

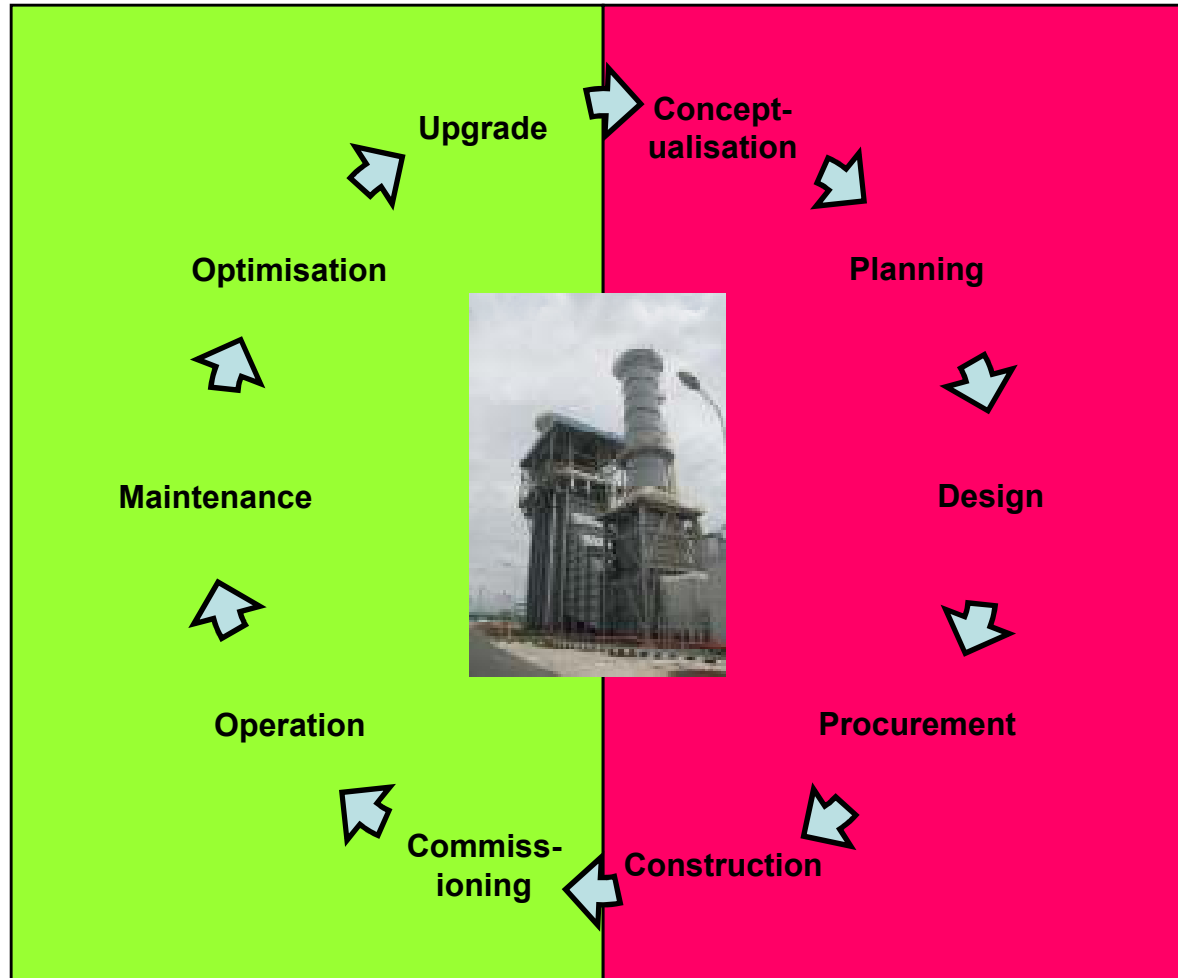
# **RISK MANAGEMENT DURING OPERATION & MAINTENANCE OF POWER PLANT**

Executive Talk  
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The Energy Commission, Malaysia

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## LIFE CYCLE OF A POWER PLANT



