



Overview of cogeneration project development

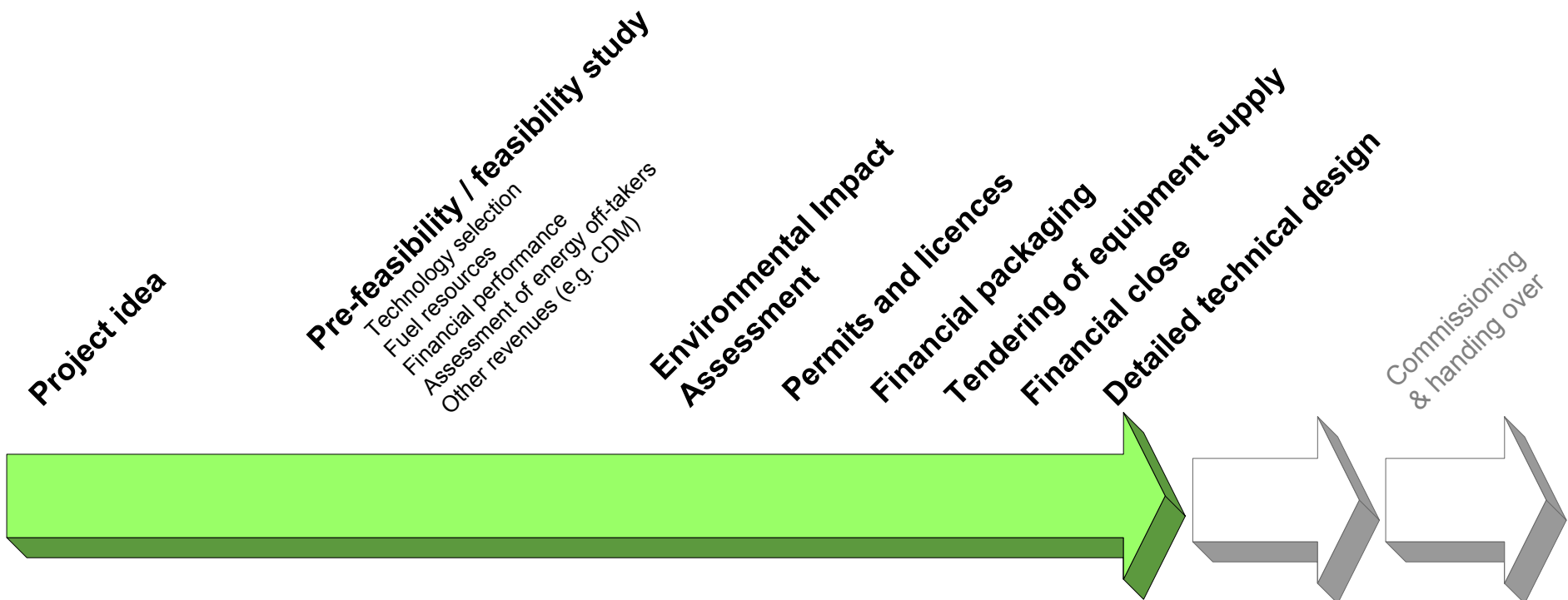
BRUNEI DARUSSALAM COGENERATION WEEK 2004

