MANAGING ASSETS & CHALLENGES IN POWER GENERATION SECTOR

Keynote Address

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TENAGA NASIONAL BERHAD

Powering The Nation's Progress

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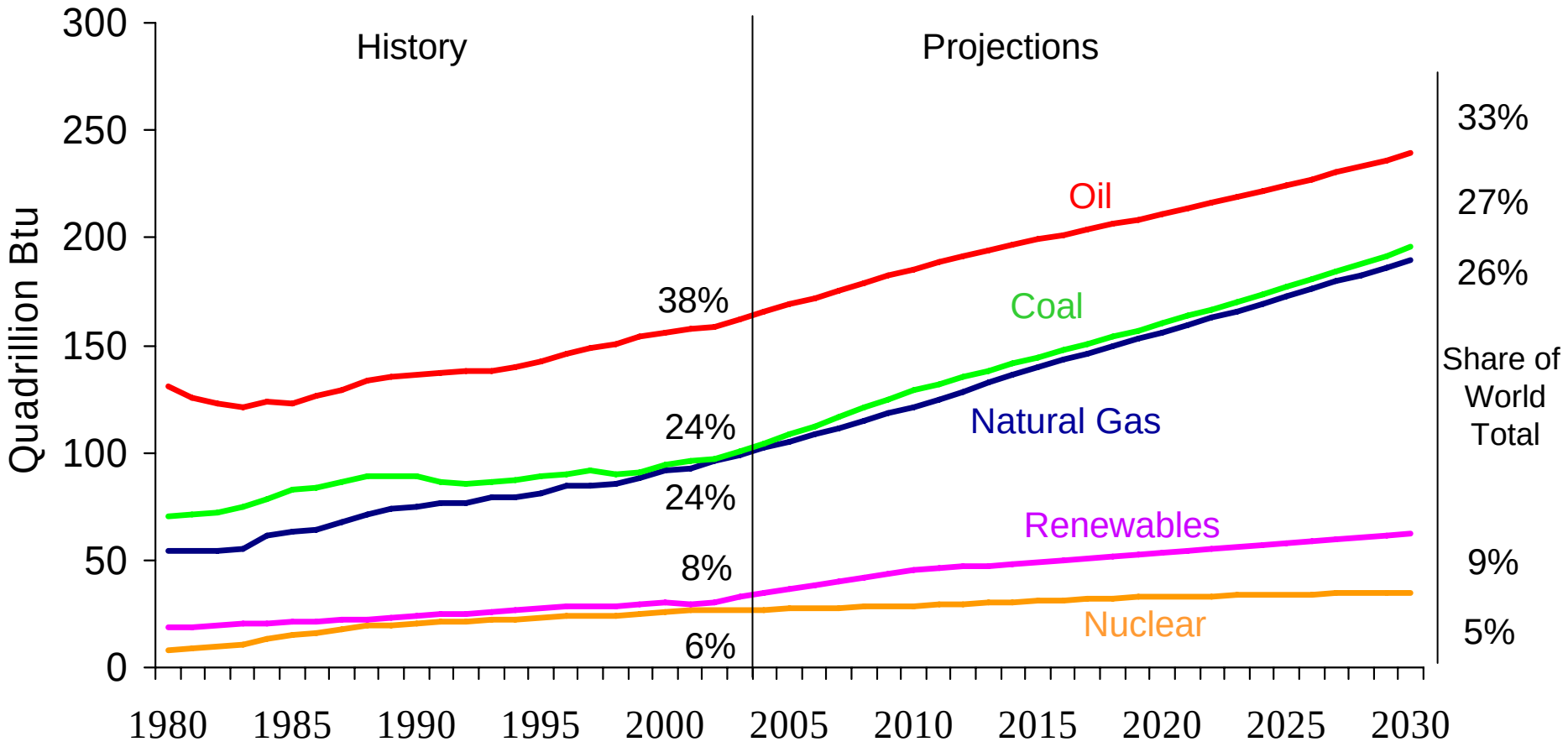
OUR SOCIETY REQUIRES ENERGY

WHAT DO THESE TRENDS TELL US?

World Marketed Energy Use by Fuel Type, 1980-2030



Source: EIA, IEO2006

SOURCE OF ENERGY TO MEET DEMAND

Renewable

BIOMASS
renewable
Heating, electricity, transportation

HYDROPOWER
renewable
Electricity

GEOTHERMAL
renewable
Heating, electricity

WIND
renewable
Electricity

SOLAR & OTHER
renewable
Light, heating, electricity

Non-renewable

PETROLEUM
nonrenewable
Transportation, manufacturing

NATURAL GAS
nonrenewable
Heating, manufacturing, electricity

COAL
nonrenewable
Electricity, **manufacturing**

URANIUM
nonrenewable
Electricity

PROPANE
nonrenewable
Manufacturing, heating

HOW BIG IS 1MW

150 W

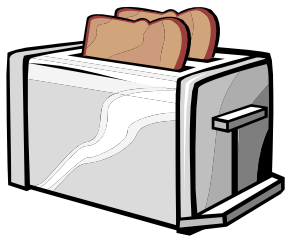
100 W x 1 hr = 100 Wh

100 W x 10 hr = 1000 Wh = 1 kWh

250 W

100 W

Appliance	Rating	Operation*
Lighting	100W	416 days
Freezer	250W	167 days
Water Heater	350W	119 days
A/ Conditioning	750W	55 days
Electric Kettle	800W	52 days
Toaster	1000W	41 days