## THREE MAJOR RISKS DURING O & M

### 1. BUSINESS RISKS

- ❖ Political
- ❖ Economic
- ❖ PPA

### 2. FUEL RISKS

- ❖ Availability
- ❖ Price
- ❖ Fuel Specifications

### 3. PLANT PERFORMANCE RISKS

- ❖ Output
- ❖ Efficiency
- ❖ Availability
- ❖ Degradation
- ❖ Outages

## **BUSINESS RISKS**

- ❖ **Political**
- ❖ **Economic**
- ❖ **PPA**
  - **Purchaser's solvency**
  - **Payment**
    - **Incorrect Forecast & Insufficient Budget**
    - **Delayed payment**
    - **Arbitrary Set-off**
    - **Penalties**
  - **Despatch**
    - **Demand Risk Sharing**
    - **Fully "despatchable"**
    - **Free start-ups**
  - **Unclear Terms and Conditions/CoC**
    - **FDI / "Claw-back" clause**
    - **"Entire Agreement"**

## Energy Payment (EP)

$$EP = FP + (VOR \times NEO)$$

$$FP_{daily} = \frac{\sum_{i=1}^{48} [E_i \times HR_i \times NEO_i]}{1000000}$$

FP = Fuel Payment, RM

VOR = Variable Operating Rate = RM XXXX per kWh (from 1<sup>st</sup> Contract Year to 5<sup>th</sup> Contract Year; thereafter, VOR escalated at 4% every four years)

NEO = Net Electrical Output, kWh

E = Weighted average fuel price, RM/GJ

HR = Heat Rate, kJ/kWh

/ = an index referring to each half-hour period

## FAP

**FAP = Fixed Availability Payment, RM/day**  
**= CCR x TAAC**

**CCR = Capacity Charge Rate, RM/kW/day**  
**= ( $X_f$  x CRF + FOR) x 12/N**

Where  $X_f = 0.5$  (Stage 1) for period from COD to before X XXXXX XXXX

$X_f = 0.85$  (Stage 2) for period from X XXXXX XXXX to YY YYYYYY YYYY

$X_f = 0.80$  for period from end of Stage 2 till the end of Term

**CRF = Capacity Rate Financial, RM/kW/month**

**= RM AAAA per kW per month (Tier 1: from COD of 1<sup>st</sup> Unit to end of 1<sup>st</sup> COD anniversary)**

**= RM BBBB per kW per month (Tier 2 : From expiry of Tier 1 to 13<sup>th</sup> anniversary of COD)**

**= RM CCCC per kW per month (Tier 3 : From expiry of Tier 2 to end of Term)**

## ENTIRE AGREEMENT

***“This Agreement constitutes the entire understanding between the Parties and supersedes any and all previous agreements and understanding between the Parties with respect to the subject matter hereof.”***

## FUEL RISKS

### ❖ **Availability**

- Supply of Natural Gas to power sector by Petronas is on best endeavour basis
- Supply of coal is affected by adverse weather conditions, port congestions, environmental issues, and other challenges
- Burning distillate in gas turbines in times of non-availability of Main Fuel is costly and will increase maintenance cost as well

### ❖ **Price**

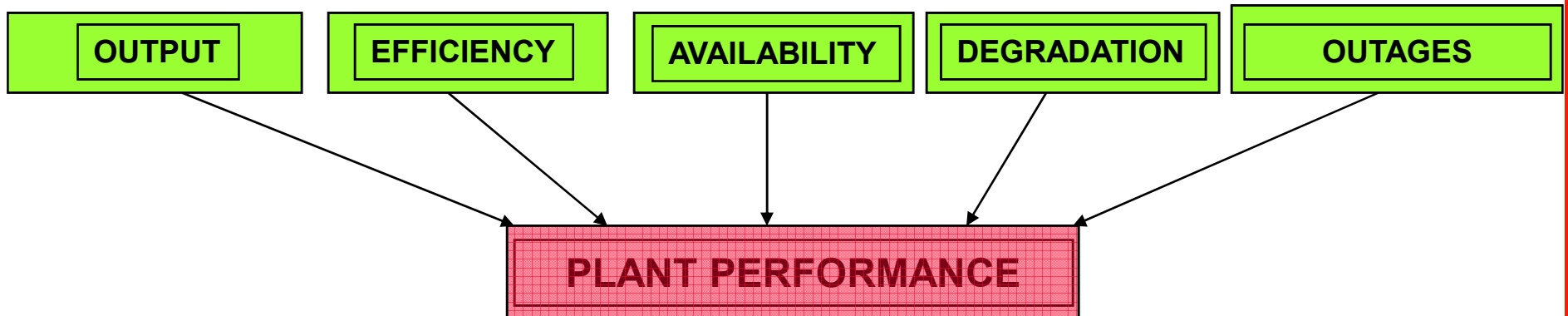
- Subsidy of Natural Gas will not be forever; LNG will cost more, when made available; the day of cheap coal is over; price of coal will not remain static, most likely to increase further
- While IPPs have “fuel passthrough” clauses in their PPAs, TNB cannot increase their tariff to consumers automatically on increase of fuel price

