

***U.S. Department of Energy
Turbine Program***

Stakeholder Road Mapping Session

***Perspectives on Integrated
Gasification Combined Cycles***



July 29, 2003



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Outline of Fluor Presentation

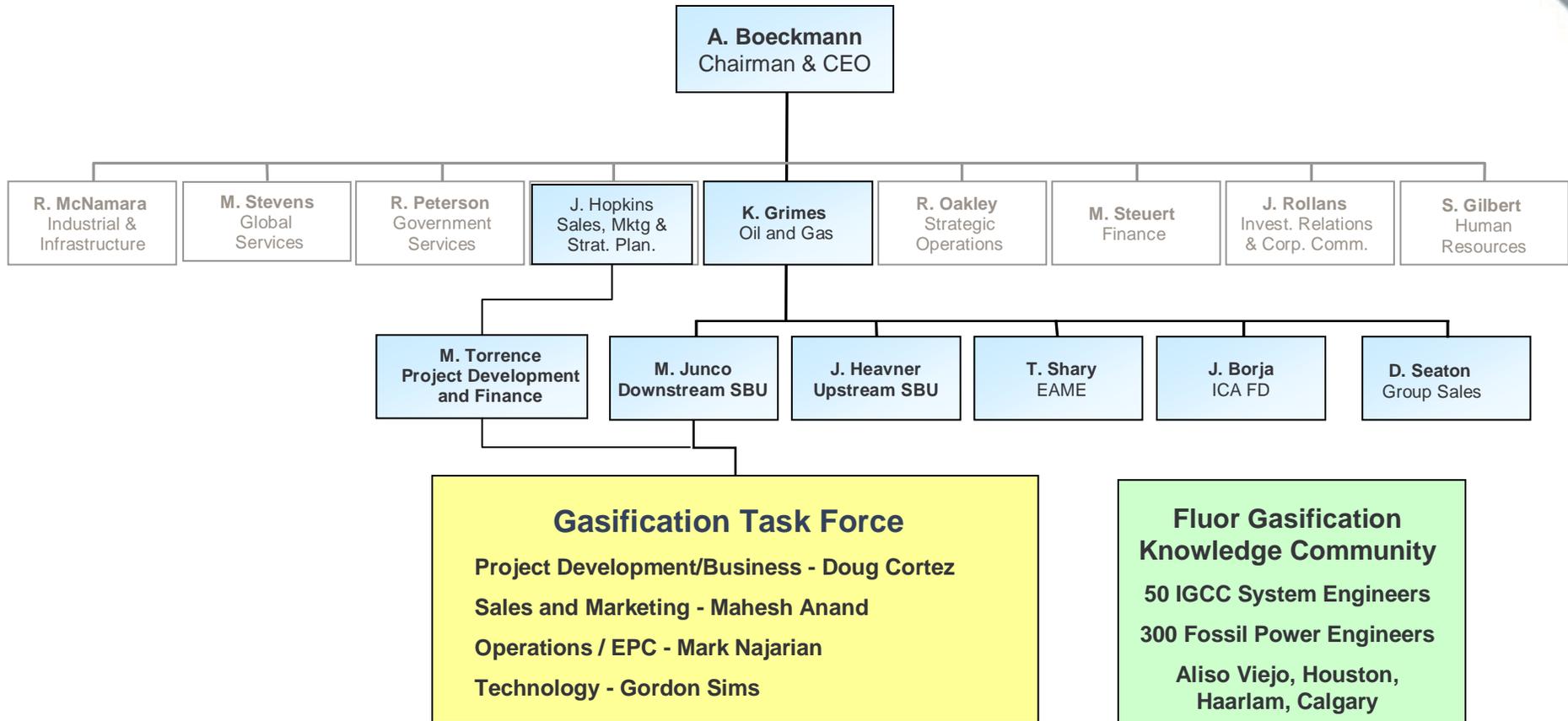
Topic

- ◆ Fluor Organization and Advanced Coal Technology
- ◆ What Our Clients Are Telling Us They Need
- ◆ IGCC Market Outlook
- ◆ EPC Perspectives On Combustion Turbine Development
- ◆ Questions & Answers

