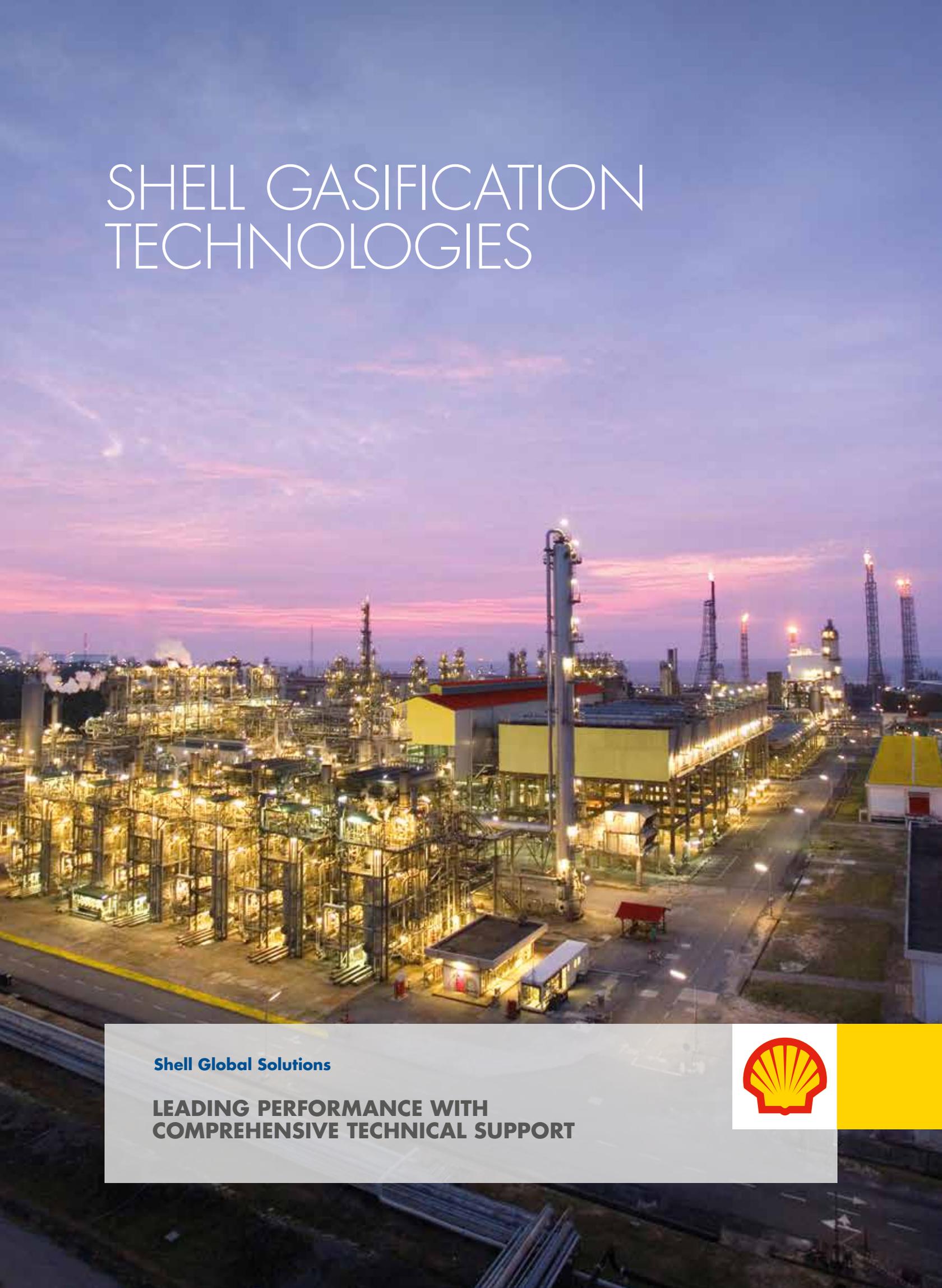


SHELL GASIFICATION TECHNOLOGIES



Shell Global Solutions

**LEADING PERFORMANCE WITH
COMPREHENSIVE TECHNICAL SUPPORT**



WHY GASIFICATION?

ARE YOU LOOKING TO FREE YOUR BUSINESS FROM THE EFFECTS OF HIGH AND VOLATILE GLOBAL OIL AND GAS PRICES? GASIFICATION CAN BE A CLEAN, RELIABLE AND FLEXIBLE WAY TO MONETISE REFINERY RESIDUE, COAL, BIOMASS OR PETROLEUM COKE (PETCOKE).