### ❖ **Fuel Specifications**

- Plant design is optimised for narrow range of fuel specs.; designing for wide range of fuel will increase plant cost
- Burning lower quality coal in boilers which are not design for that fuel will cause combustion problems and may affect plant performance as well frequent maintenace



# Plant Performance Risks

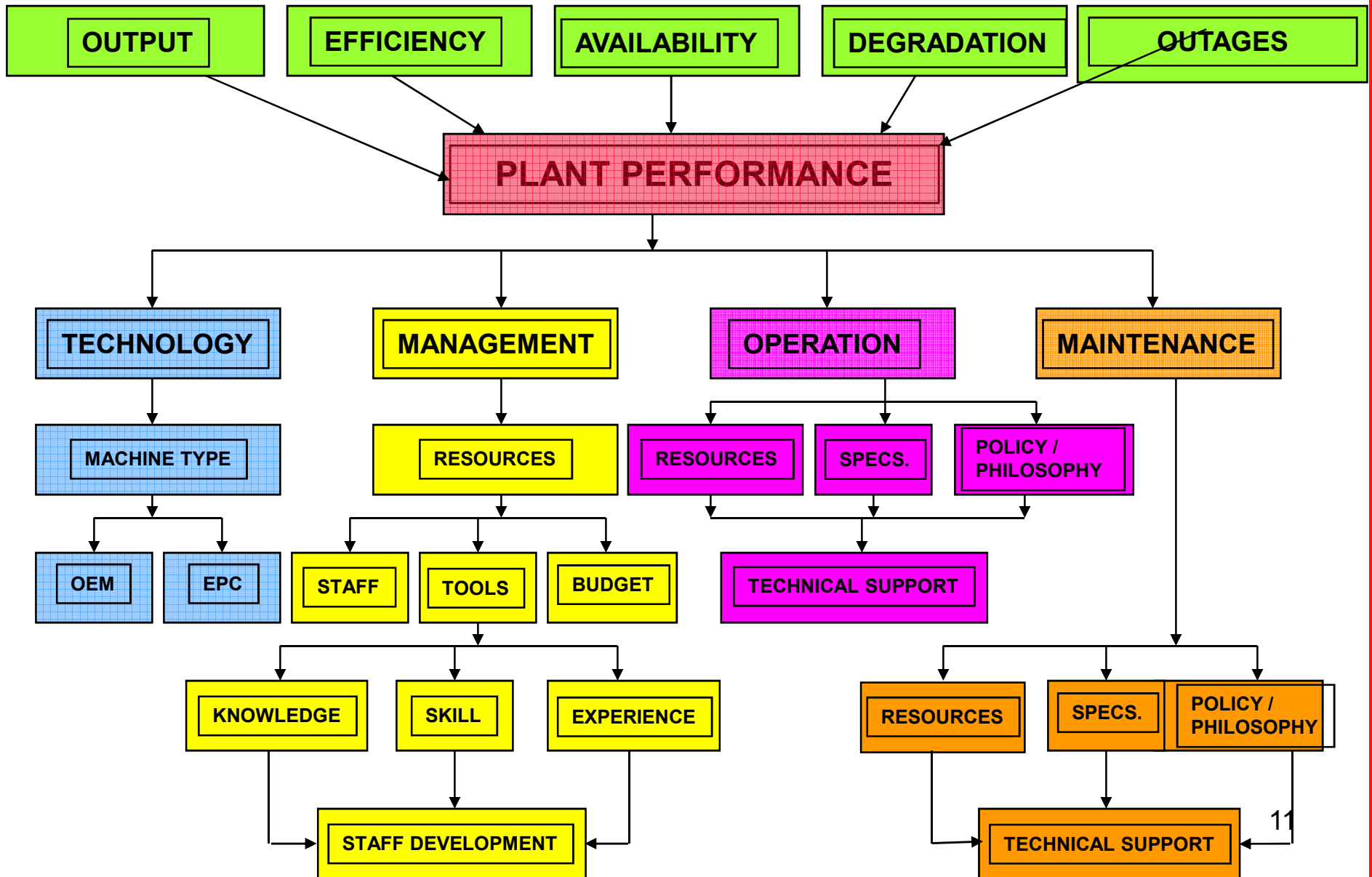


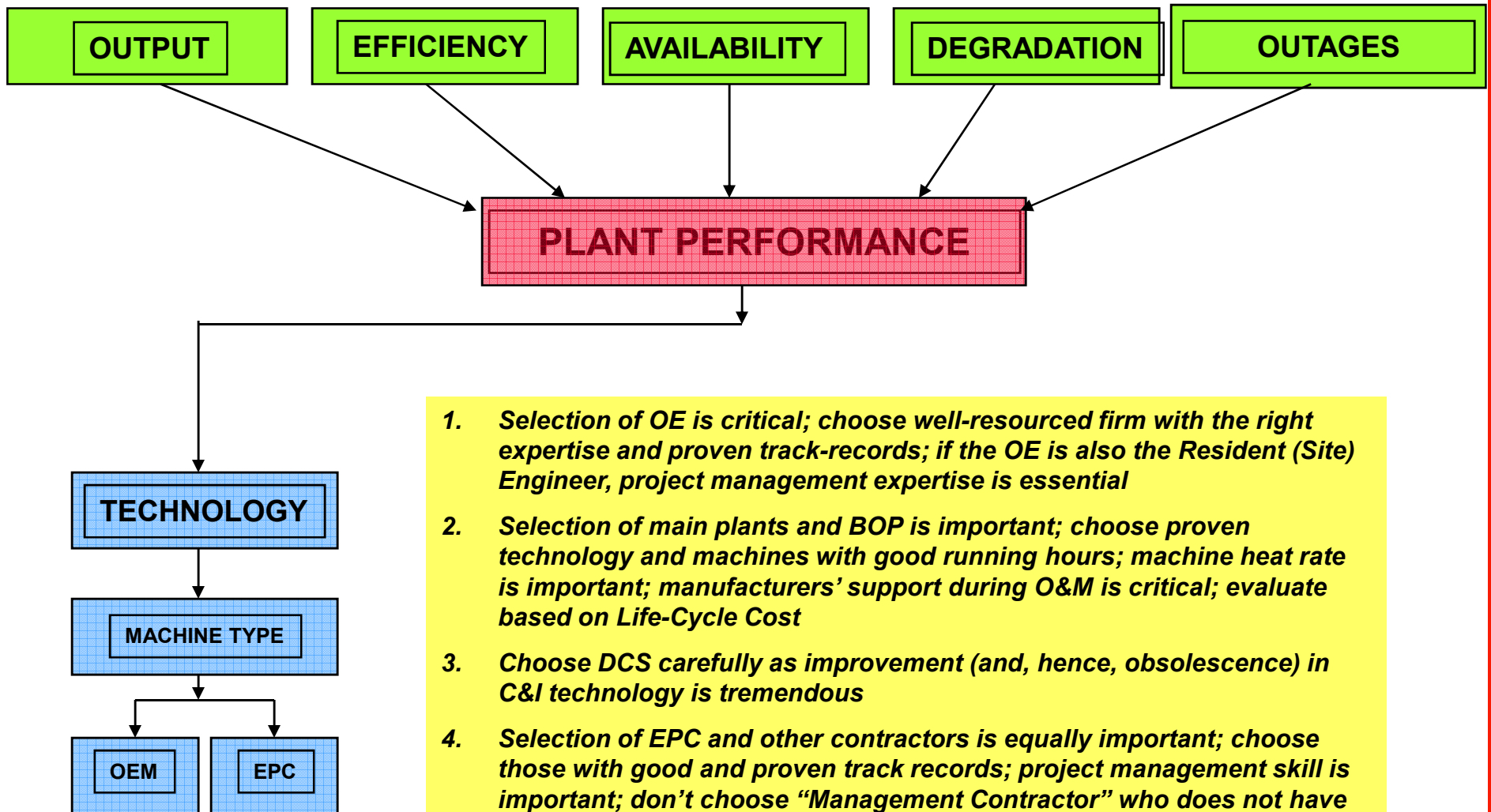
## RISKS

1. **BUSINESS RISKS**
  - ❖ Political
  - ❖ Economic
  - ❖ PPA
2. **FUEL RISKS**
  - ❖ Availability
  - ❖ Price
  - ❖ Fuel Specifications