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Fluor Organization

Advance Coal Technology Organization



What Our Clients Are Telling Us They Need

Lowest Life Cycle Cost of Electricity (and other products, if any)

- ◆ Low Capital Investment
- ◆ High Efficiency
- ◆ High Availability
- ◆ Ability to Handle a Range of Low Cost Fuels
- ◆ Superior Environmental Performance on Controlled Pollutants
- ◆ Potential to Control Future Emissions of Carbon Dioxide and Mercury

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Certainty the Project Will Meet It's Financial Objectives

Most Owners and Lenders Want a Single Entity to be Responsible for EPC Project Risks

- ◆ Lump Sum Price
- ◆ Date Certain Completion
- ◆ System Performance Guarantees
- ◆ Environmental Performance Guarantees

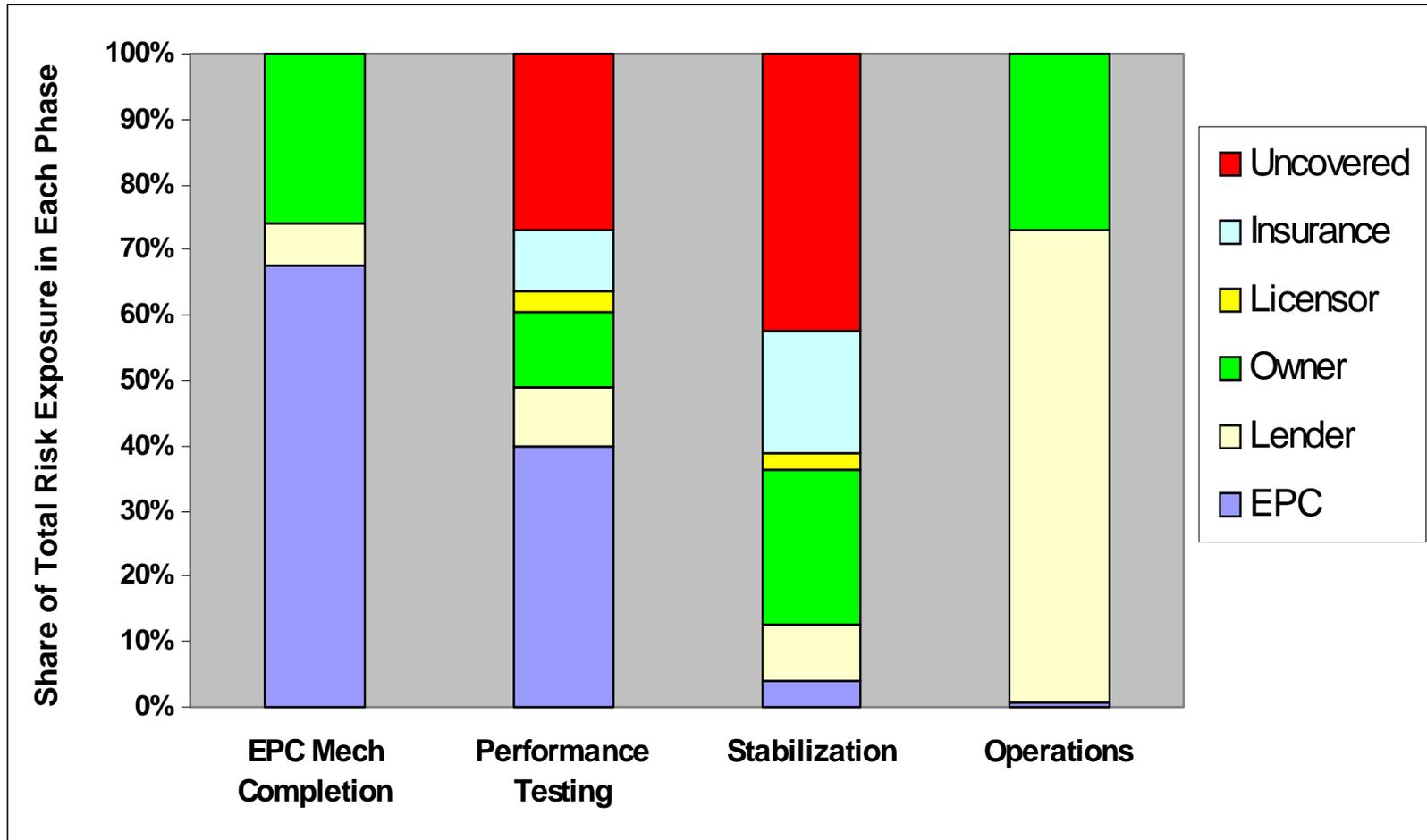
Certainty the Project Will Meet It's Financial Objectives