1000 W

800 W

* 24hrs Operation

ASSET VALUE CHAIN
- CONVERTING FUEL INTO ELECTRICITY

FUEL
- Coal
- Oil
- Gas
- Distillate

GENERATOR

Cheapest

Most Flexible

Most Reliable

GRID

PUBLIC–AT-LARGE

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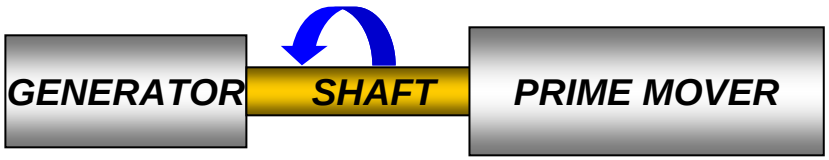
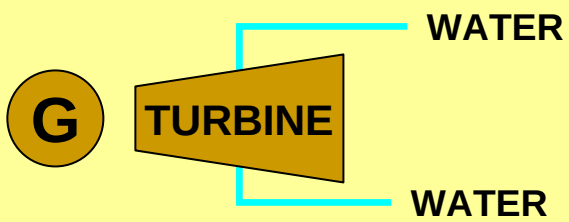
ELECTRICITY BASICS: TURNING A ROTOR IN A MAGNETIC FIELD USING A GENERATOR



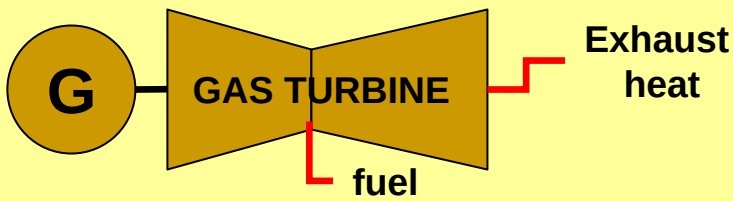
UNIQUE INDUSTRY

- *TO MEET EXTERNAL DEMAND*
- *ELECTRICITY NOT STOREABLE*

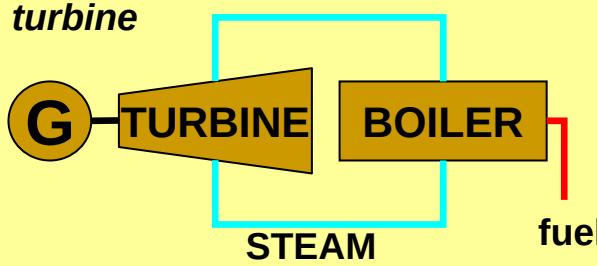
1. Hydro – uses water to turn turbine



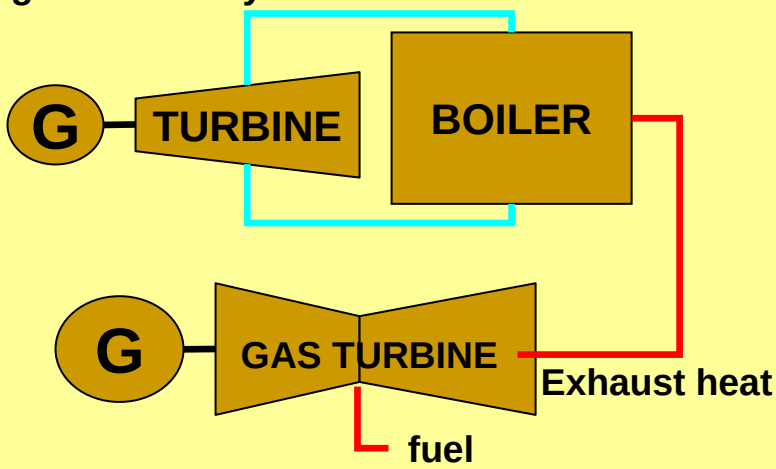
2. Gas turbine – uses fuel to turn generator



3. Steam Plant using different fuels produces steam to turn turbine



4. Combined cycle- combines thermal and gas turbine cycles



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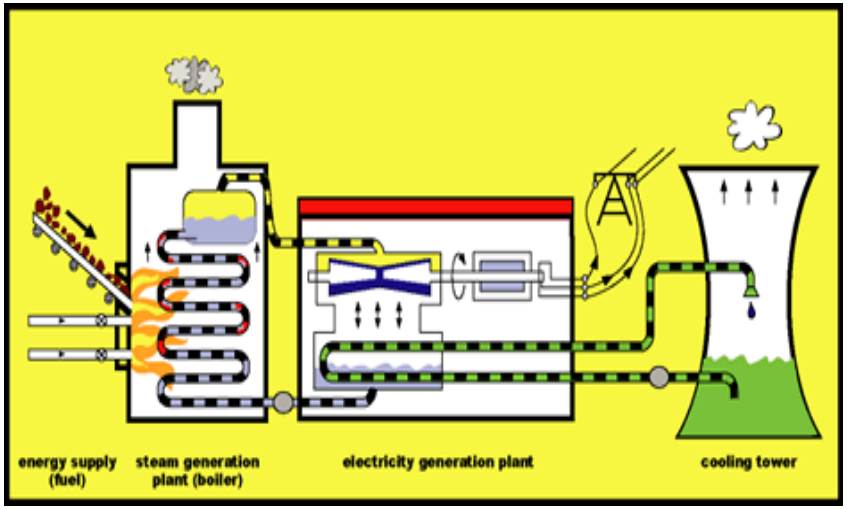
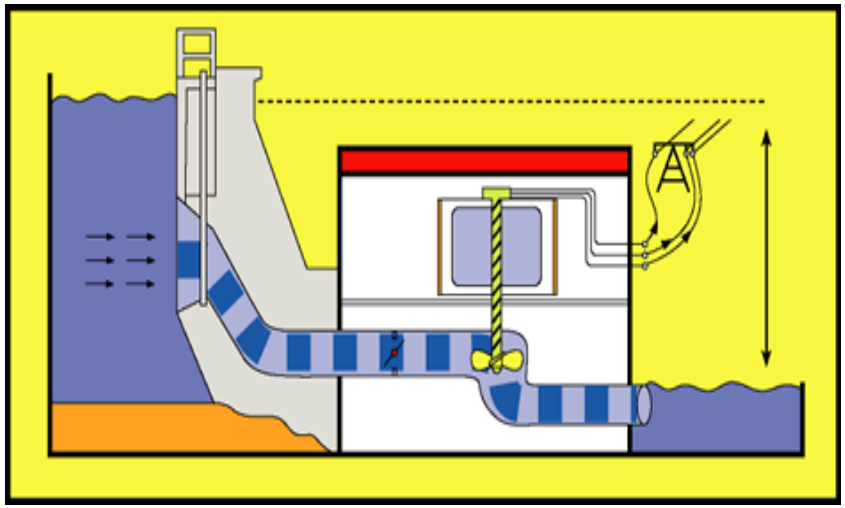
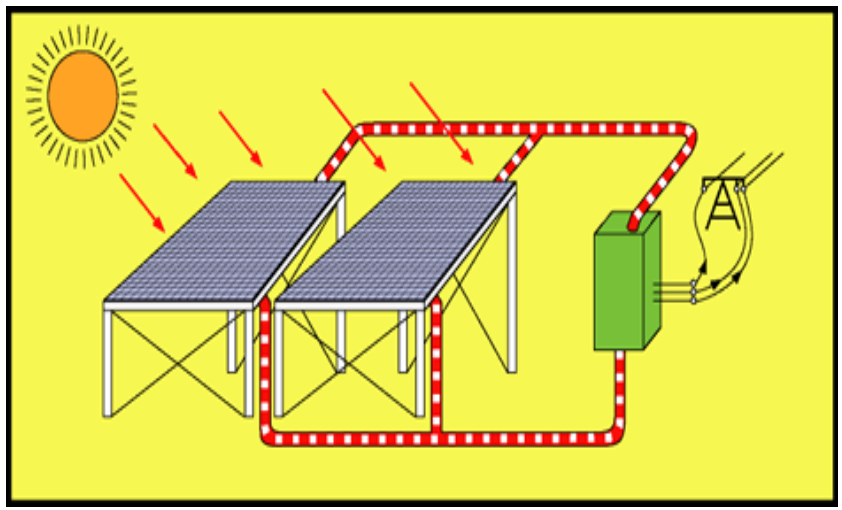
MOST COMMON METHOD OF GENERATING ELECTRICITY



