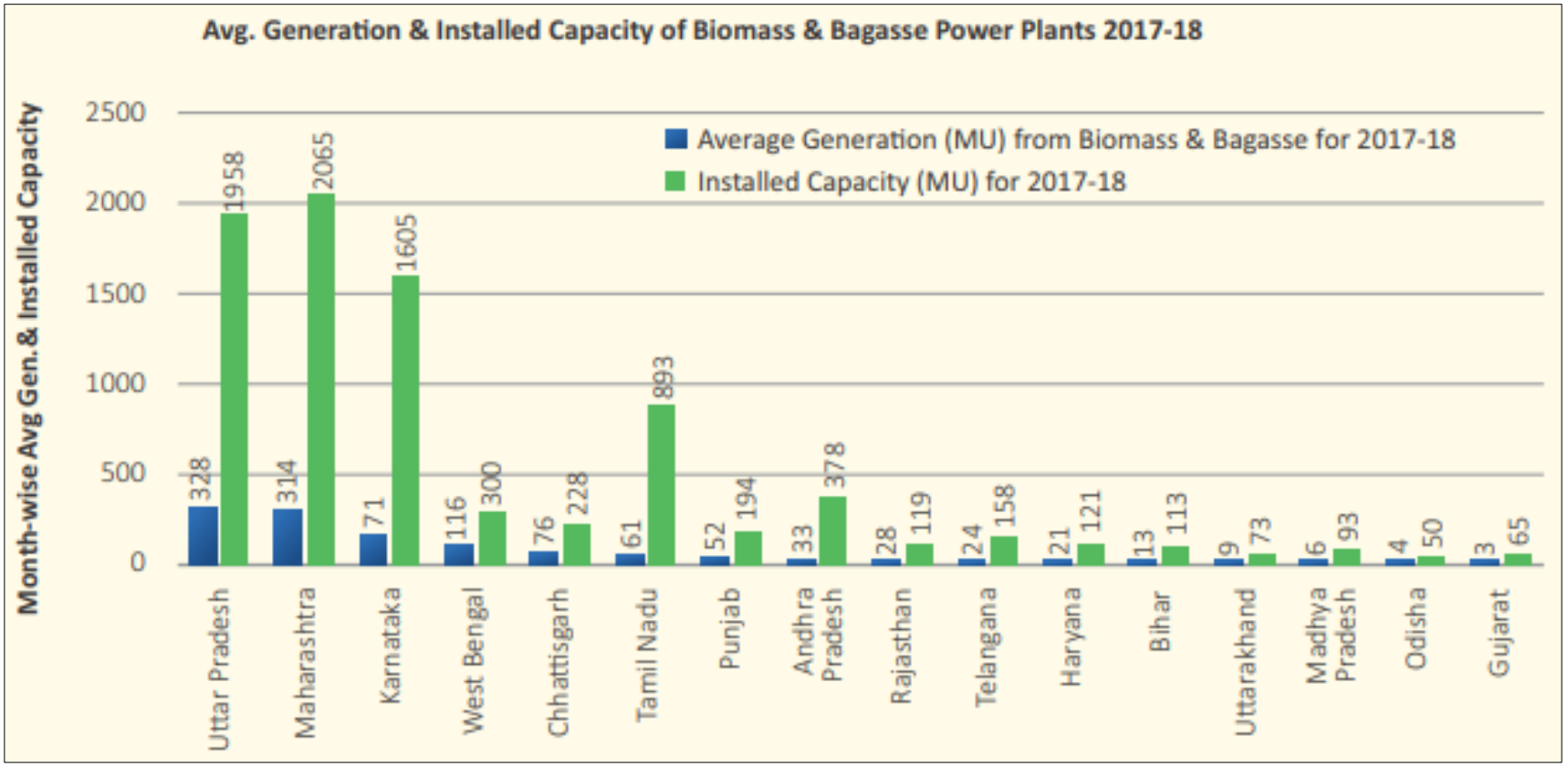
COGEN INSTALLED CAPACITY (MW)