SHELL GASIFICATION TECHNOLOGIES ARE EFFICIENT AND PROVEN, AND COME WITH GLOBAL SUPPORT FOR FAST START-UP AND RELIABLE OPERATION.

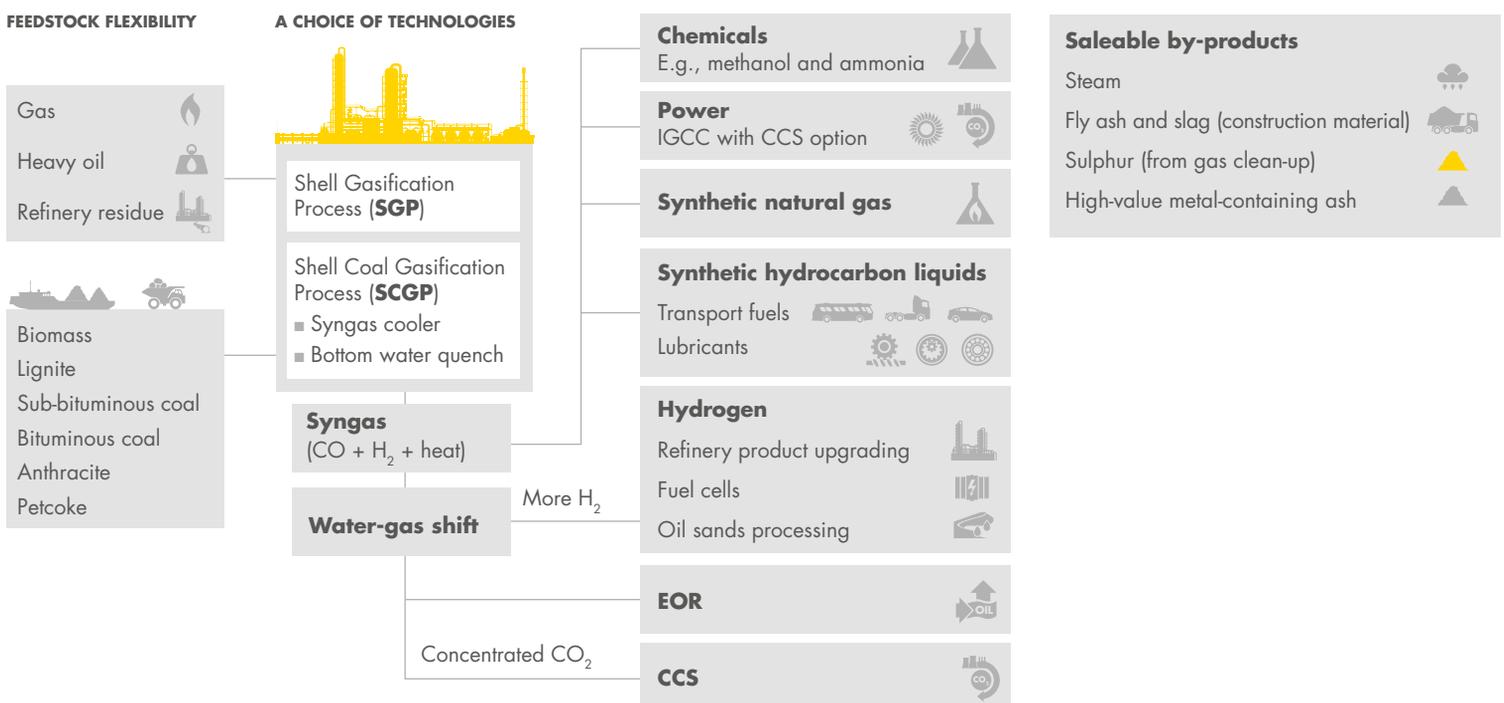
Shell gasification technologies offer low-emission conversion of a wide range of low-value feedstocks to synthesis gas (syngas) for the manufacture of high-value products or to generate power. They are efficient and proven, and come with global support for fast start-up and reliable operation.

In addition to syngas for chemicals, synthetic hydrocarbons and integrated gasification combined-cycle (IGCC) power production, gasification can give you:

- **hydrogen** for maximising high-margin, ultra-low-sulphur fuel yields;
- **high- and medium-pressure steam** that can help to lower operational costs;
- **a high-purity carbon dioxide** stream for carbon capture and storage (CCS) or enhanced oil recovery (EOR); and
- **saleable by-products**, including fly ash and slag for use as a construction material.