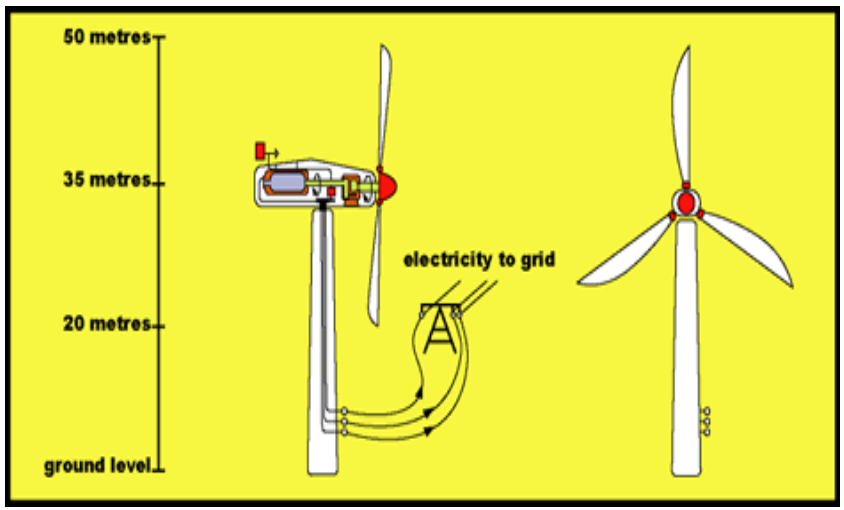
Thermal



Hydro



Solar



Wind

HYDRO SCHEME

Example: TNB Hydro (SG. PERAK RIVER SYSTEM)