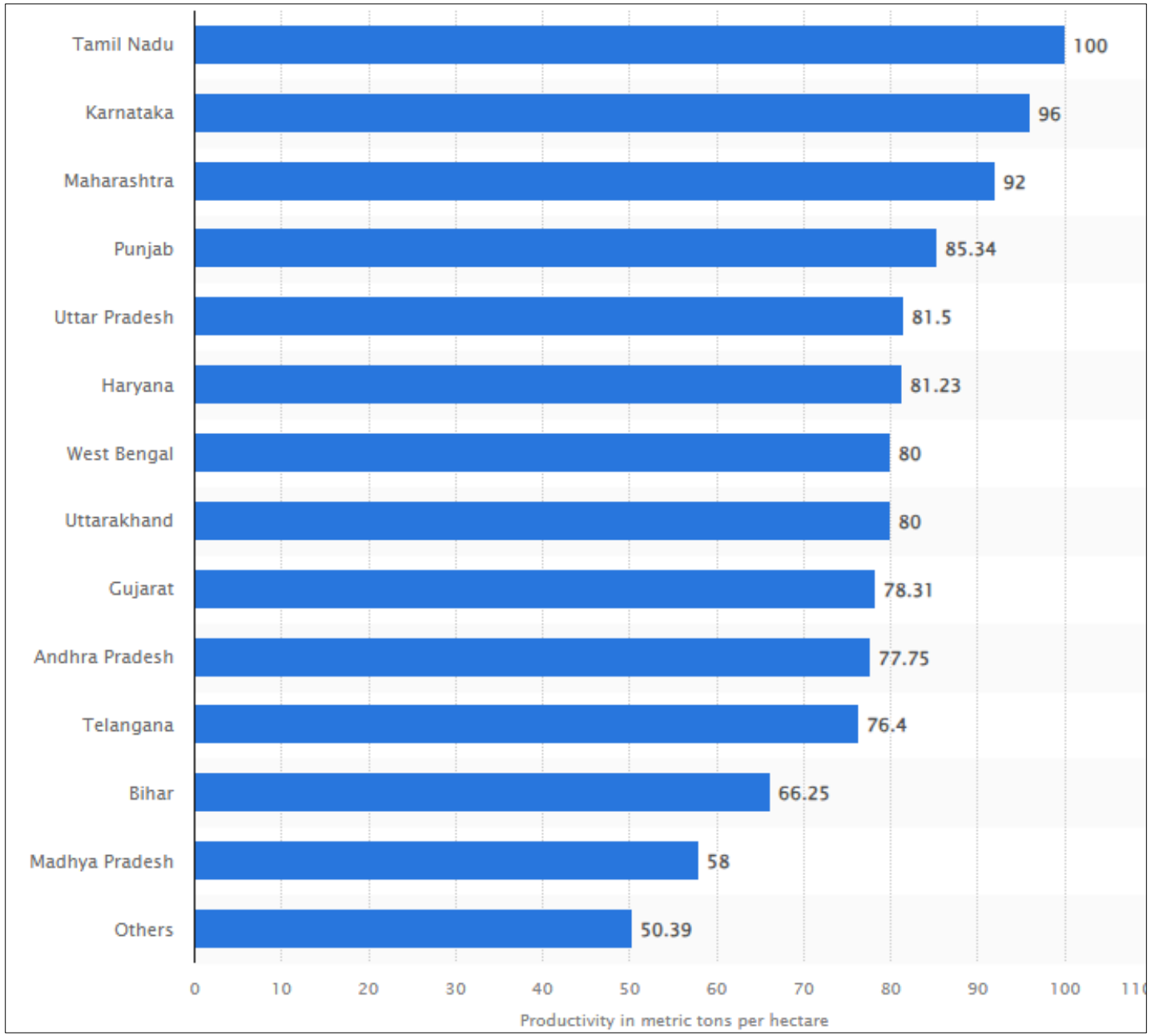
STATE WISE INSTALLED CAPACITY (MW)



