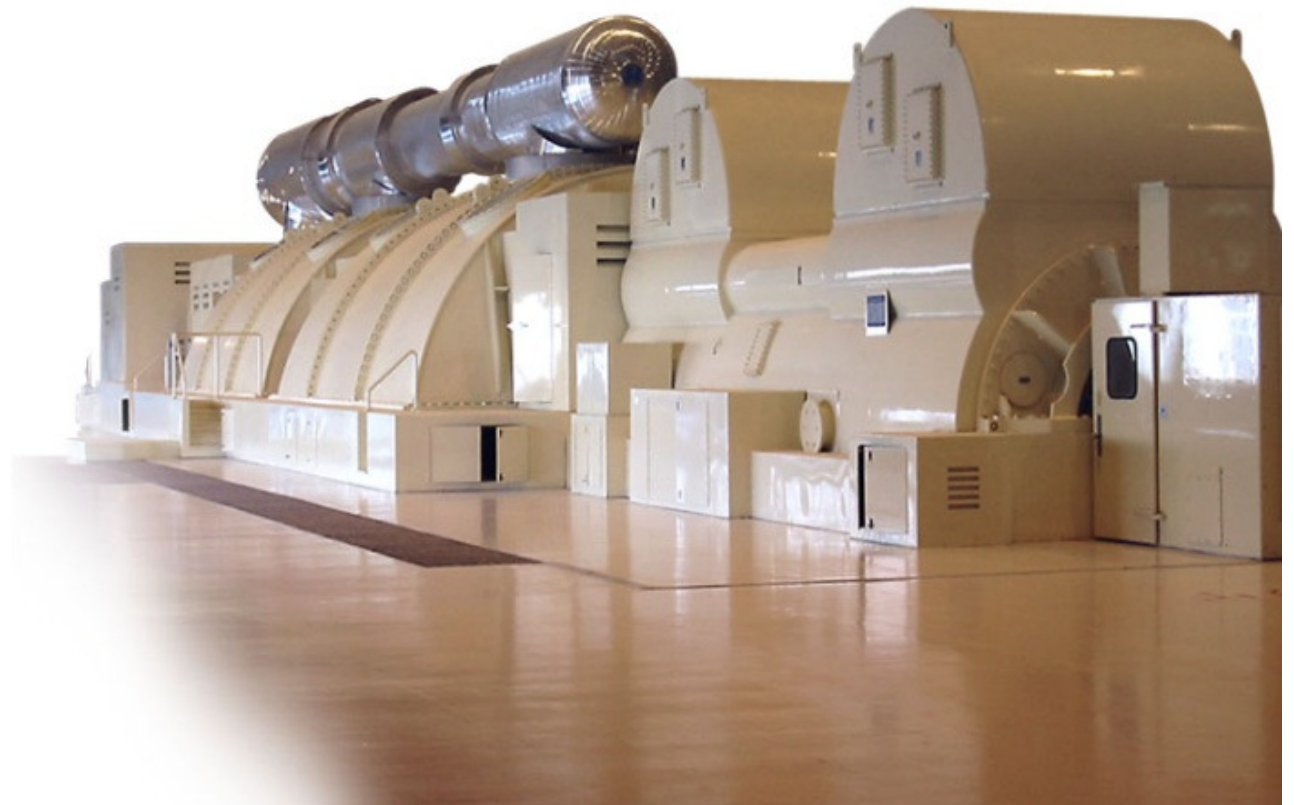


# Future of Coal Sector in Pakistan

Trevor Bailey



imagination at work

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## **Making Power Projects Reality**

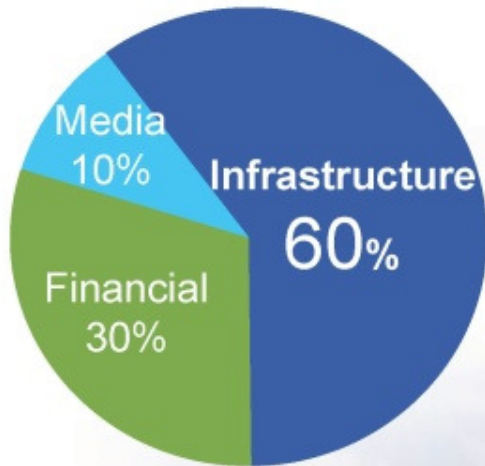
- Scope Management
- Partnering Concepts

## **Summary**

# GE

2009 Revenue: \$157B

Employees: >300,000



~60% Revenue global  
\$6.5B annual R+D spend

# GE Energy

2009 Revenue: \$40B

Employees: >82,000

## Business units

Power & Water

Energy Services

Oil & Gas

**130 year old start-up**





Electricity  
to enhance  
quality of  
life



Fuel to power  
life's work



Clean water  
to sustain life

# GE Energy ...

- 82,000 employees
- Operating in 140 countries
- Technology partner for customers