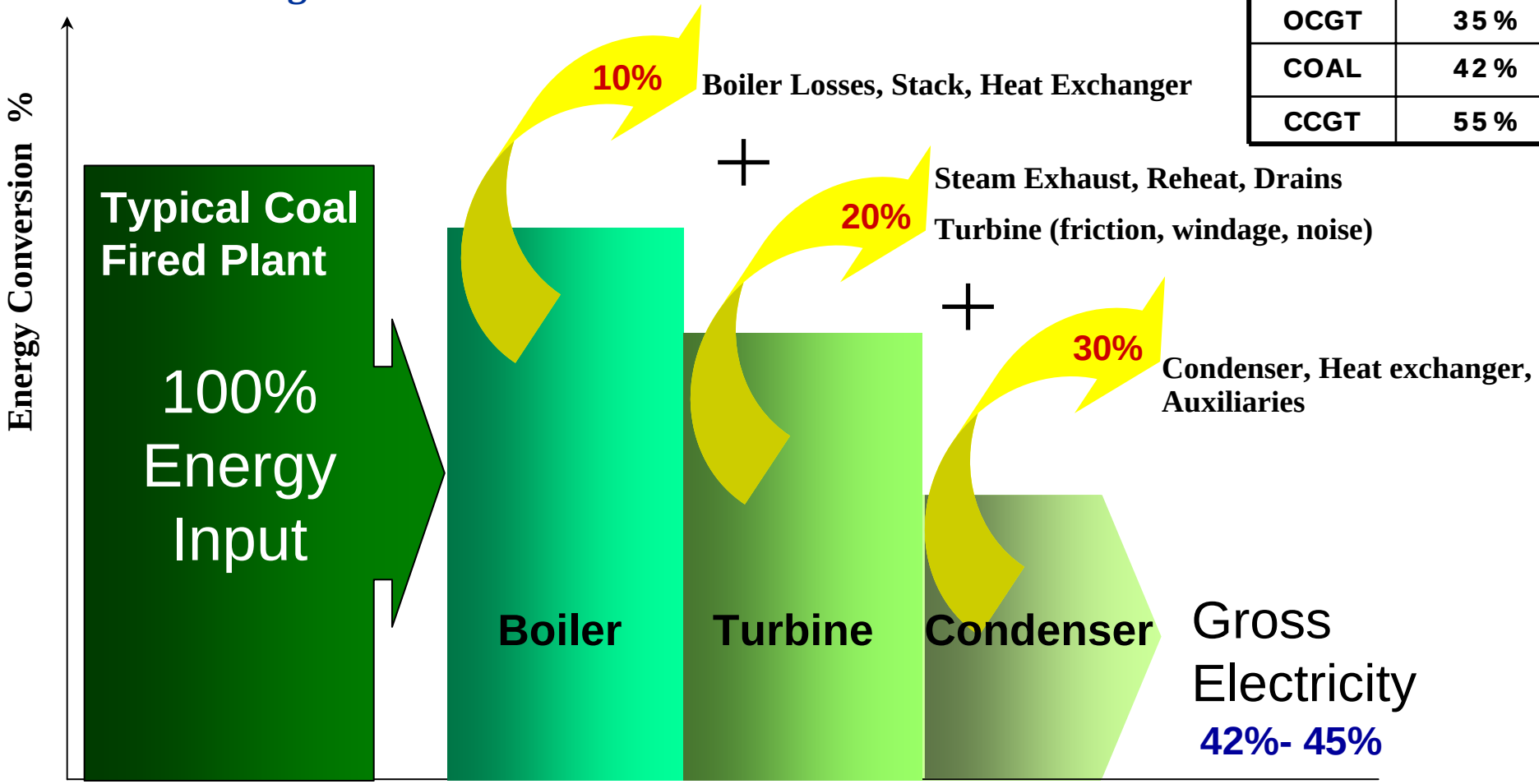
CHALLENGES FOR GENERATING POWER

- Rising Demand of Developing Countries
- Higher Usage of Energy per capita
- Reliability and Quality of Supply
- Technology limitation – Cannot store
- Rising in Fuel Cost – Location of fuel source
- Environmental Concern & Mitigation –KYOTO Protocol
- Scarcity of Project Site
- Project Funding and Risk
- Country Policy – Import of technology (e.g Nuclear) & fuels

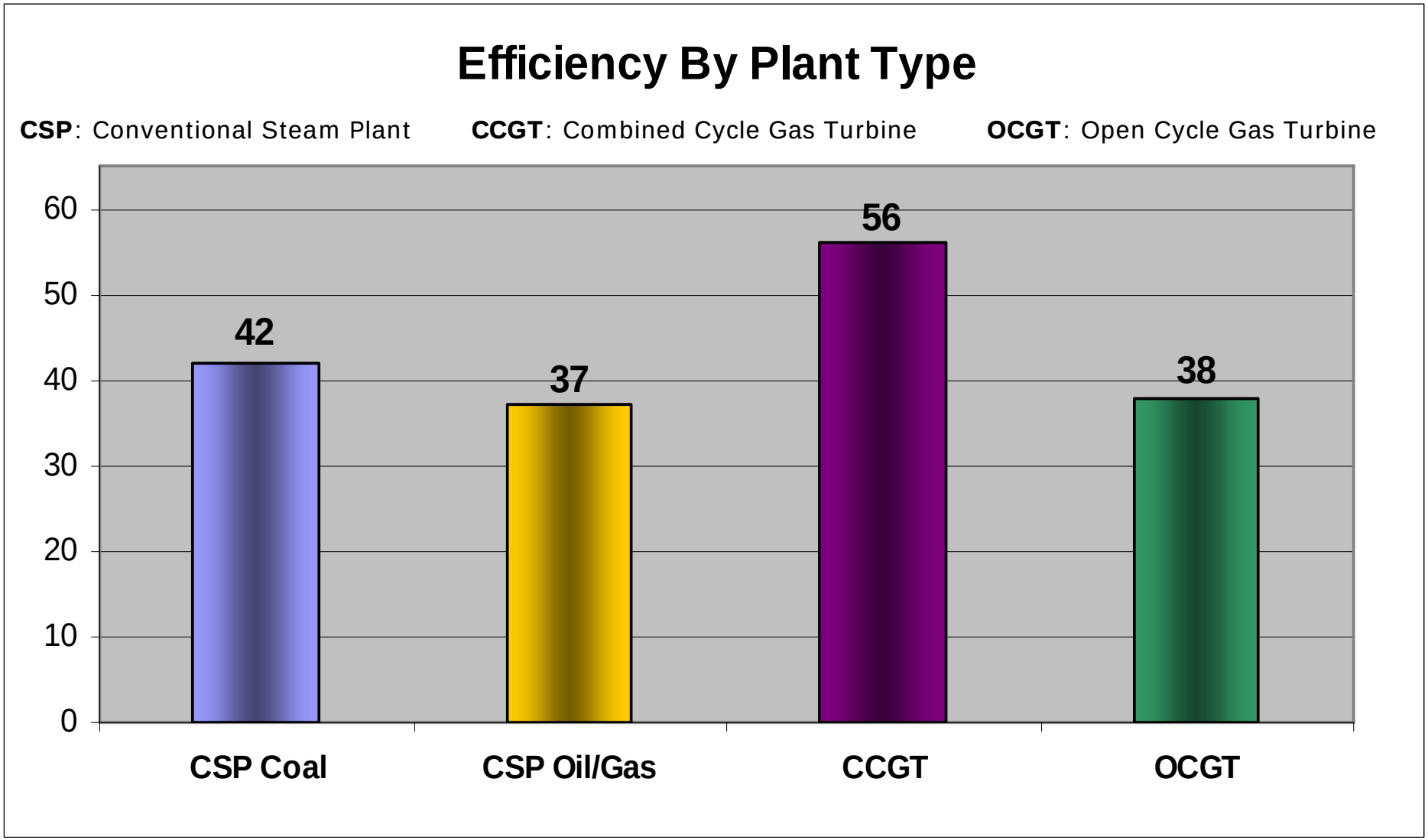
ENERGY EFFICIENCY

- Measures the amount of energy in the raw fuel needed to produce a specified amount of electricity.
- Measured using a measure called the Heat Rate.