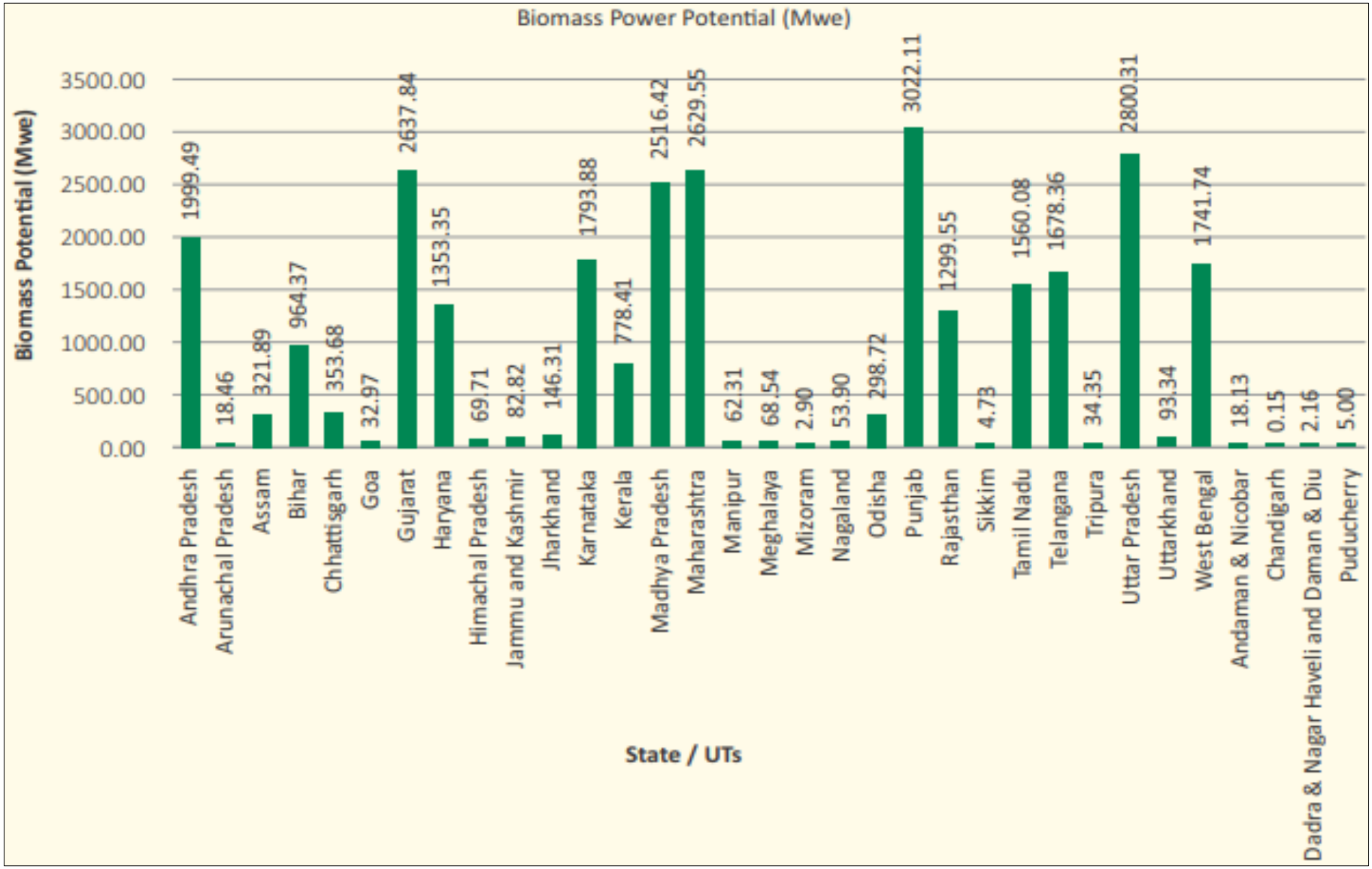
AVERAGE GENERATION VS INSTALLED



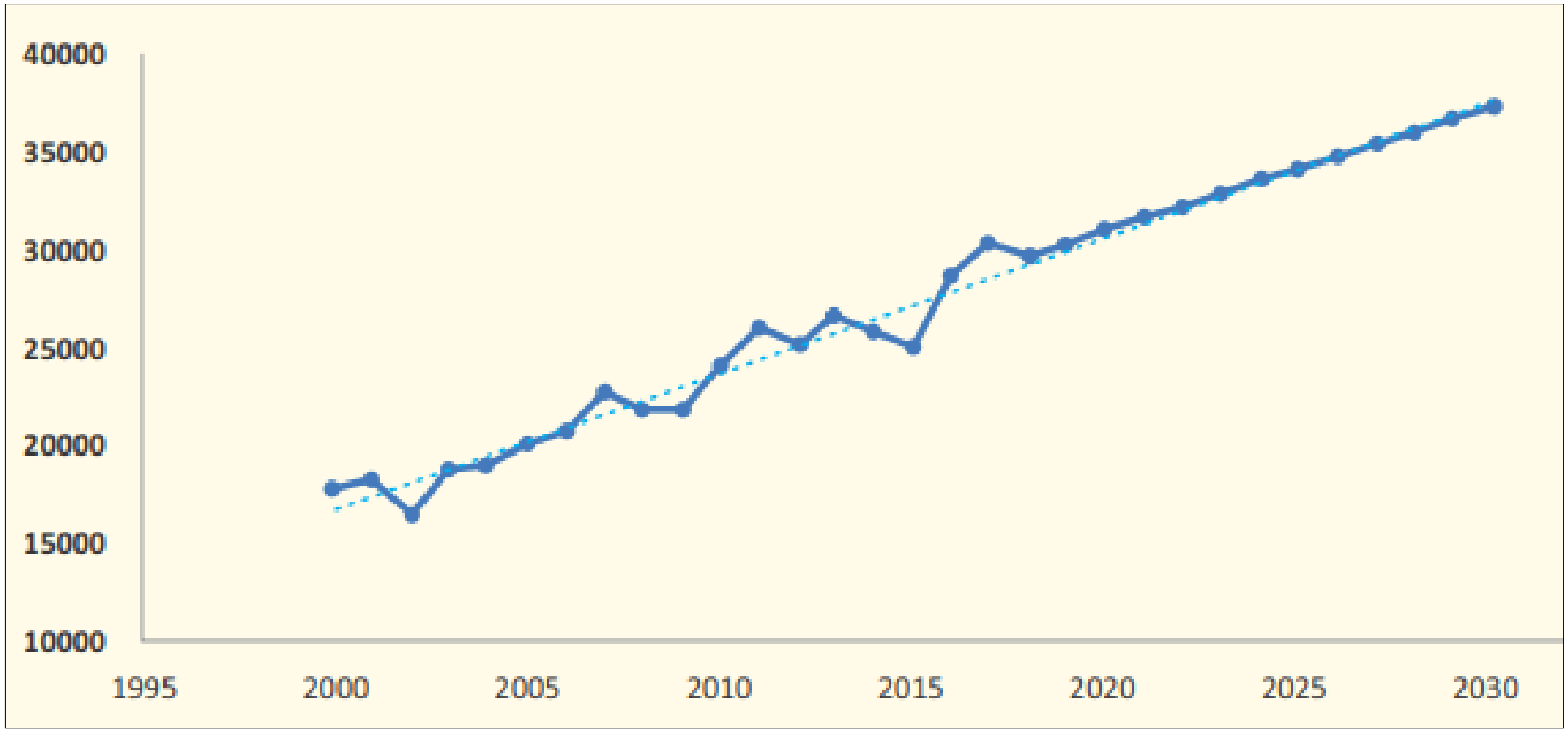
STATE WISE SUGARCANE YIELD IN INDIA



STATE WISE POWER POTENTIAL (Mwe)



TREND OF BIOMASS POWER POTENTIAL



STATE WISE BAGASSE COGEN INSTALLED CAPACITY

State/UTs	Bagasse Cogeneration (MW)
Andhra Pradesh	207
Bihar	101
Chhattisgarh	20
Gujarat	21
Haryana	102
Karnataka	1730
Madhya Pradesh	0
Maharashtra	2351
Punjab	161
Rajasthan	5
Tamil Nadu	750
Telangana	98
Uttarakhand	73
Uttar Pradesh	1930
Total	**7547**