A BROAD RANGE OF APPLICATIONS AND PRODUCTS

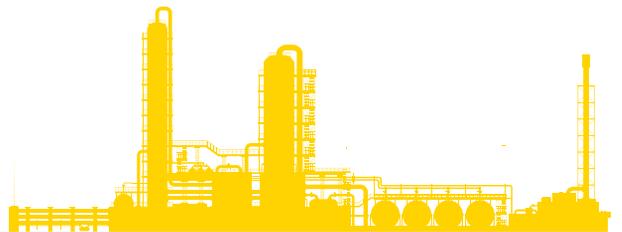


SHELL GASIFICATION TECHNOLOGIES

- **The Shell Gasification Process (SGP)** is a proven technology that can process a wide range of low-value refinery residues, thereby enabling refiners to use heavier, less expensive crudes and benefit from deeper conversion.
- **The Shell Coal Gasification Process (SCGP)** is a mature technology that comes in two line-ups designed to meet different user business objectives:
 - The SCGP syngas cooler line-up offers high thermal efficiency and is especially suitable for large projects and IGCC power generation.
 - The bottom water-quench line-up uses the same mature reactor membrane wall/burner technology, but with a simplified syngas cooler configuration that reduces capital costs by up to 30% and increases feedstock flexibility.



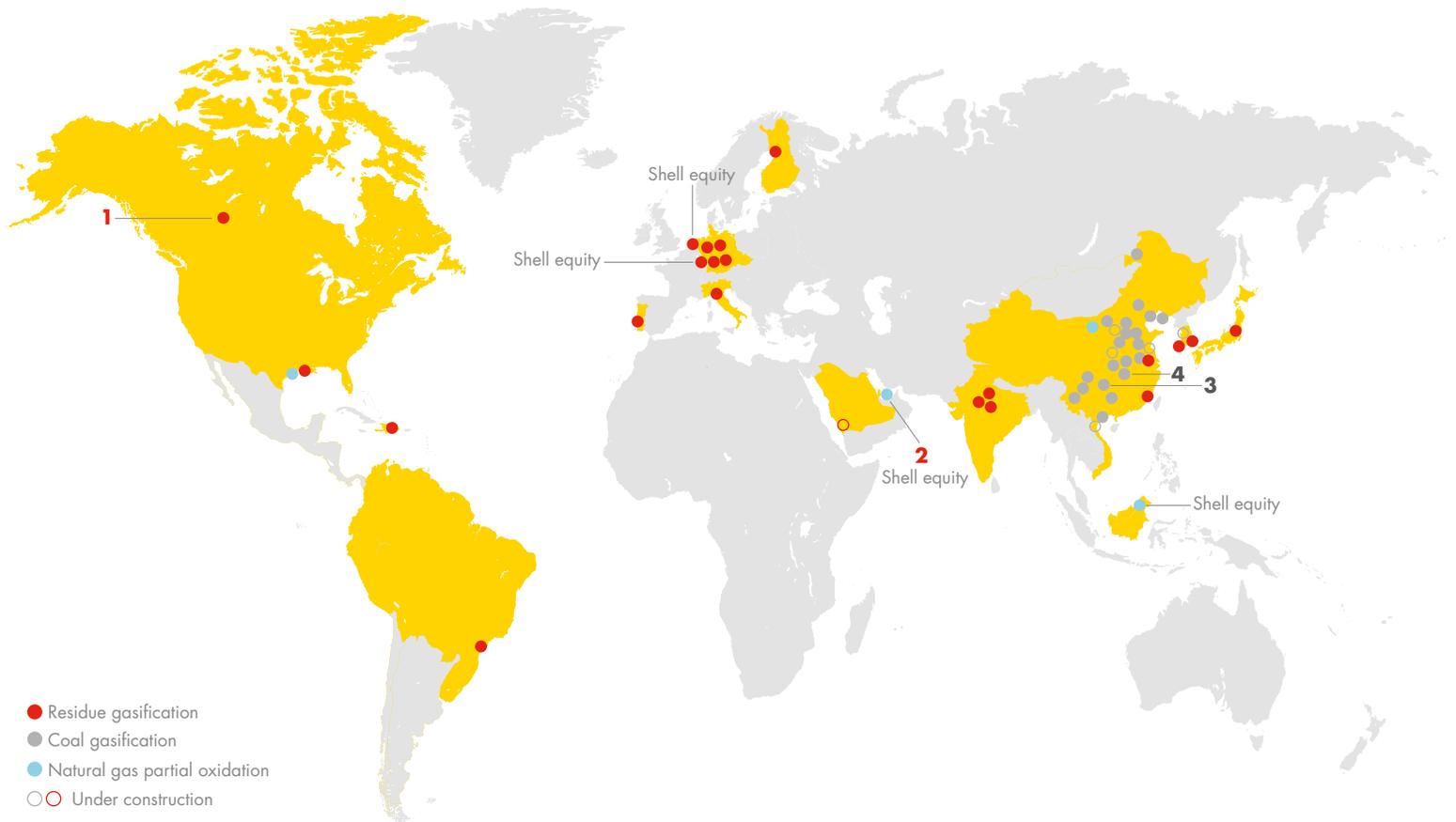
SHELL OFFERS TWO PROVEN GASIFICATION TECHNOLOGIES THAT CAN EFFICIENTLY CONVERT A WIDE RANGE OF LOW-VALUE FEEDSTOCKS INTO SYNGAS FOR THE PRODUCTION OF HIGH-VALUE PRODUCTS OR POWER.