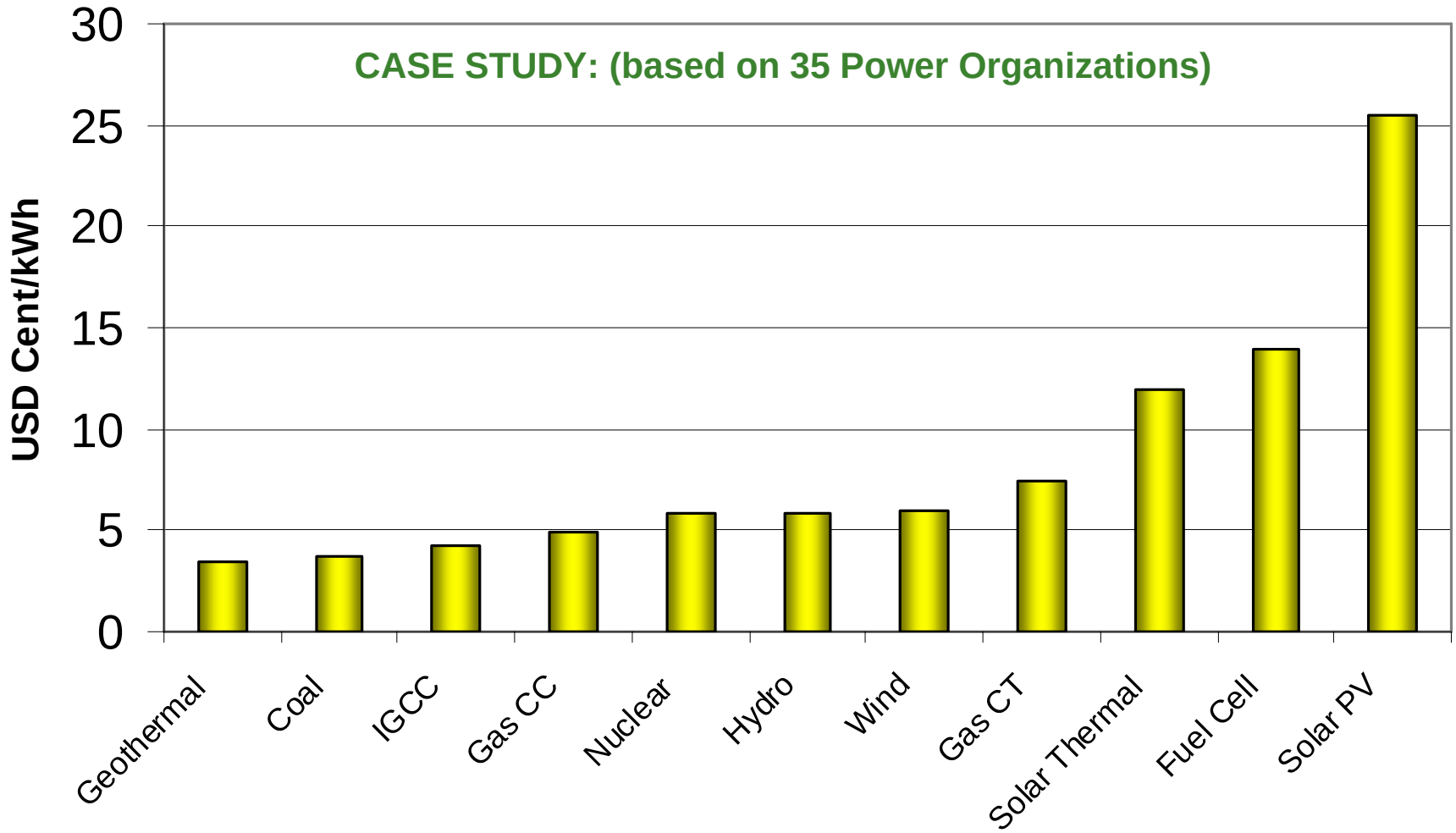
Plant Type	Gross Efficiency
OCGT	35 %
COAL	42 %
CCGT	55 %