23-24 November 2004, The Centrepont Hotel, Bandar Seri Begawan

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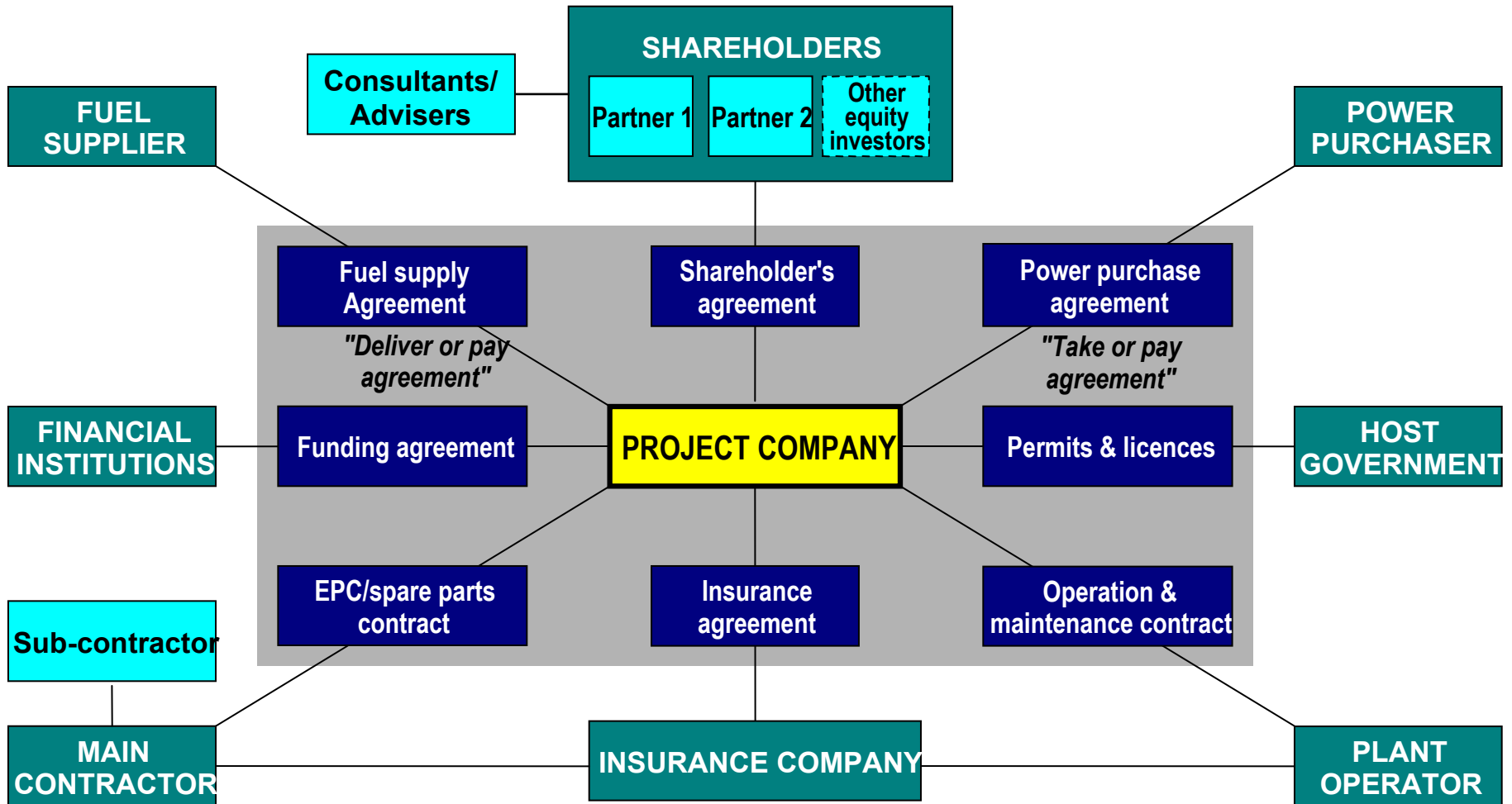