STATE WISE BAGASSE COGEN INSTALLED CAPACITY

Sector	Potential (MW)	Realizable Potential (MW)
Distilleries	3500	2500
Cement	600	400
Chemicals	900	600
Fertilizers	1200	750
Metal Industry	1060	700
Sugar	5000	3000
Refineries	800	600
Paper & Pulp	1000	750
Textile	1200	800
BCHP	650	400
Other sector	750	500
Total	**16000**	**11500**

COGENERATION ADVANTAGES

Dalmia Bharat Sugar

Efficient way of conveying primary fuel to useful energy

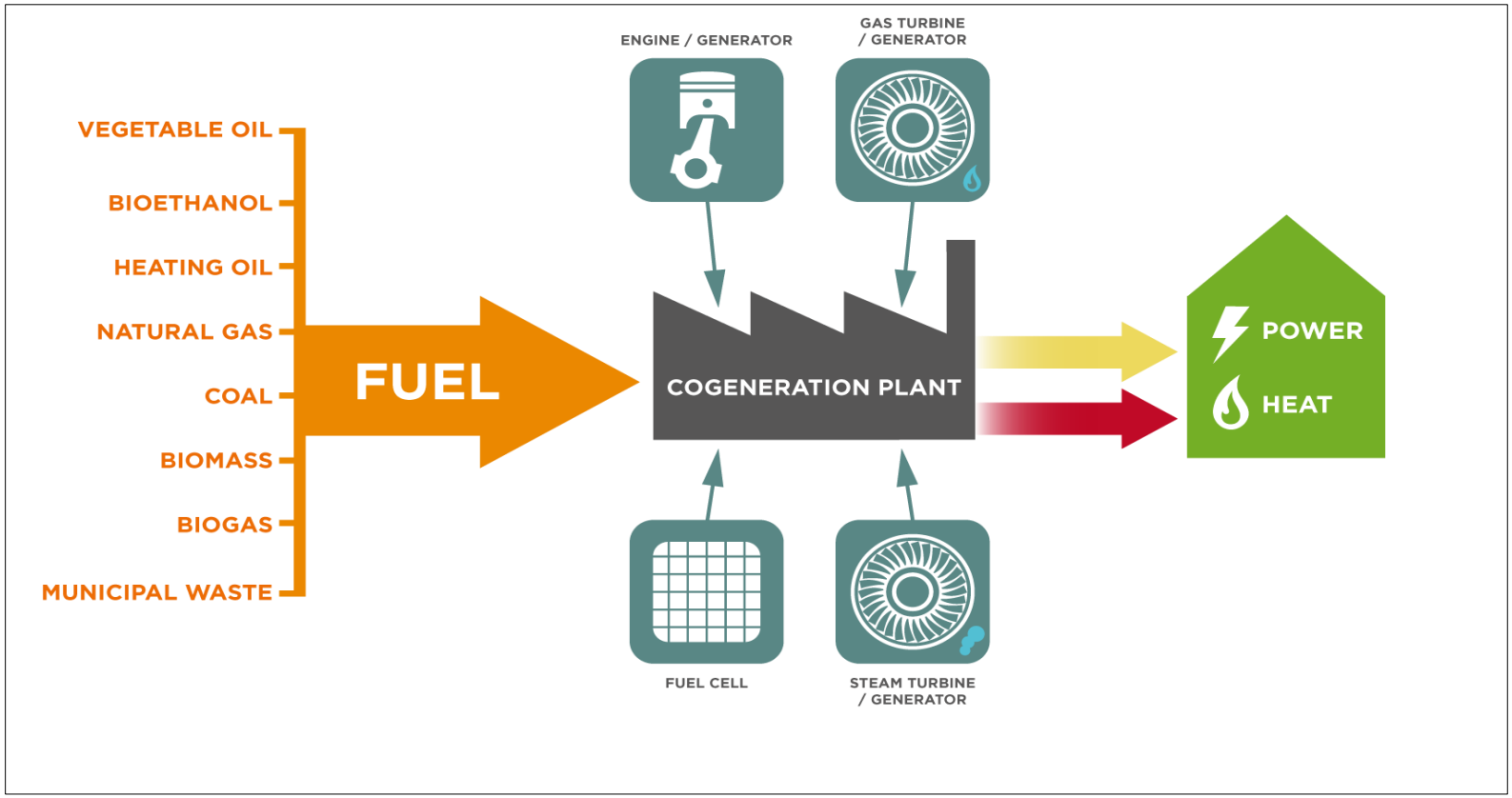
Process industries benefit viz. commercial + environmental sectors

Target have been set by government and this will depend on.

