Company Overview

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- Leading professional services provider to the energy, resource, and complex process industries
- Organized into Customer Sector Groups:

Upstream Hydrocarbons

Fixed Offshore Facilities
Floating Production Systems
Deepwater Solutions
Subsea Systems
Offshore Pipelines
Onshore Pipelines
Onshore Oil & Gas Production Facilities
Heavy Oil and Oil Sands
LNG
Terminals

Downstream Hydrocarbons

Refining
Petrochemicals
Chemicals
Polymers
Gasification
Sulphur Management

Power

Coal-Fired Plants
Advanced Coal
Nuclear
Gas Turbine/ Combined Cycle
Air Quality Control
Integrated Gasification Combined Cycle (IGCC)
Transmission Networks
Operations & Maintenance
Renewable Energy

Minerals, Metals & Chemicals

Base Metals
Coal
Chemicals
Ferrous Metals
Alumina
Aluminum
Iron Ore
Gas Cleaning

Infrastructure & Environment

Resource Infrastructure
Urban Infrastructure
Coastal and Marine
Water and Wastewater
Transport
Environment

Global Reach

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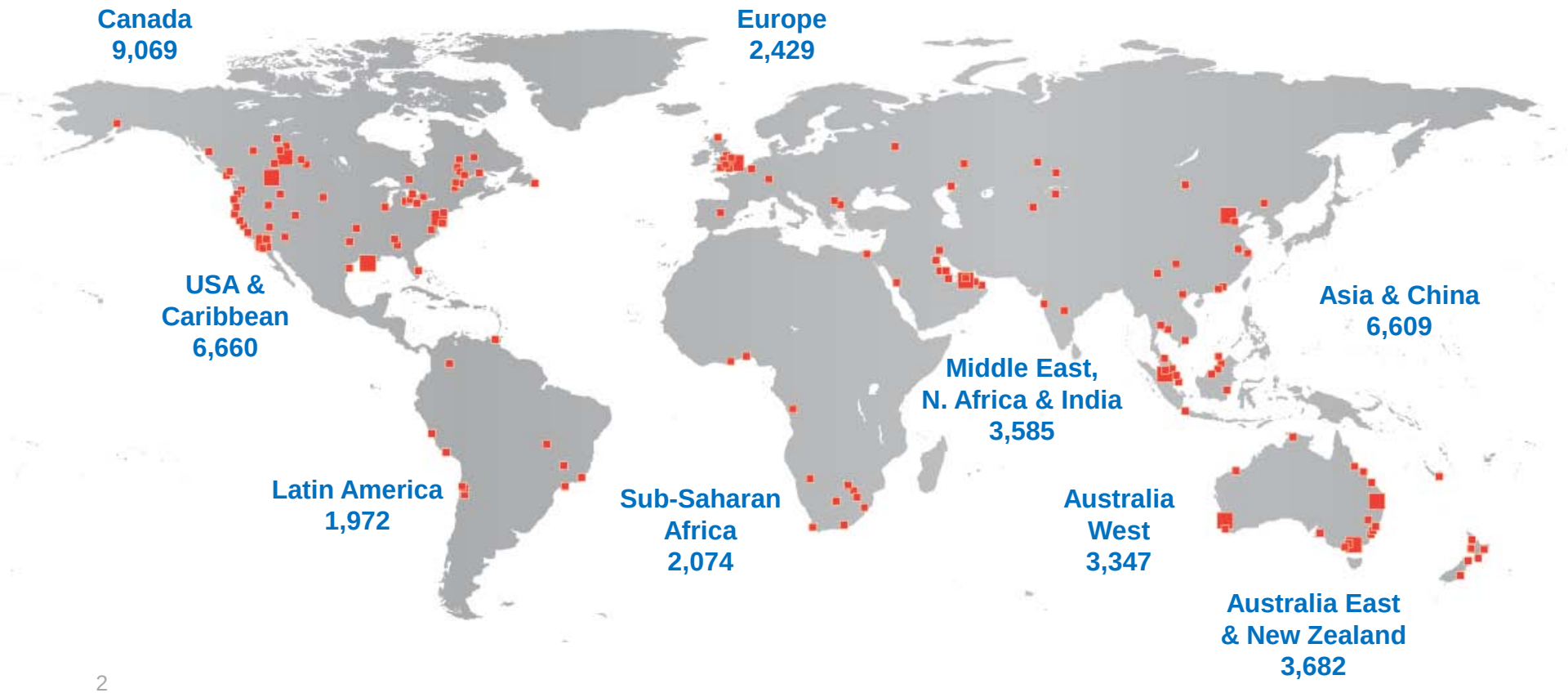
41 countries | 163 offices | 40,800 personnel