Reduce Time and Cost to Reach “Mature” Performance (Dependable Capacity)

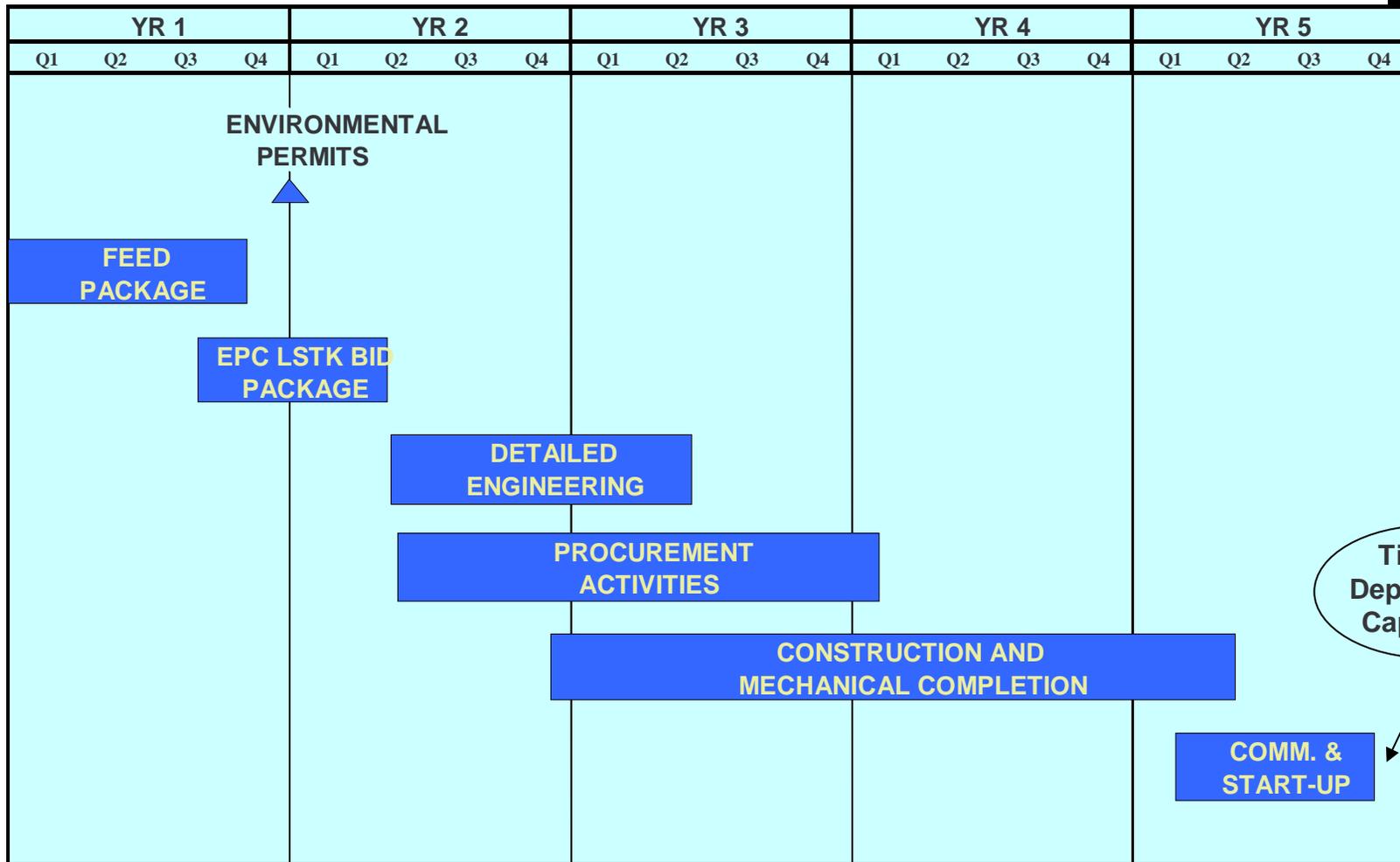
- ◆ Shorten Construction Schedule
- ◆ Commissioning and Performance Testing Responsibility
- ◆ Time and Cost to Reach Stable Operations After Performance Testing
- ◆ Operations and Maintenance Training
- ◆ Technical Support for Initial Operations
- ◆ Availability Assurance Program