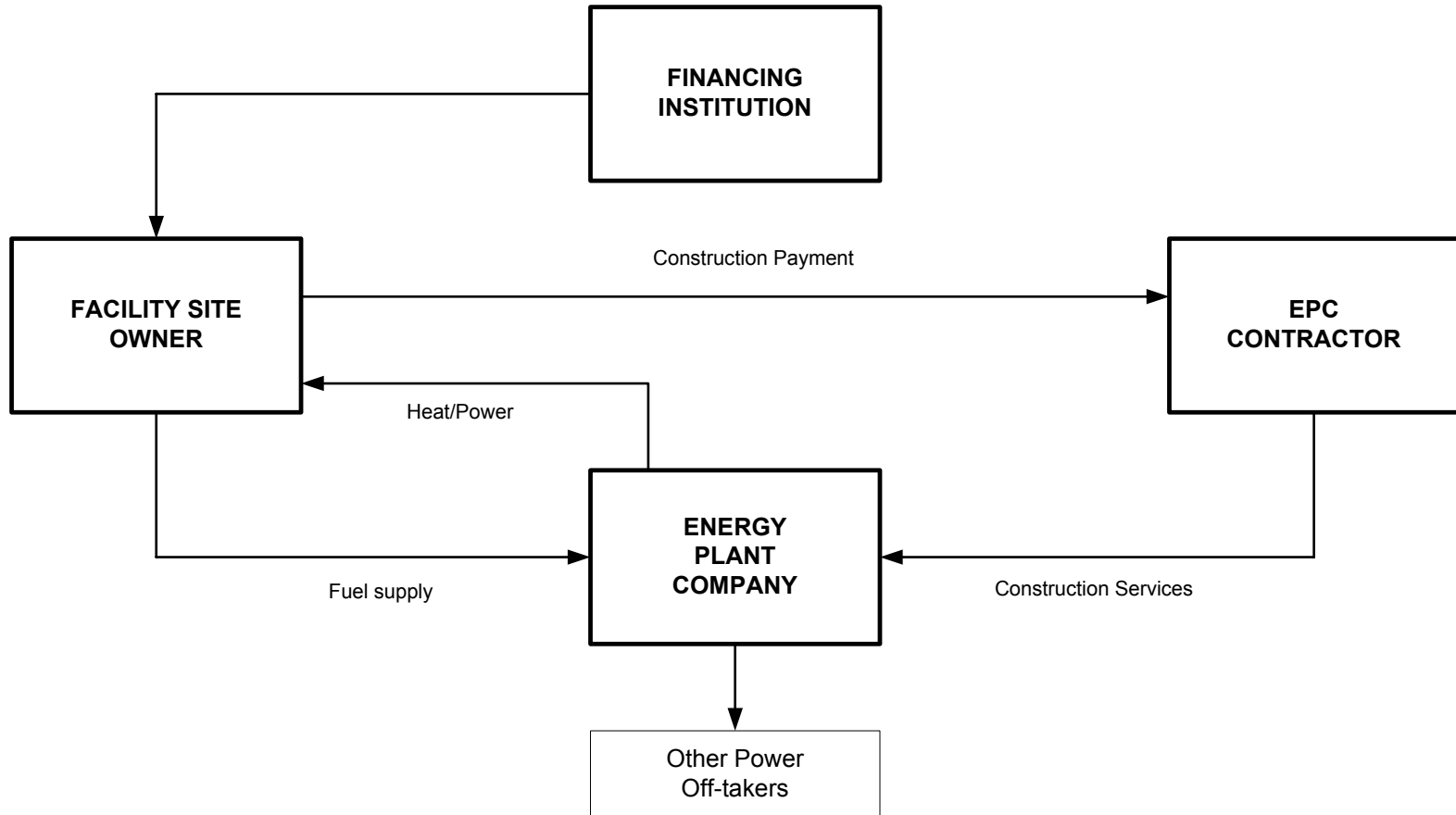
PROJECT DEVELOPMENT PROCESS



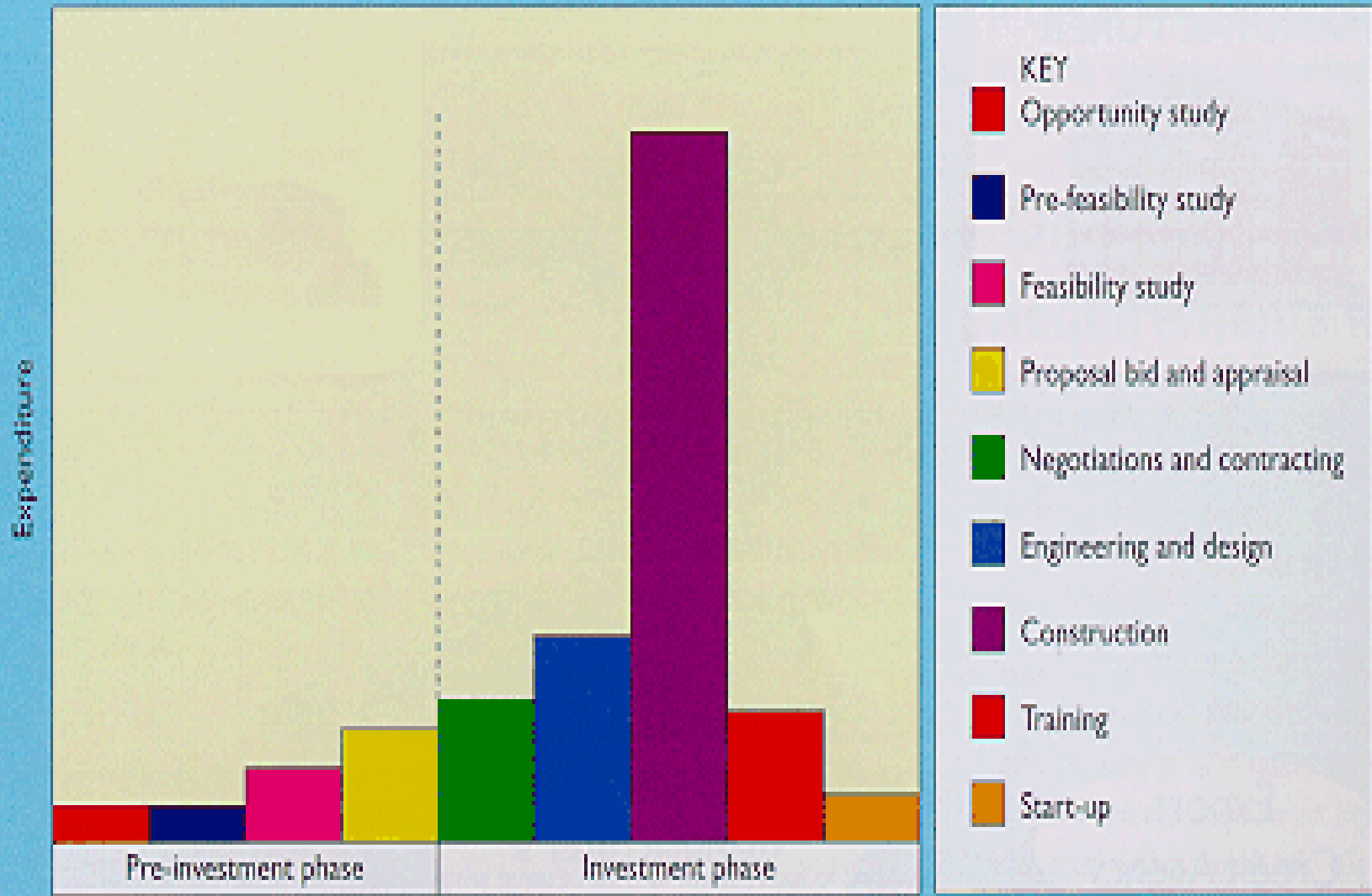


Stakeholders





Typical project life cycle expenditure



Source: ETSU, Cleaner Coal Technologies: Financing, 1999



Cogeneration projects: development and implementation

Steps (Success Factors):

- ◆ Assessment of needs and resources
- ◆ Identifying/assessment of partners & stakeholders
- ◆ Conduct of feasibility study
- ◆ Preparation of contracts and permits
- ◆ Tendering of equipment supply
- ◆ Financing of the project
- ◆ Detailed design, engineering and construction
- ◆ Operation and maintenance



Early competent advice

- ◆ Seek professional advice at early stage on:
 - technical matters
 - structuring of the project
 - sourcing and mobilisation of funds

- ◆ Key advisers:
 - technical
 - financial
 - legal



Assessment of needs and resources

- ◆ Assessment of needs and market
- ◆ Assessment of resources
 - Survey of fuel resources: primary and potential back-up
 - Logistics and fuel handling
 - Characteristics of fuel
- ◆ Assessment of technology and supply
 - Comparative costs and benefits
 - Technical reliability
 - Manufacturer's capability
 - Environmental considerations



Assessment of partners/stakeholders

- ◆ Sponsors
 - 100% facility owned, JV, or third party implementation
- ◆ Off-takers of energy produced
 - Captive
 - Export of energy to grid and/or other customers
- ◆ Government
 - Favorable regulatory policies
 - Appropriate incentives and subsidies
- ◆ General public, local community, NGOs
 - Awareness, acceptance and support



Conduct of feasibility study

- ✦ Provide optimum configuration & alternative options
 - Current and future energy requirements
 - Availability of resources within the facility
 - Integration with existing equipment
- ✦ Clear, comprehensive, and accurate financial model showing:
 - all costs
 - project/shareholder returns
 - lender coverage ratios
 - conservative assumptions
- ✦ Use of Sensitivity analysis demonstrating project viability at different scenarios