## GE Power & Water

- Thermal Products
- Renewables
- Jenbacher gas engines
- Nuclear
- Aeroderivatives
- Water

## GE Energy Services

- Power Gen Services
- Measurement & Control Solutions
- Digital Energy
- Industrial Solutions
- Environmental Services

## GE Oil & Gas

- Turbomachinery
- Drilling & Production
- Global Services
- Pipeline Solutions

**Energy is a global scale business**



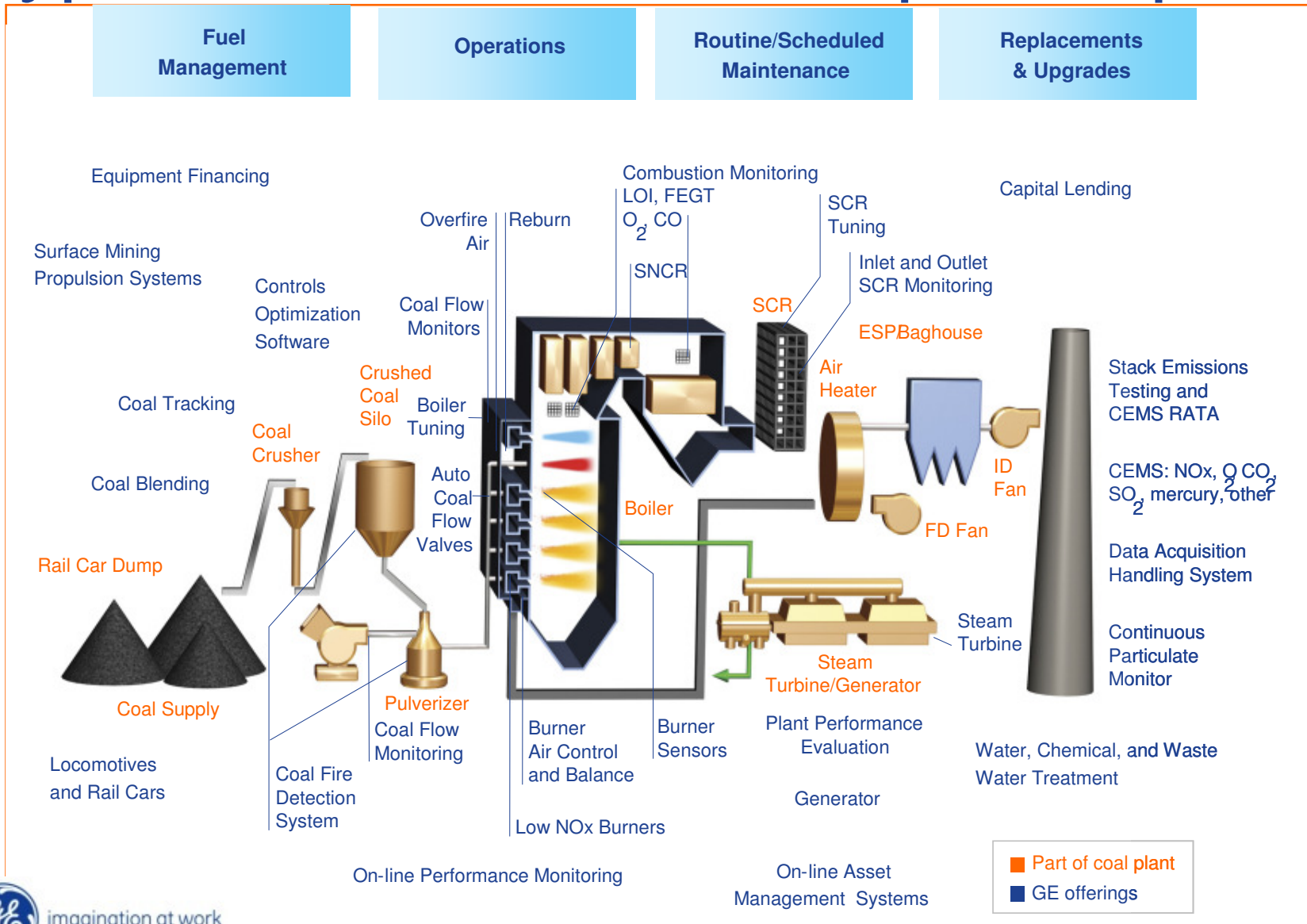
# Coal to electricity options



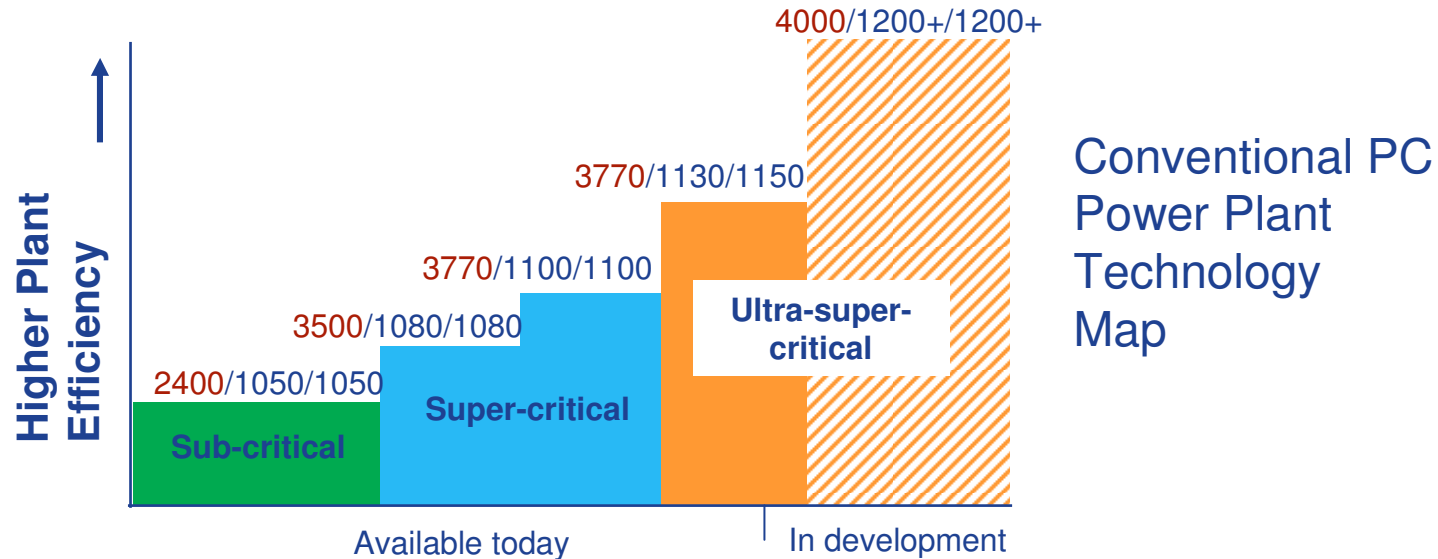
## Electricity production from coal

- **Conventional PC boiler technologies**
  - Sub-critical steam conditions
  - Super-critical steam conditions
  - Ultra-super-critical steam conditions
- **Gasification technologies**

# Typical conventional PC power plant



# Higher efficiency enables... ... cleaner coal utilization



## Considerations influencing technology deployment

- Technology/cost breakpoints for key equipment - boilers and STGs
  - Piping fabrication and welding issues
  - Special materials ... limited supply base ... cost challenges
- Economies of scale needed to offset the cost of further efficiency gains?
- Value of reliability versus efficiency



Operational risk-benefit trade off over plant lifecycle

# Asia ... example of supercritical deployment

## South Korea ... over 18GW of supercritical units:

- 20 units, 520 MW - 3500#/1000F/1000F
- 12 units, 550 MW - 3500#/1050F/1100F
- 2 units, 800 MW, 3500#/1050F/1050F

## Electric Power Development Company ... advanced steam cycle experience

- 3626 PSIG/1112F/1130F



Award from Electric Power International  
100% Operating Availability Record 1996



# Gasification provides flexible technology

Gasification transforms cheap & plentiful hydrocarbons into syngas, used in:

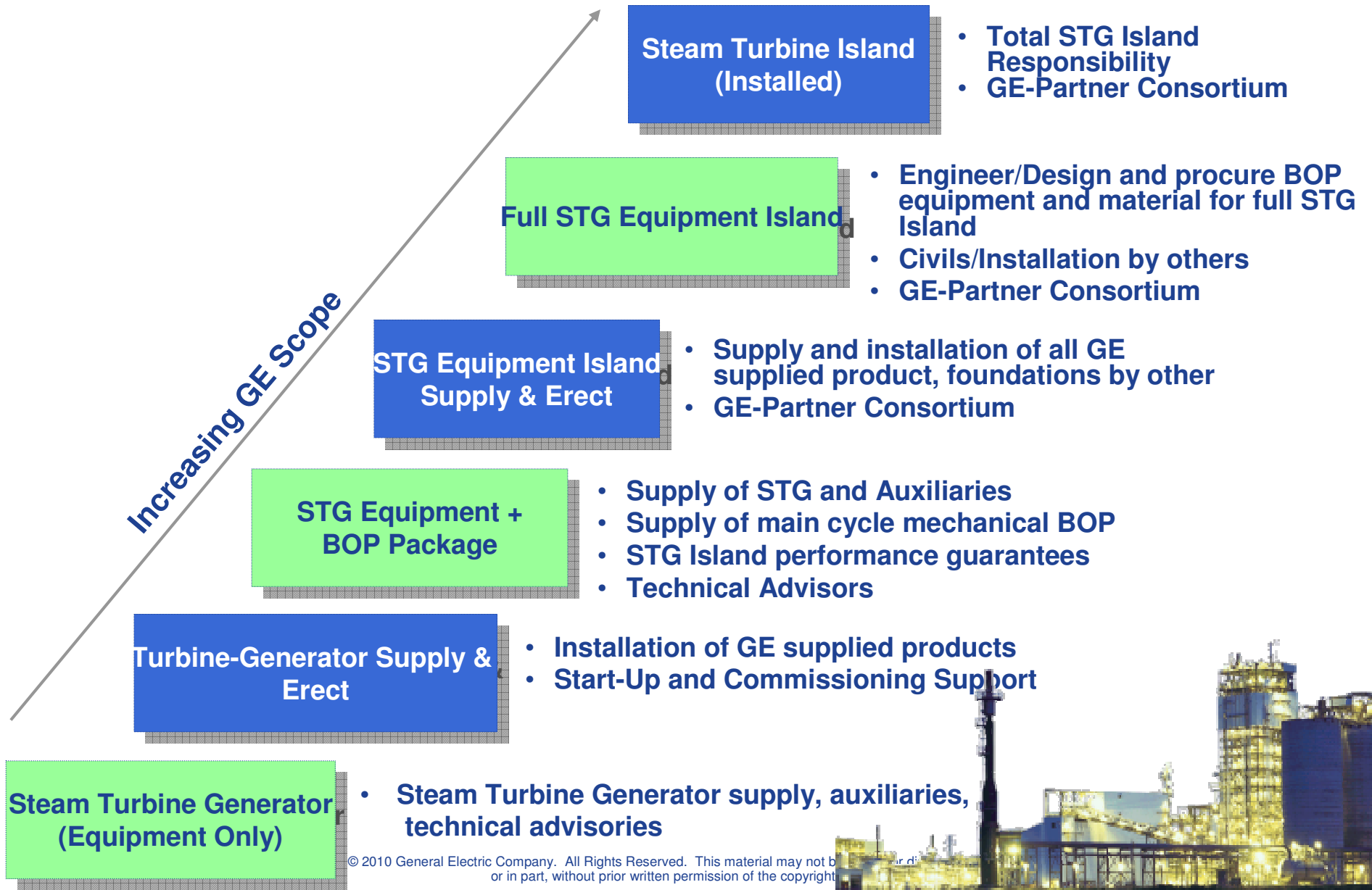
- Power production ... lower emissions than traditional coal plants
- Building blocks for industrial chemicals & fuels
- Converting low value refinery bottoms to H<sub>2</sub>, steam, & power



Edwardsport IGCC project,  
USA



# Scope flexibility for our customers



# Why do we partner with experienced EPCs?

## ... a proven partnering model

- Partners bring the EPC capability and resources
- Partners bring local knowledge ... labor market, local codes and standards, site knowledge
- GE and partner share the commercial and technical risks
- Partners often have unique customer relationships
- Allows GE to focus on core capability



# Partner selection criteria

## Matching strengths with transaction attributes

- Capable - Proven capability for the work scope
- Capacity - Resources, leadership and support available
- Competitive - Prices aggressively to market level
- Financial - Financial strength matches risk exposure
- Local Presence - Access to local labor, knowledge of codes
- Risks - Takes full contract exposure for scope
- Consortium - Willingness for consortium arrangement
- Influence - Good customer and GE relationships
- Motivated - Shared objectives and business culture



# Partnering approach on STG Island projects

... utilizing an “open” consortium model

- Entire contract scope is identified and assigned ... partners join in a consortium with clear division of responsibility document
- GE takes the lead for single point interface with customer
- Merge strengths of two parties
- Maintain focus on owner needs
- Strong partners with complementary skills
- Established consortium agreement
- Both parties sign prime contract and are jointly and severally liable

**Maximize GE & partner’s expertise in their respective fields**



# Summary



## Electricity production from coal

- **Coal is the classic fuel source for power generation**
- **PC technologies continue to develop**
  - Sub-critical steam conditions
  - Super-critical steam conditions
  - Ultra-super-critical steam conditions
- **Gasification technologies**
- **Making complex power project reality a key factor**