TECHNOLOGY LIMITATION

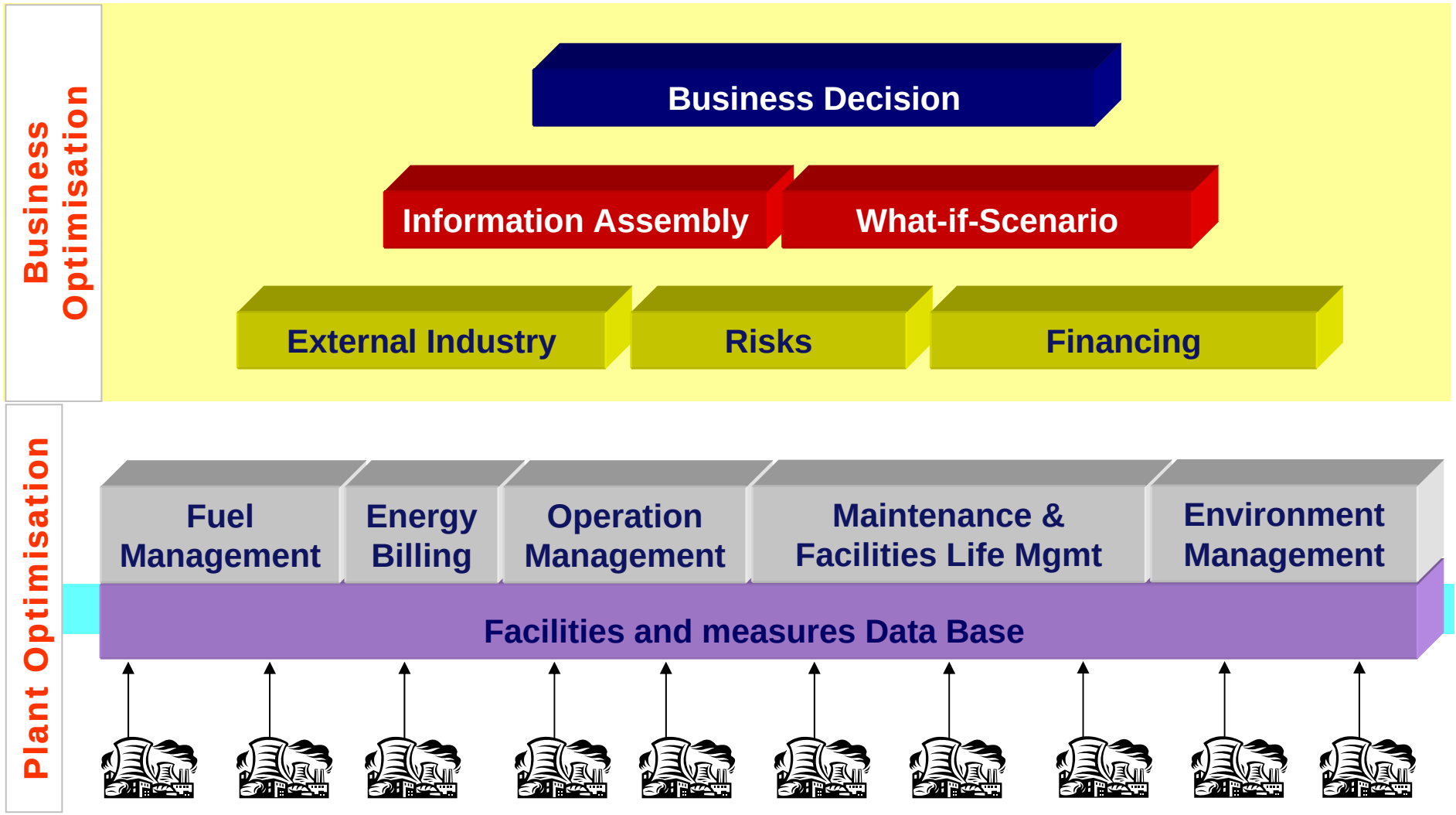


COMPARATIVE GENERATION COST PER kWh

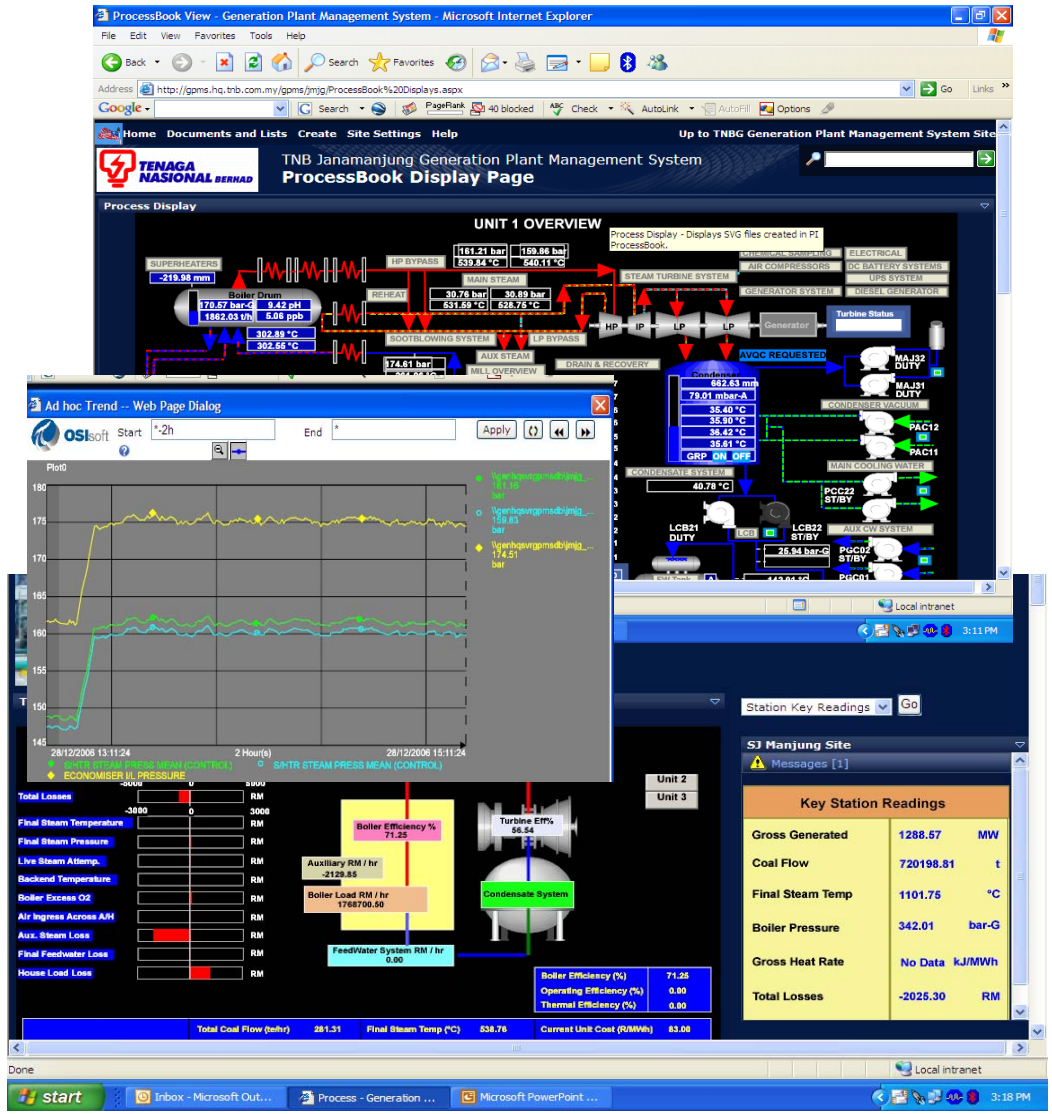


Source: **Paper 'The Economics of Generation Tecnologies' (Lockwood Greene consulting study) 2003**