Experience Covering all Phases of the Asset Lifecycle

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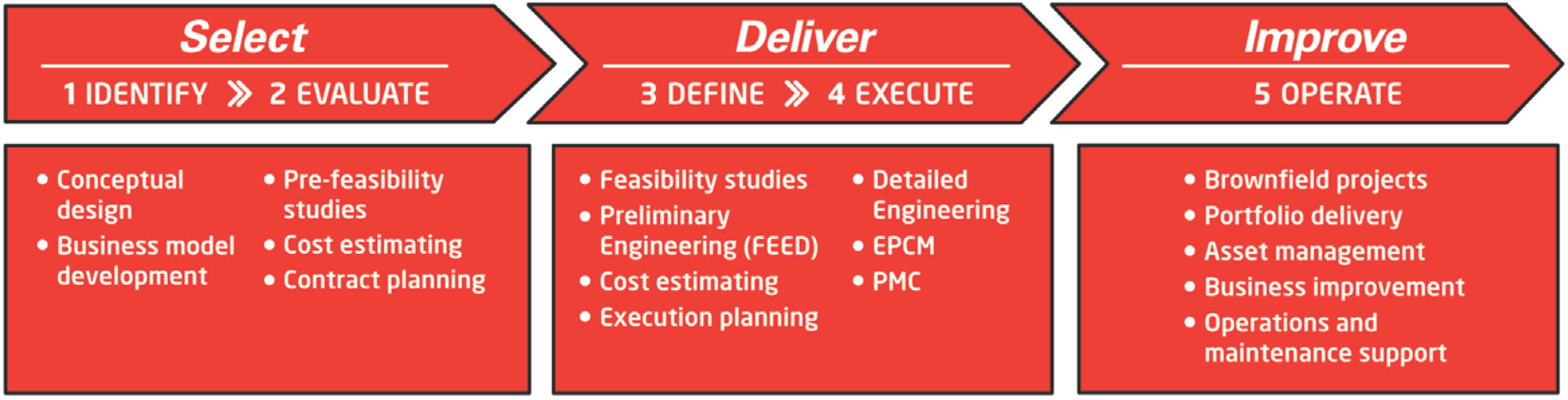

Delivering profitable sustainability EcoNomics™

Select

- *Select* is the specialist front-end division of WorleyParsons
- *Select* is an integral part of the WorleyParsons global project delivery capability
- *Select* recognises that the decisions made during the initial stages of a project have the greatest impact on the ultimate business outcome
- *Select* provides pre-FEED (Phase 1 and 2) services to asset owners, operators, and investors
- *Select* utilizes WorleyParsons' extensive "real world" experience in total project delivery, asset operation and industry best practice

500+

Specialist early-phase personnel

13+

Select International operating centres

Cost data base containing

$45B+

of CAPEX projects

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Contributions to University of Kentucky CLC Project

EcoNomics

WorleyParsons Activities

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- Objectives:
  1. Ensure complete technical design of generating facility incorporating University of Kentucky CLC technology.
  2. Develop economic comparison of University of Kentucky CLC Technology to reference carbon capture technologies.
- Activities:
  - Provide technical review and guidance of CLC system
  - Develop capital and O&M costs for reference and CLC cases.
  - Perform financial analysis to determine COE, LCOE and cost of CO_2 captured:
    - Existing supercritical PC cases with and without CO_2 capture
    - University of KY Advanced CLC system

Technical Review and Guidance

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- Purpose: To ensure that the facility design developed by the University of Kentucky:
  - Meets requirements of design basis
  - Complete – review of components/equipment and energy/mass flows
  - Sufficient information provided to perform cost estimate
- The review will be completed by engineers with background in power generation systems and traditional and novel CO_2 capture systems.
- Guidance in incorporating the review into the final plant design will be provided to the University of Kentucky.

Capital and Operating Costs

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- Reference Case
  - Capital and O&M cost will be determined from escalating the costs presented DOE/NETL Cost and Performance Baseline Study for coal-fired supercritical.
- University Kentucky CLC System
  - Sizing information of reactors and consumption rates for consumables will be provided by University of Kentucky
  - ICARUS, from Aspen Tech., and in house parametric models will be used for developing costs for reactor vessels, absorbers, and other specialized process equipment based on the equipment size, basic design, and materials of construction information.
  - Factored estimates for equipment such as pumps
  - Costs will be presented in January 2012 dollars

Capital Cost Breakdown

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- Capital costs breakdown will be provided to illustrate the contribution of various accounts (such as Coal & Sorbent Handling and Instrumentation & Control) to the total plant costs.
- Breakdown of accounts will include:

- Equipment
- Material
- Labor
- Engineering, Construction Management, Home Office and Fees
- Process and Project Contingencies

Operating and Maintenance Costs Breakdown

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- Operation and maintenance cost breakdown will include:

Fixed

- Operating Labor
- Maintenance Labor
- Administrative & Support Labor
- Property Taxes and Insurance
- Maintenance Material

Variable

- Consumables
  - Water
  - Oxygen carrier
  - Solvents
- Waste Disposal
- Fuel

Economic Analysis

- Purpose:
  - Compare Cost of Electricity (COE)with CLC capture technology to:
    - COE without CO_2 capture → assess ability to meet 35% increase in cost target set by DOE
    - COE with current state-of-the-art CO_2 capture technologies (advanced amine solvents)
  - Provide understanding of factors that impact COE
- Activities:
  - Determine COE and LCOE and cost of CO_2 captured using DOE/NETL Power Systems Financial Model or similar in house models.
  - Explore sensitivity of metrics on input parameters to economic model including:
    - process efficiency
    - capital costs
    - operating costs