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Typical Allocation of Risk By Phase



Typical IGCC Project Schedule



IGCC Market Outlook

Most Near Term Projects Have Site Specific Advantages

- ◆ Petroleum Coke, Heavy Oil or Other Low Cost Feed Stocks are Available
- ◆ Co-production of Steam, Hydrogen, Ammonia, Methanol or Other Chemical Precursors are Needed for Existing Facilities or New Projects
- ◆ Power Production May Not be the Primary Economic Driver

IGCC Market Outlook

High Natural Gas Prices in North America are Making it Difficult for Chemical Plants that Compete in the World Market

- ◆ “Refueling” Projects Will be Likely to Go Ahead if Natural Gas Prices Stay High
- ◆ IGCC with Co-production of Chemical Feedstocks Provides a Good Hedge Against Natural Gas Price Risk
- ◆ Some Chemical Plants May be “Retired” if They Can’t be Refueled

IGCC Market Outlook

Developing Countries Need to Support Economic Growth

- ◆ Countries With Coal Reserves and the Need for Fertilizers and Chemical Feed Stocks are Planning IGCC Projects
- ◆ Again, the Need for Power May not be the Primary Economic Driver

Utility Baseload Coal Projects are in the Early Stages of Planning

- ◆ Construction Would Begin in 2 to 6 Years
- ◆ Many Will Consider IGCC as an Alternative to Super Critical Pulverized Coal Plants

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EPC Perspective on Combustion Turbine Development

The Turbine Suppliers Have Done a Remarkable Job of Improving Gas Fired Combined Cycle Plants

- ◆ Larger More Efficient Turbines Optimized for Combined Cycles
- ◆ Improvements in Availability, Operability and Maintainability
- ◆ Improvements to Design and Controls That Facilitate Load Following and Reduce Startup Times
- ◆ Commercial Guarantees that Support LSTK Contracts for Natural Gas Fired CC Plants
- ◆ This Led to a Thriving Nat Gas Combined Cycle Market (Until Recently)

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EPC Perspective on Combustion Turbine Development

Obstacles Faced by the IGCC Market for Large Power Plants

- ◆ Uncertainty in Natural Gas Price and Supply
- ◆ Competition From Super Critical Pulverized Coal Plants with Emission Controls
 - Perceived as Proven and Predictable Generation
 - Meet Current Air Emission Standards
 - Concern Over Impact of Future Changes in Environmental Law
- ◆ Economics Favor Baseload Operation (Limited IGCC Experience in Load Following and Cyclic Operation)

EPC Perspective on Combustion Turbine Development

Concern Over Commercial Readiness of IGCC Plants

- ◆ IGCC Demonstration Project Costs, Performance and Availability Often Compared to Mature SCPC Technology
- ◆ Concern Over the Need for an Extended Initial Operating Period (Time to Dependable Capacity)
- ◆ Reluctance of IGCC Supplier Industry to Stand Behind the Entire System Through Commercial Operation