MANAGING GENERATION BUSINESS PORTFOLIO
- Building Block of Decision Support System (DSS)



OUR PILOT INTEGRATED PROJECT (PHASE I) – Started in 2004



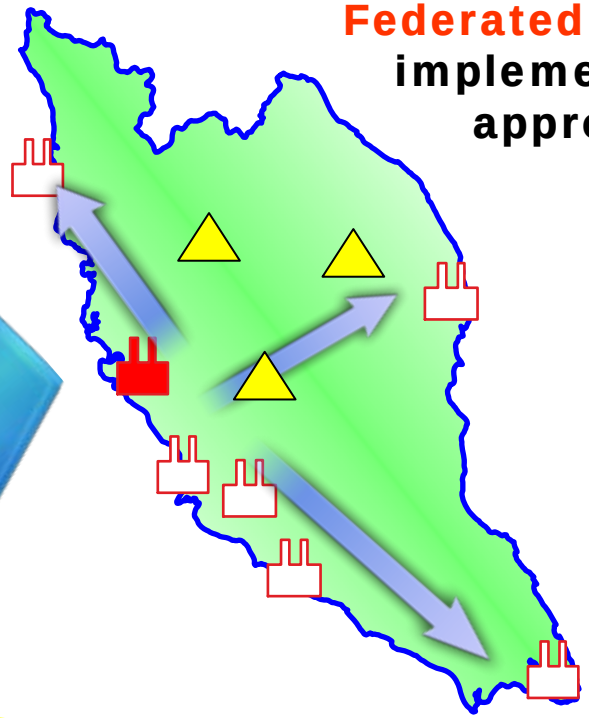
Main Modules

- Plant Historians and Analysis
- Business Analysis and Reporting
- Real Time Plant Modelling and Optimisation

PHASE 2 : EXTENSION TO ALL OTHER TNB'S PLANTS
- Full Completion by End 2008

Full Turnkey approach for Phase I implementation at SJSAS Manjung

Federated In-House implementation approach



- Using PI as the solution
- Central team with owner's team at site
- TNB own technical & commercial advisors

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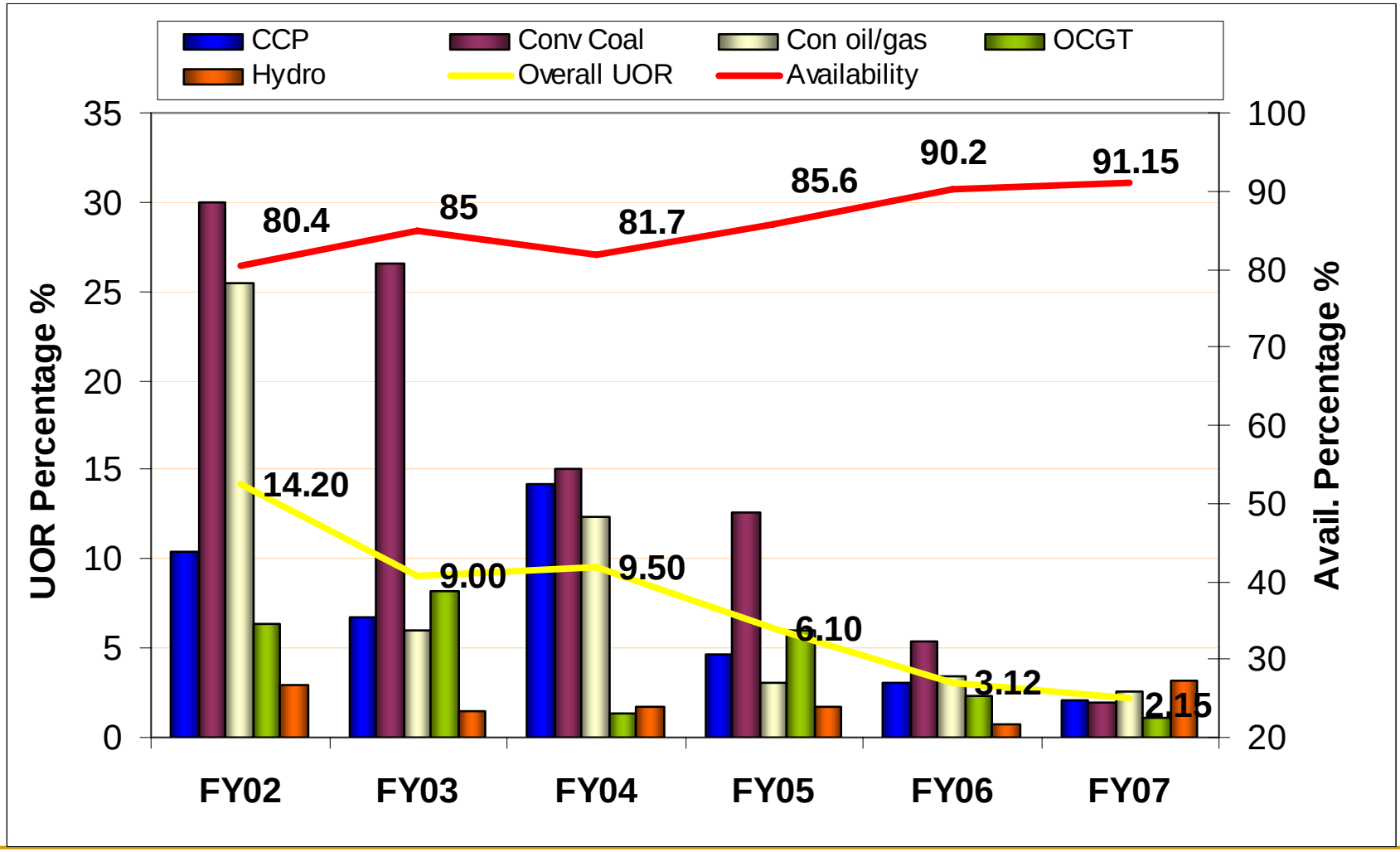
PROVIDING REAL TIME DATA PLATFORM TO TRACK AND MONITORING OUR KEY PERFORMANCE INDEX (KPIs)