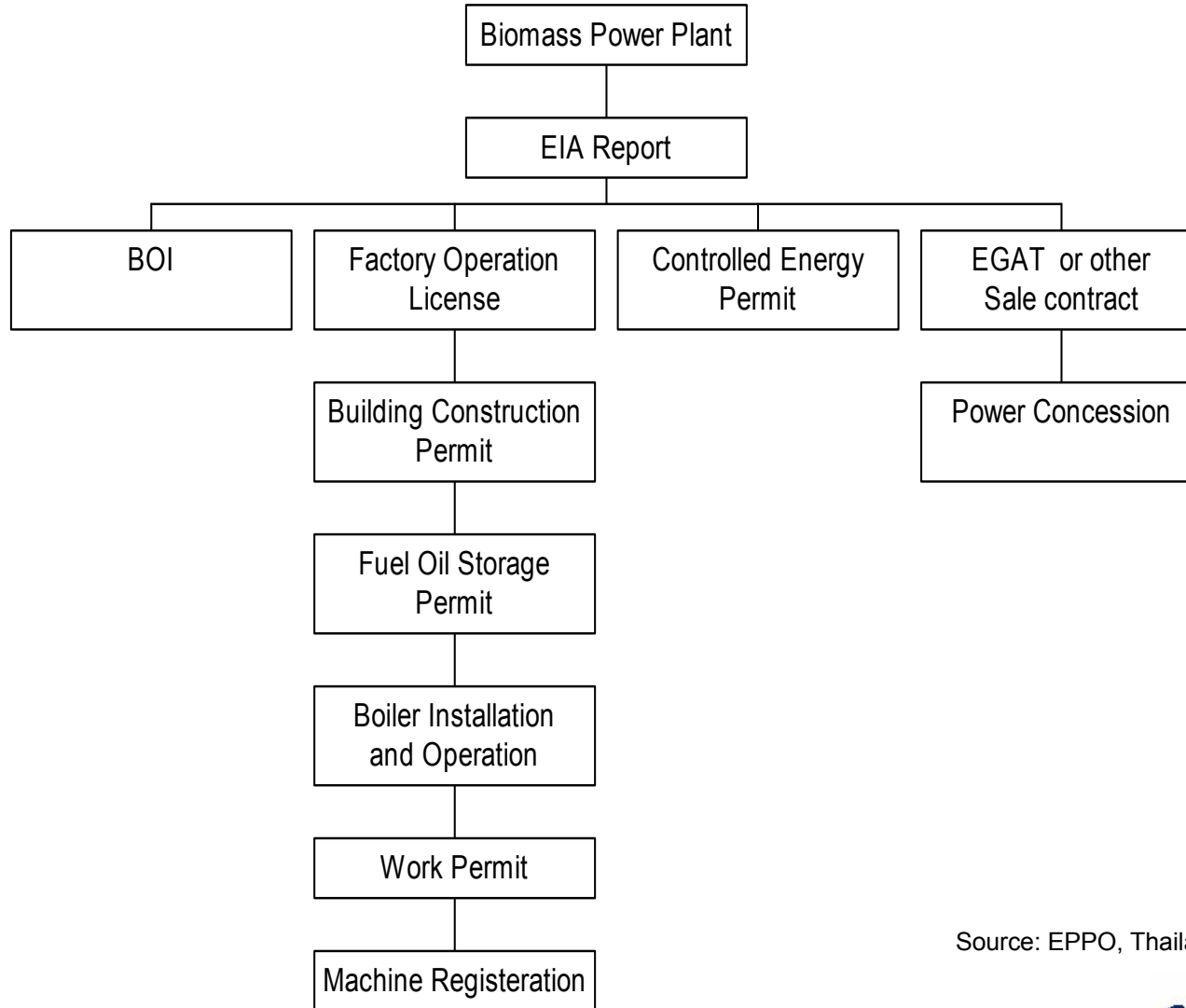


Preparation of contracts and permits

- ✦ Checklist for contracts, licenses, permits and consents necessary for development
- ✦ Rigorous planning with realistic time schedule
- ✦ Legally sound contractual arrangements that allow for:
 - Performance guarantees
 - Liquidated damages
 - Arbitration at an acceptable neutral location
- ✦ Soundly conceived projects may fail because of problems related to permits and consents



THAILAND: Licensing and Permitting



Source: EPPO, Thailand (2000)





Tendering of equipment supply

- ◆ Systematic approach using internationally accepted procurement procedures for the required equipment and services supply
- ◆ Tender document details the scope and specification of the equipment and services supply
- ◆ Supply offer should provide provision for:
 - After-sales service
 - Spare parts
 - Training of operators