EPC Perspective on Combustion Turbine Development

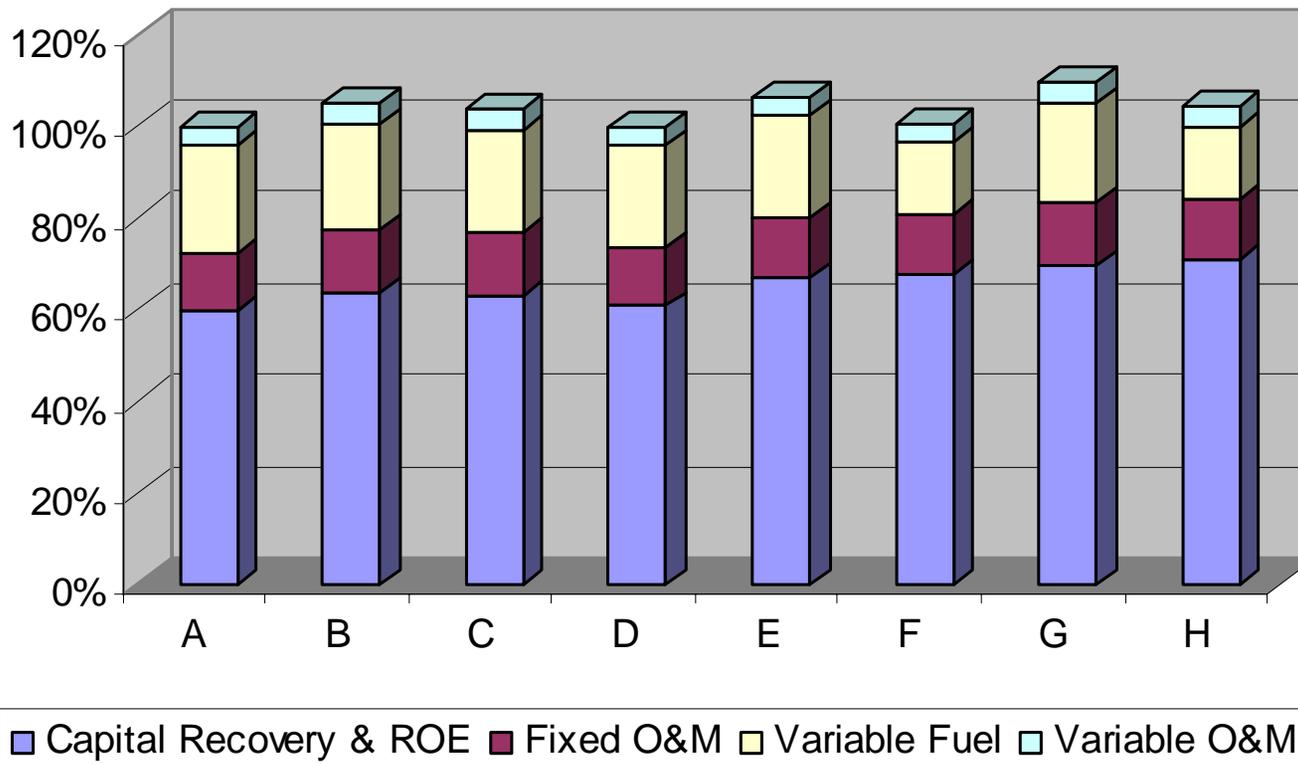
What Can Turbine Suppliers Do to Make IGCC the Clean Coal Technology of Choice?

- ◆ Improve Guaranteed Output and Efficiency
 - Higher Firing Temperatures on Syn Gas
 - Improve Integration With Gasification, Air Separation and BOP Facilities
 - Both of the Above Should Also Reduce Cost (\$/KW)
- ◆ Continue Programs to Achieve Very Low NOX Emissions Without SCR
- ◆ Provide Online Transfer to Backup Fuel When Necessary to Meet Capacity Commitments
 - Take Advantage of High CC Plant Availability
 - Prevent the Need for Owner to Buy Expensive Replacement Power

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EPC Perspective on Combustion Turbine Development

IGCC Cost of Electricity Components



EPC Perspective on Combustion Turbine Development

What Can Turbine Suppliers Do to Make IGCC the Clean Coal Technology of Choice?

- ◆ Provide Similar Performance and Emission Guarantees for Syn Gas as Currently Offered for Natural Gas
- ◆ Collaborate More Effectively with EPC Industry to Offer Commercial Systems Wrap Warranties Comparable to Those Offered by Competing Boiler Technology Providers

EPC Perspective on Combustion Turbine Development

Questions?

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