1. Future gas and electricity prices
2. Development in electricity trading
3. Environmental pressure

COGENERATION TECHNOLOGY

- Steam turbine based cogeneration system
- Gas turbine based cogeneration system
- Combined steam/gas turbine based cogeneration system
- Reciprocating engine based cogeneration system



FACTORS FOR SELECTION OF COGEN SYSTEM

Dalmia Bharat Sugar

FACTORS FOR SELECTION OF COGENERATION SYSTEM

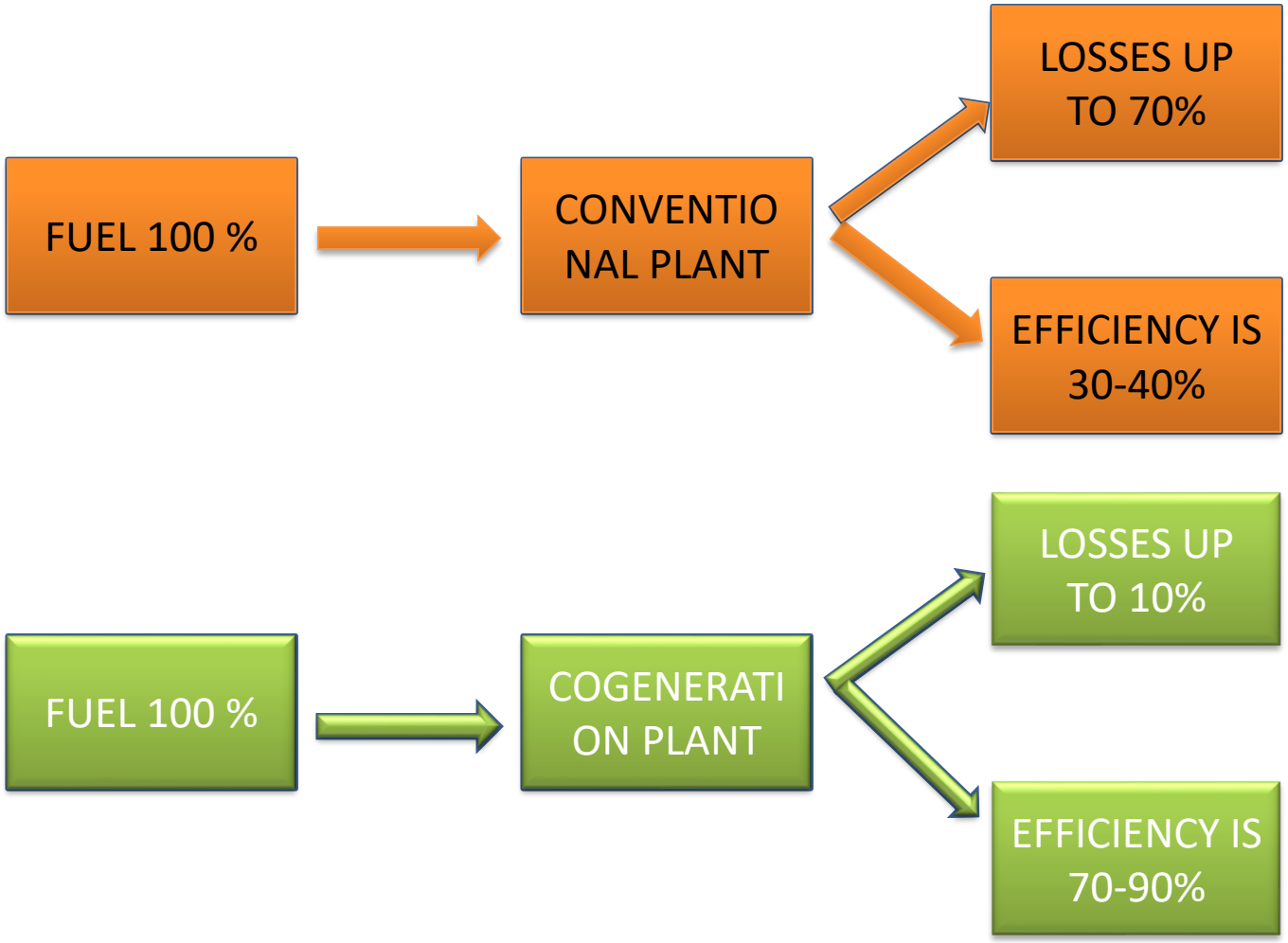
- Maximum/minimum power load and steam load in the plant
- What is more critical - whether power or steam, to decide about emergency back-up availability of power or steam.

- Long term availability of fuels and fuel pricing
- Commercial availability of various system alternatives, life span of various systems and corresponding outlay for maintenance