Financing of the project

- ◆ Prepare financial plan appropriate to the size, structure and nature of the project
- ◆ Prepare project information memorandum
- ◆ Conduct proper risk mitigation and allocation
- ◆ Aim is to attain financial close with terms agreeable to both developers and lenders

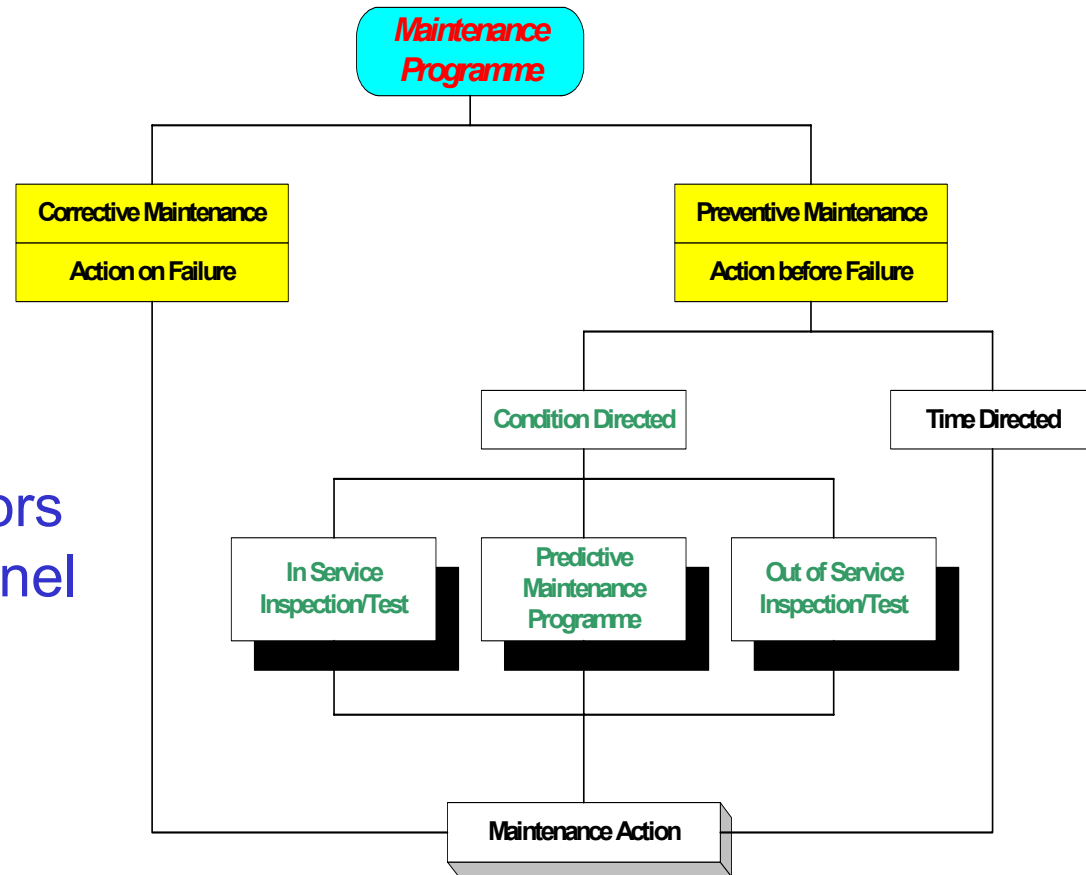
Detailed design, engineering and construction

- ◆ Creation of project management team
- ◆ Input and guidance of owner's engineers
- ◆ Evaluate plant performance vs. guaranteed technical specification by EPC contractors





Operation and maintenance



O/M through:

- ◆ Reputable O/M contractors
- ◆ Trained in-house personnel



Risk allocation and mitigation matrix

Risk	Allocation							Mitigation
	Govt.	Sponsors	Project Company	Third Party Contractor/ Supplier	Project Lenders	Insurers	Performance & other bond banks or insurers	
1. Political/Country								<ul style="list-style-type: none"> Political risk insurance from ECA or multilateral development agencies Regulatory framework supporting sustainable energy projects BOI privileges for green field projects
Change in law	✓		✓			✓		
Development/permitting approvals	✓	✓	✓					
Adverse govt. action/inaction	✓	✓	✓			✓		
Corporate taxation			✓					
Expropriation			✓			✓		
Political force majeure events	✓					✓	✓	
2. Sponsor								<ul style="list-style-type: none"> Sponsors to provide equity and pre-completion guarantee Experience in supporting renewable energy projects
Competence and reliability		✓						
Equity at risk		✓						
Pre-completion guarantees		✓					✓	





Contd.....