HALF A CENTURY OF GASIFICATION INNOVATION

- 2014 Lu'an Coal Mine Group is building four 3,200t/d SCGP gasifiers, China
- 2013 Coal gasification bottom water-quench demonstration plant, China
- 2010 Eighteen SGP gasifiers for Pearl gas-to-liquids project, Qatar
- 2009 SGP IGCC for Sinopec Fujian, China
- 2008 SGP for a Nexen oil sands project, Canada ■ Seven SCGP coal-to-chemical plants, China
- 2006 Refinery SGP for Eni, Italy ■ Five SCGP units in ammonia plants, China
- 1997 Pernis refinery installs SGP, the Netherlands
- 1993 253-MW IGCC unit with SCGP for Nuon, the Netherlands
- 1987 250t/d SCGP demonstration unit, USA
- 1978 1.50t/d SCGP demonstration unit, Germany
- 1976 6t/d coal gasification pilot unit, the Netherlands
- 1956 Oil gasification research and development begins

GLOBAL EXPERIENCE



Since we began our gasification research in the 1950s, more than 170 SGP and 34 coal gasifiers have been built. There are currently 96 SGP and 24 SCGP gasifiers in operation worldwide. We also operate our own gasifiers, which helps us to understand and anticipate your operational needs.

1 NEXEN LONG LAKE PROJECT, CANADA

- 72,000 bbl/d of bitumen from the Athabasca oil sands
- The heavy asphaltene by-product of the primary upgrading process feeds a 3,800t/d SGP unit
- Produces hydrogen for the hydrocracker and steam for the steam-assisted gravity drainage operations

2 SHELL PEARL GAS-TO-LIQUIDS (GTL) PROJECT, QATAR

- The world's largest GTL plant: 18 gasifiers
- Peak production: 1.6 Bcf/d natural gas into:
 - 140,000 bbl/d of GTL products; and
 - 120,000 boe/d of condensate, liquefied petroleum gas and ethane

3 GUIZHOU TIANFU CHEMICAL CO., CHINA

- SCGP technology
- 2,000t/d dry coal intake capacity
- Long full-capacity run with 50% petcoke

4 SINOPEC AND SHELL (DONGTING) JOINT VENTURE, CHINA

- SCGP technology
- 2,000t/d dry coal intake capacity
- Syngas and steam for fertiliser production
- Direct operational experience since 2006

OPERATIONAL EXPERIENCE, SUPPORT AND RELIABILITY

Along with our customers, we believe in the benefits of learning from operational experience. We recognise the importance of supporting the people who use our gasification technologies – across the world, whenever they need us and over the full project life cycle.

- Innovations and improvements are recorded in a **lessons-learned database** for the benefit of all licensees and to improve our master design.
- We facilitate global **technology-user conferences** that aim to build user communities and accelerate learning.
- We focus on **continuous improvement** through innovation and partnership to carry on delivering highly reliable gasification units with long continuous runs and low maintenance costs.
- Our global SGP and coal gasification technical service centres provide **dedicated life-cycle support** to our licensees for full life-time assurance, including design, simulation, start-up assistance and training, and long-term operational assistance.
- As an operator, Shell can arrange **site visits and on-site training** to support your SCGP project.



WE BELIEVE IN THE BENEFITS OF LEARNING
FROM OPERATIONAL EXPERIENCE.



For further information, please visit our website at www.shell.com/globalsolutions

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