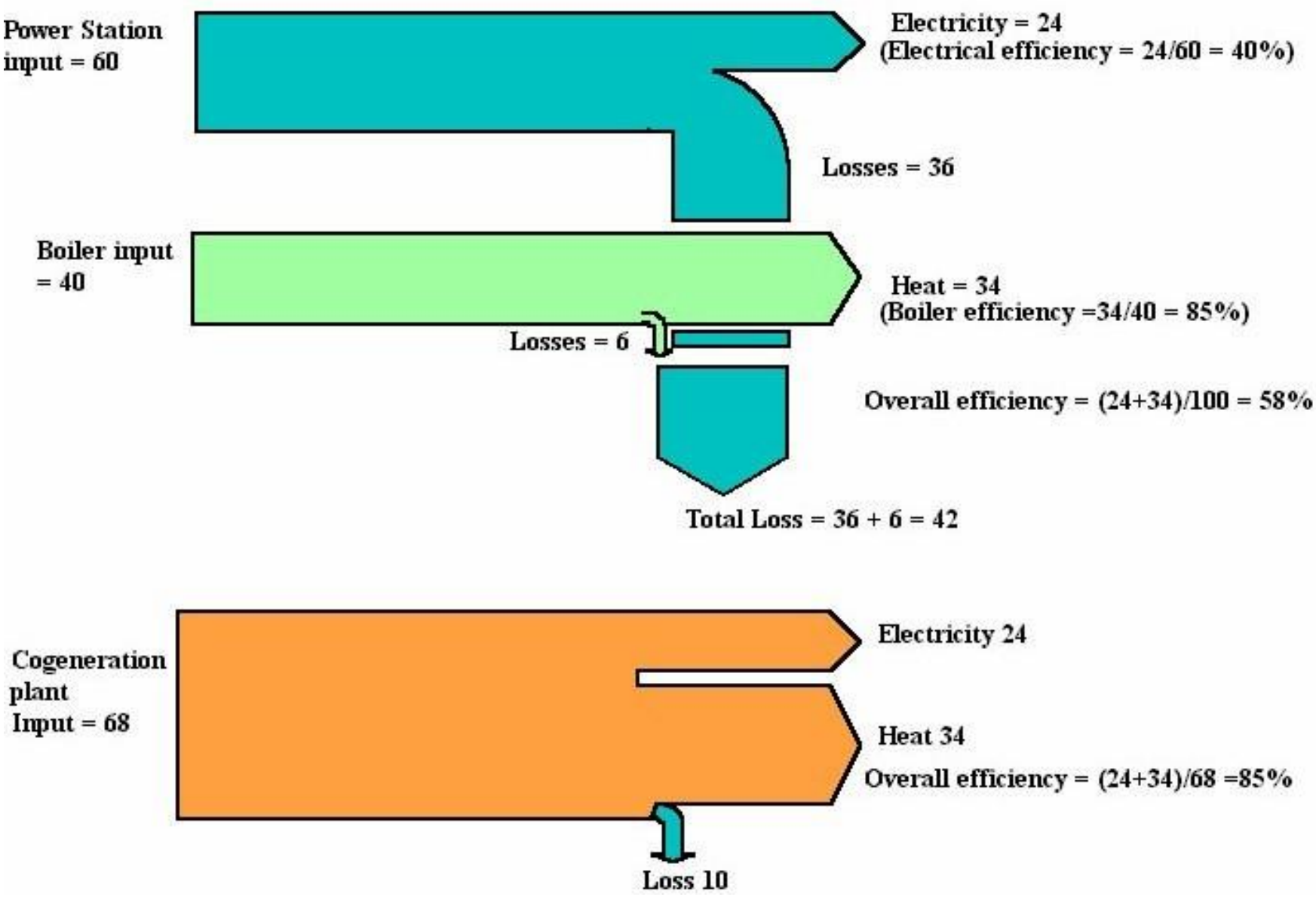
- Type of fuel available - whether clean fuel like natural gas, bagasse and any other biomass.
- Anticipated fluctuations in power and steam load and pattern of fluctuation