Risk	Allocation							Mitigation
	Govt.	Sponsors	Project Company	Third Party Contractor/ Supplier	Project Lenders	Insurers	Performance & other bond banks or insurers	
3. Construction								<ul style="list-style-type: none"> • Fixed-price turnkey (EPC) contract with provision for liquidated damages • Construction time insurance • Choice of reputable contractors through internationally accepted bidding process
Cost over-runs			✓	✓	✓		✓	
Timeliness and quality			✓	✓			✓	
Contractor default			✓	✓			✓	
Default by company			✓	✓				
Time, cost and scope of identified but related work and variations				✓	✓			
Increase in financing costs		✓	✓		✓			
Environmental damage	✓		✓			✓		
Force majeure						✓	✓	
4. Technical								<ul style="list-style-type: none"> • Use of proven technology • Turnkey supplier with successful references implemented in similar environment • Performance guarantees • Liquidated damages
Reliability of process and equipment			✓	✓			✓	
Failure to meet performance			✓	✓			✓	
Accidents during operation			✓	✓			✓	



Contd.....

Risk	Allocation							Mitigation
	Govt.	Sponsors	Project Company	Third Party Contractor/ Supplier	Project Lenders	Insurers	Performance & other bond banks or insurers	
5. Environmental								<ul style="list-style-type: none"> EIA from reputable institution Implementable operational environmental plan Public awareness campaign
Environmental impact assessment (EIA)	✓		✓					
Operational environmental management			✓	✓				
Public acceptance	✓	✓	✓					
6. Fuel								<ul style="list-style-type: none"> Fuel supply availability study Long-term fuel supply contract Storage of rice husk during lean season
Availability of supply			✓	✓				
Price and future escalation			✓	✓				
Competing usage			✓	✓				
7. Financial/Legal								<ul style="list-style-type: none"> PPA from national grid including provision for foreign exchange and fuel price fluctuation Equity from sponsors Fixed rate loans Hedging mechanisms such as interest swaps Joint venture agreement/agreement for the establishment for SPC
Inflation	✓	✓	✓		✓			
Interest rate	✓	✓	✓		✓	✓		
Foreign currency exchange rate	✓	✓	✓	✓	✓	✓		
Ownership of assets			✓					
Security structure			✓		✓			
Insolvency of company		✓	✓		✓			
Breach of financing documents		✓	✓		✓			
Enforceability of security			✓		✓			



Contd.....

Risk	Allocation							Mitigation
	Govt.	Sponsors	Project Company	Third Party Contractor/ Supplier	Project Lenders	Insurers	Performance & other bond & banks or insurers	
8. Operation								<ul style="list-style-type: none"> Hiring of competent O&M contractor Sound O&M contract Insurance during operating life of project
Company default		✓						
Termination of O&M contract by company			✓	✓				
Environmental damage - ongoing			✓			✓		
Force majeure event	✓		✓			✓		
Change in law	✓		✓	✓				
Labour issues			✓					
9. Market and Revenue								<ul style="list-style-type: none"> PPA from national grid Established SPP scheme Long-term purchase contract for other income stream (e.g. rice husk ash, fly ash)
Insufficient income			✓		✓			
Off-taker default			✓	✓	✓		✓	
Insufficient demand			✓		✓			



COGENERATION PROJECT DEVELOPMENT GUIDE

Cogeneration Project Development Guide Developing and Implementing Biomass, Clean Coal and Natural Gas Cogeneration Projects in ASEAN



Second Edition

March 2004



COGEN 3 FSDPs in ASEAN (grant contracts signed as 14/06/04)