3. **PLANT PERFORMANCE RISKS**
  - ❖ Output
  - ❖ Efficiency
  - ❖ Availability
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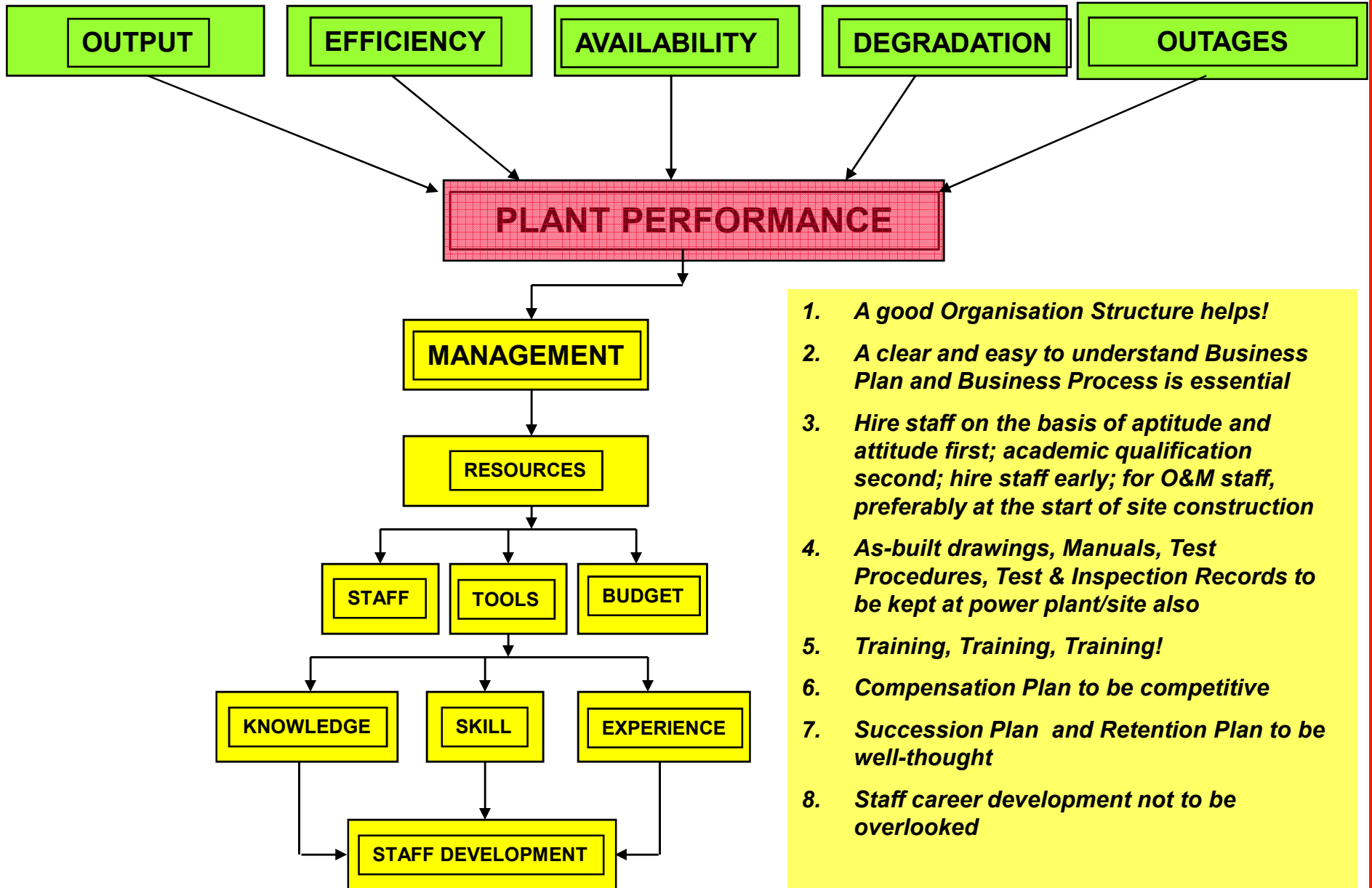
## MANAGEMENT

- *Pray that it remains stable*
- *Pray that it remains stable*
- *Better PPA?; Better T&C?*
  