- Project completion time.
- Project cost and long term benefits

COGENRATION EFFICIENCY



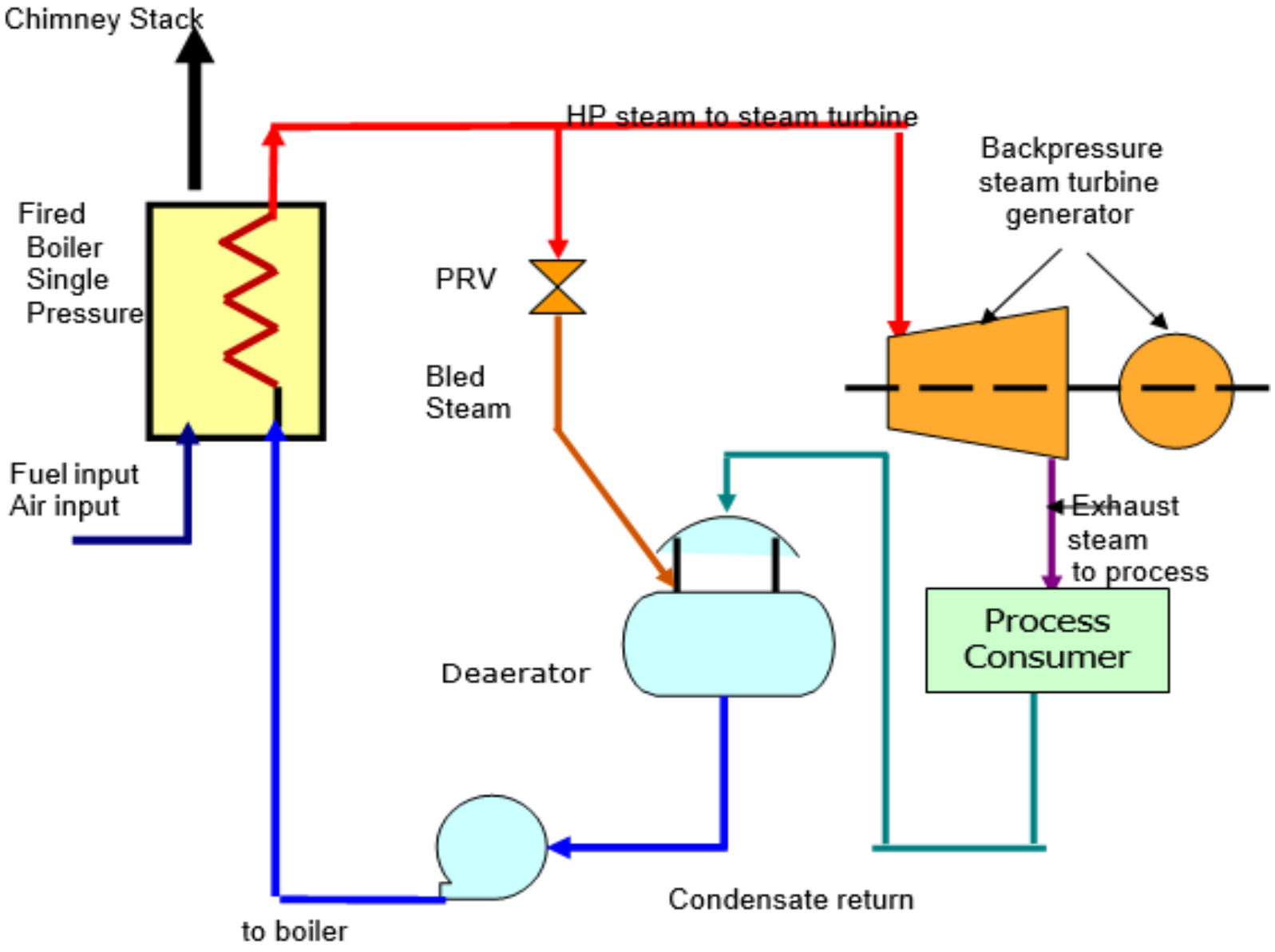
EXAMPLE 60/40 COGENERATION



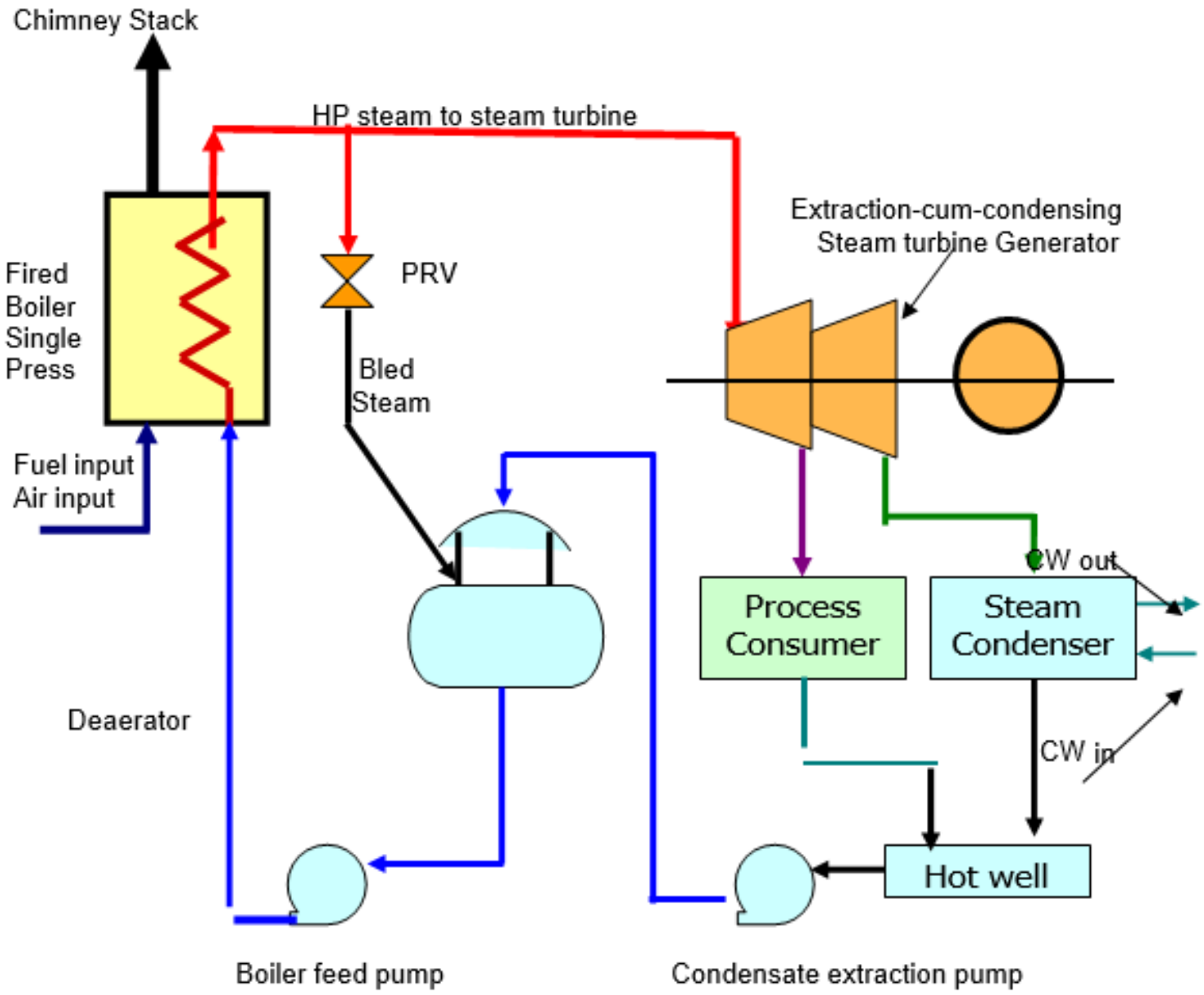
STATE WISE BAGASSE COGEN INSTALLED CAPACITY

Cogeneration System	Heat-to-power ratio	Power Output (as percent of fuel input)	Overall Efficiency %
Back-pressure steam turbine	4.0 – 14.3	14 – 28	84 – 92
Extraction-condensing steam turbine	2.0 – 10	22 – 40	60 – 80
Gas turbine	1.3 – 2.0	24 – 35	70 – 85
Combined cycle (Gas plus steam turbine)	1.0 – 1.7	34 – 40	69 – 83
Reciprocating engine	1.1 – 2.5	33 - 53	75 - 85