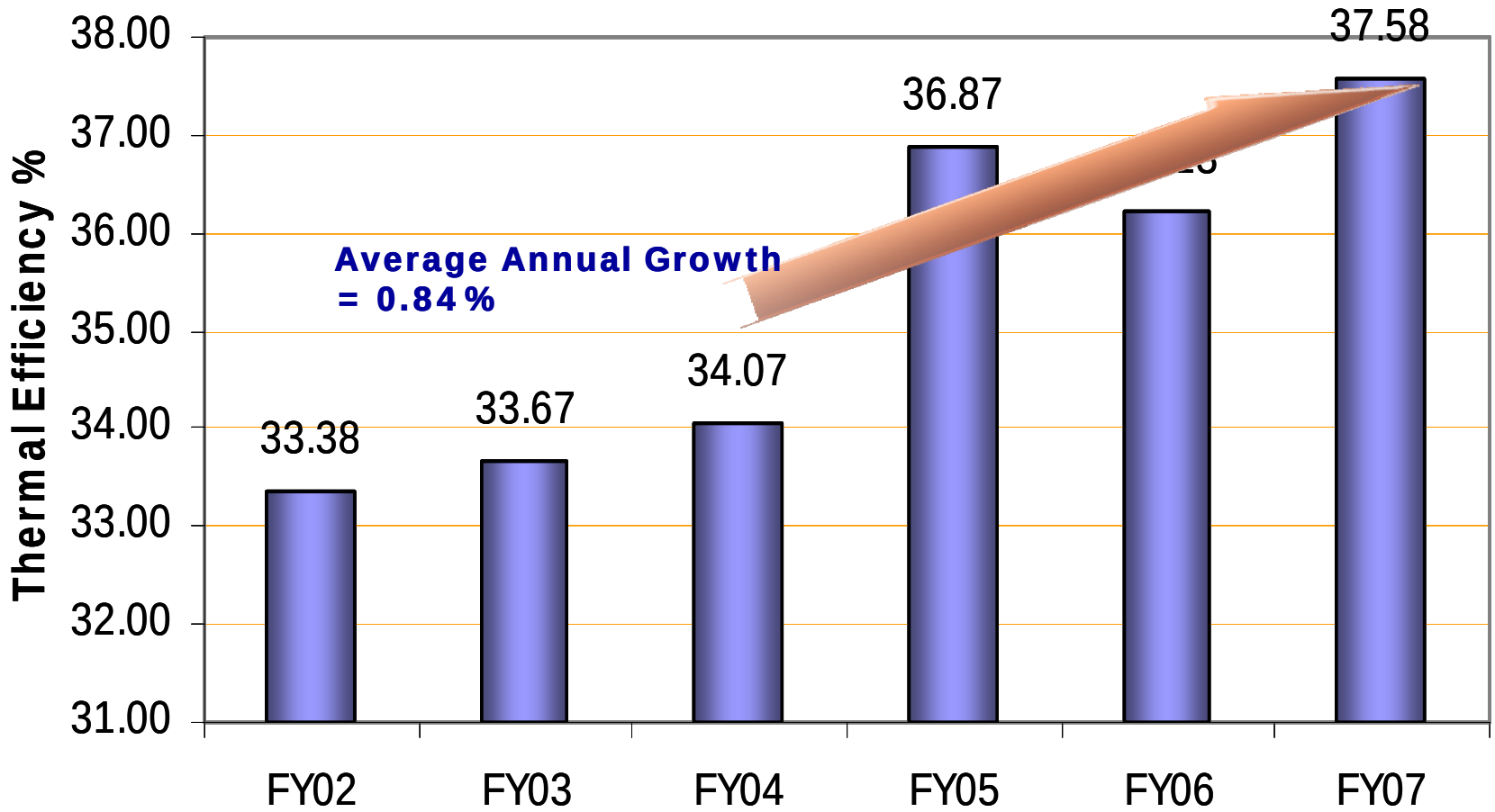
AVAILABILITY AND UNPLANNED OUTAGE TRENDING

- TNB Plant Availability achieved 91.15%, with 8 stations exceeding 90%
- TNB plant UOR achieved 2.15%, with majority of plants below 4%



AGGREGATE EFFICIENCY (%) TRENDING

❖ **TNB Plant Thermal Efficiency increased by >4% in 5-Years**



SUMMARY & CONCLUSION

TNB's Drive Towards Efficient Asset Management & Profitability.
- Thru Several Initiatives Includes T7, KPI and Continuous Monitoring

OPERATIONAL EXCELLENCE – Efficient and Flexible

- **Operating at most efficient manner – [*Benchmarking with designed data*]**
- **High availability and reliability – [*Early detection of wear and tear*]**
- **Moving towards real-time enterprise – [*Remote operation monitoring*]**
- **Ability to track maintenance requirement.**
- **Improve Technical know-how.**

COMMERCIAL EXCELLENCE – Investment and Cost

- **Separate plant accounting and reporting**
- **Economics and overall competitiveness**
- **Improve Business know-how.**

REGULATORY COMPLIANCE – Reliability & Environmental

- **KTAK - Reliability of supply and Energy mix**
- **EC - Technical & Financial Performance Reporting**
- **DOE - Continuous On-Line Emission monitoring**
- **DOSH - Safe operation and Early warning**

THANK YOU

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