- *Remains a challenge*
- *Remains a challenge*
- *Remains a challenge*
  
- *Better Technology, Better Management, Better Operations and Better Maintenance*

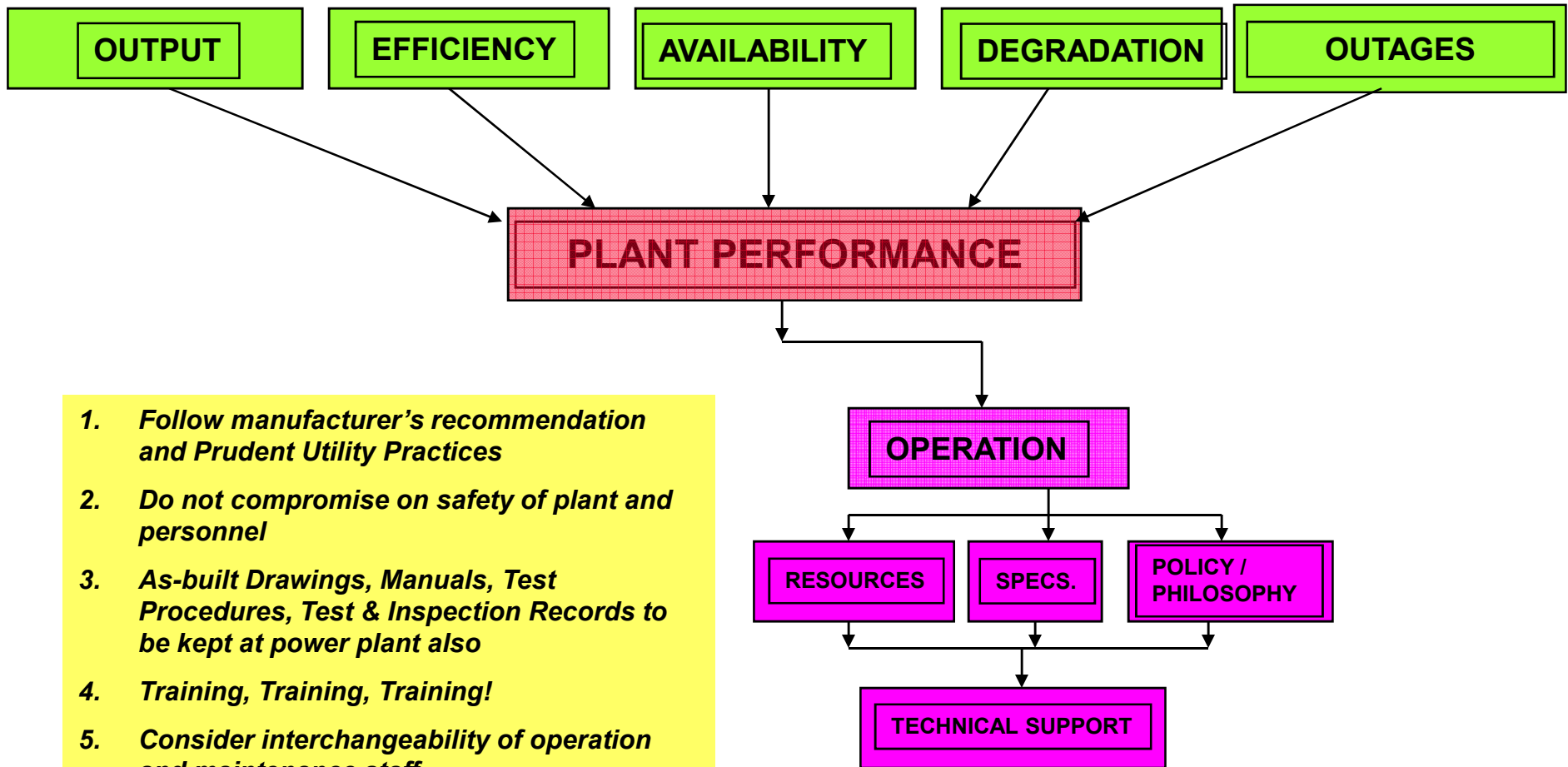




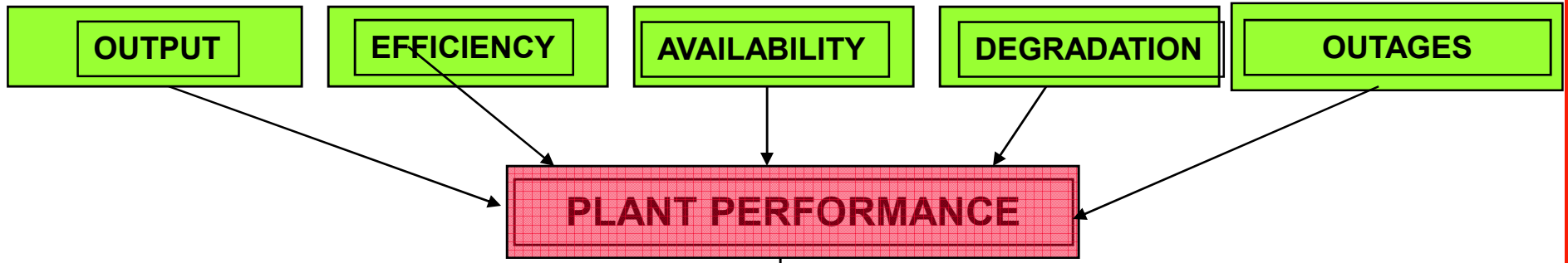
1. *Selection of OE is critical; choose well-resourced firm with the right expertise and proven track-records; if the OE is also the Resident (Site) Engineer, project management expertise is essential*
2. *Selection of main plants and BOP is important; choose proven technology and machines with good running hours; machine heat rate is important; manufacturers' support during O&M is critical; evaluate based on Life-Cycle Cost*
3. *Choose DCS carefully as improvement (and, hence, obsolescence) in C&I technology is tremendous*
4. *Selection of EPC and other contractors is equally important; choose those with good and proven track records; project management skill is important; don't choose "Management Contractor" who does not have in-house engineering capability*



1. ***A good Organisation Structure helps!***
2. ***A clear and easy to understand Business Plan and Business Process is essential***
3. ***Hire staff on the basis of aptitude and attitude first; academic qualification second; hire staff early; for O&M staff, preferably at the start of site construction***