EXAMPLE 1 - BACK PRESSURE TURBINE



EXAMPLE 2 – CONDENSING TURBINE



SAMPLE EFFICIENCY CALCULATIONS

Dalmia Bharat Sugar

Electric generation output = 12000 kw
= 4,31,37,600 kJ/h

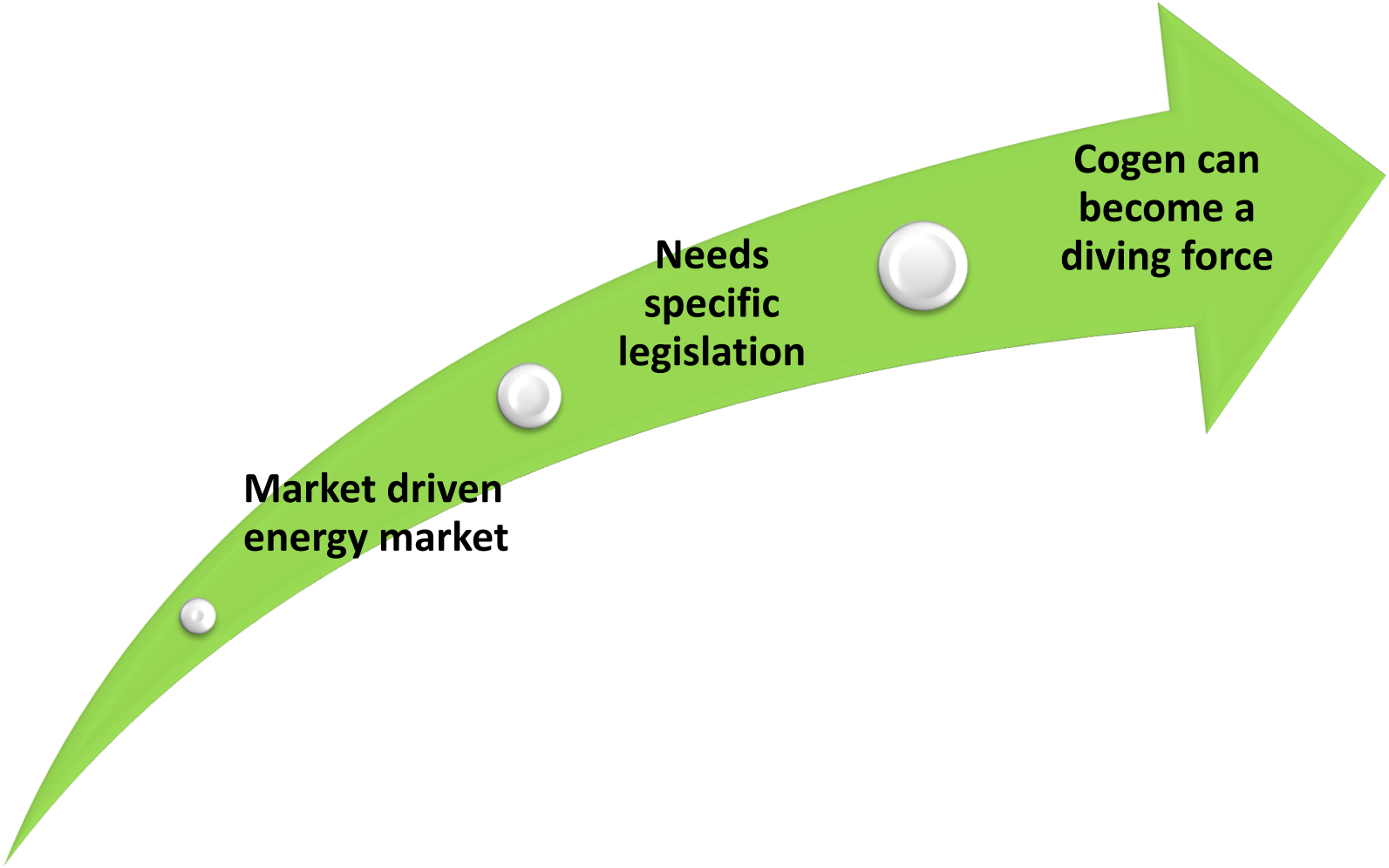
Steam utilized at	Quantity (MT/h)	Energy used kJ/h
22 bar to process	15	27149100
22 bar to HP heater	5	9049700
22 bar to Calciner	14	25339160
22 bar to Calciner	76.8	139003392
2.2 bar to process	65	117646100

Total energy in steam output = 31,81,87,452 kJ/h
Total energy output (Electricity + Steam) = 42,35,44,352 kJ/h

Parameter	Unit	Lignite
Fuel flow	MT/hr.	9.34
Higher heating value (Gross Cal)	koala/kg	3894

Total energy input = 9.34 x 1000 x 3894 x 4.18 + 4.0 x 5832 x 1000 x 4.18 kJ/h
= 74,87,20,294 kJ/h
Overall efficiency = Total energy output/Total energy input = 56.6%

THE FUTURE


Market driven energy market
Needs specific legislation
Cogen can become a diving force

THANK YOU