Project Structure: Dan Chang Bio Energy

Owner/Developer	: Dan Chang Bio-Energy Co., Ltd.
Major Shareholders	: Mitr Phol Sugar Co., Ltd.; Mitr Particle Board; Others
Location	: Dan Chang, Suphanburi, Thailand
Total Capacity	: 53 MW
Fuel	: Bagasse, cane leaves, wood bark and rice husk
Major Off-takers	: EGAT (SPP, 21 years, firm contract) Mitr Phol Sugar Co., Ltd. (steam + power)
Major equipment	: Boilers - 2x120 tph, 68 bar, 510 ⁰ C (Alstom) Turbine - 41 MW extraction-condensing (Alstom) Existing boilers + turbine (from sugar mill)
O&M	: Internal
Incentives	: BOI privileges, EPPO subsidy
Financing	: Project finance

Project : Dan Chang Bio Energy



Project : Dan Chang Bio Energy





Project Structure: Phu Khieo Bio Energy

Owner/Developer	: Phu Khieo Bio-Energy Co., Ltd.
Major Shareholders	: United Farmers & Industry Co., Ltd.; Others
Location	: Phu Khieo, Chaiyapum, Thailand
Total Capacity	: 65 MW
Fuel	: Bagasse, cane leaves, wood bark and rice husk
Major Off-takers	: EGAT (SPP, 21 years, firm contract) United Farmer & industry Co., Ltd. (steam + power)
Major Equipment	: Boilers - 2x120 tph, 68 bar, 510°C (Alstom) Turbine - 41 MW extraction-condensing (Alstom) Existing boilers + turbine (from sugar mill)
O&M	: Internal
Incentives	: BOI privileges
Financing	: Project finance



Project : Phu Khieo Bio Energy





Project Structure: Rayong Waste to Fertilizer & Energy

Owner/Developer	: Rayong Municipality
Location	: Rayong, Thailand
Total Capacity	: 625 kW
Fuel	: Biogas
Major Off-takers	: PEA (VSPP)
Major Equipment	: Gas engine (Jenbacher)
O&M	: External contractor
Financing	: Government funds



Project Structure: TSH Bio Energy

Owner/Developer	: TSH Bio Energy Sdn Bhd
Major Shareholders	: TSH Resources Bhd
Location	: Kunak, Sabah, Malaysia
Capacity	: 14 MW
Fuel	: EFB (Empty Fruit Bunch), mesocarp fiber and palm kernel shell
Major Off-takers	: SESB (SREP, 21 years, firm contract) TSH Plantation Sdn. Bhd. (steam + power)
Major Equipment	: Boiler - 80 tph, 58 bar, 402 ⁰ C (Babcock&Wilcox) through ENCO
O&M	: Internal
Incentives	: Tax holidays, accelerated depreciation of CAPEX
Financing	: Corporate finance

Project : TSH Bio Energy





Project Structure: Titi Serong Cogeneration Plant

Owner/Developer	: Kelang Beras Co., Titi Serong Sdn. Bhd.
Location	: Perak, Malaysia
Capacity	: 1.5 MW
Fuel	: Rice husk
Major Off-takers	: Internal use
Major Equipment	: Boiler - 12 tph, 25 bar, 300 ⁰ C (Vyncke) Turbine – 1.5 MW extraction-condensing (KKK) through Jebsen & Jessen Paddy drier (Cimbria Unigrain A/S)
O&M	: Internal
Financing	: Corporate finance



Project Structure: Guthrie Cogeneration Plant

Owner/Developer	: Kumpulan Guthrie Bhd.
Location	: Kedah, Malaysia
Capacity	: 2 MW
Fuel	: Palm fibres and shells
Major Off-takers	: Internal use
Major Equipment	: Boiler – 2x22.5 tph, 20 bar, 212 ⁰ C (Vyncke) Turbine – 2x2 MW back-pressure (KKK) through Jebsen & Jessen
O&M	: Internal
Financing	: Corporate finance

Project : Guthrie Cogeneration Plant



Project : Guthrie Cogeneration Plant





Project Structure: ECO Special Waste Management Plant

Owner/Developer	: ECO Industrial Environmental Engineering Pte Ltd
Location	: Tuas View industrial Estate, Singapore
Capacity	: 530 kW
Fuel	: shredded wood chips
Major Off-takers	: Internal use
Major Equipment	: Boiler – 15 tph, 22 bar, 260 ⁰ C (Vyncke) Turbine – 530 kW back-pressure (KKK) through Jebsen & Jessen
O&M	: Internal
Financing	: Corporate finance

Project : ECO Special Waste Management Plant





Project : ECO Special Waste Management Plant





For more information,
please visit COGEN 3 Website at:

<http://www.cogen3.net>

Thank You !