4. ***As-built drawings, Manuals, Test Procedures, Test & Inspection Records to be kept at power plant/site also***
5. ***Training, Training, Training!***
6. ***Compensation Plan to be competitive***
7. ***Succession Plan and Retention Plan to be well-thought***
8. ***Staff career development not to be overlooked***



1. *Follow manufacturer's recommendation and Prudent Utility Practices*
2. *Do not compromise on safety of plant and personnel*
3. *As-built Drawings, Manuals, Test Procedures, Test & Inspection Records to be kept at power plant also*
4. *Training, Training, Training!*
5. *Consider interchangeability of operation and maintenance staff*



**1. Follow manufacturer's recommendation and maintenance schedule religiously; example:**

**GT:-** 12000 hours - CI  
24000 hours - HGPI  
48000 hours - MI

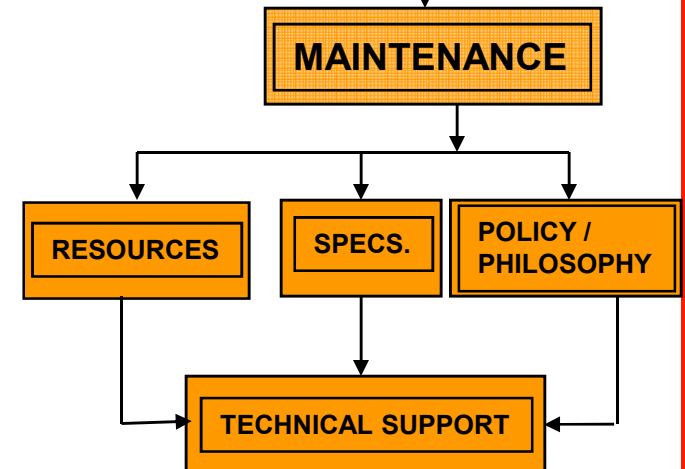
**ST:-** 3 year – Minor Inspection  
6 year – Major Inspection

**Generator:-** 2 x 2-year Minor Insp., followed by 1 x 6-year Major

**Boiler:-** Statutory DOSH Inspection – every 18 months

**2. Preferable to have a Long Term Service & Part Agreement with OEM**

1. Do not compromise on safety of plant and personnel
2. As-built Drawings, Manuals, Test Procedures, Test & Inspection Records to be kept at power plant also
3. Training, Training, Training!





# Stage & Performers



# Thank You