

Creating petrochemical growth platforms:  
leveraging upstream and existing assets  
with world class technology

Speech given by  
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Petchem Arabia 2009  
October 2009  
Abu Dhabi



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Good afternoon. The availability of abundant hydrocarbon resources has already enabled the Middle East to play an increasingly important role in global petrochemicals supply by developing an industry based largely upon low-cost feedstock.

By 1995, the Middle East was producing around 5 per cent of global ethylene output. Recent estimates suggest that by 2015, this will increase to 20 per cent.

Today, much of the petrochemicals output of this region is exported, primarily to Asia Pacific. But given the speed at which the world is changing and developing, will we see a new role for the Middle East industry? Will expanding production now supply developing downstream industries and markets within the region, or extend the reach of exports into Europe and the Americas?

Whatever happens, it is certain that the Middle East will play a pivotal role in future global petrochemicals growth and development.

Because Shell's activities in the Middle East have both a long history and an increasingly important place in the Group's global businesses, my main focus today will be on this region and the opportunities we see for petrochemicals growth.

However, I will also set my comments within the context of Shell's global petrochemicals activities and the changing competitive landscape and challenges of today's global marketplace. And while we live in an era of rapid change, Shell believes the key ingredients for successful petrochemicals growth remain the same.

As a key element of an integrated global energy group, Shell's petrochemicals activities are focused on adding value along the hydrocarbon supply chain.

Today, our petrochemicals investment projects are primarily determined by the opportunity to upgrade oil and gas streams - what we call upstream chemical advantage or UCA - or by upgrading products and operating performance through closer co-operation and integration between oil refining and petrochemicals production, which we call oil chemicals advantage or OCA. More on these later.

Our new projects are world-scale and world-class. In the current competitive environment, small-scale bulk petrochemicals plants make no sense. Technology - particularly process technology - also has a key role to play in both new and existing assets by lowering production costs, improving productivity or improving environmental performance, for example.

We also seek to leverage our global project implementation and operating knowledge. In some cases, that means upgrading existing assets to enhance competitive performance.

Supply chain management factors are important. Is infrastructure in place to optimise logistics? And what are the risks, and can they be managed?

Shell also recognises that the bases on which successful partnerships with major resource holders are built are constantly evolving. Upstream, relationships are constantly evolving as major resource holders and international oil companies adjust their contributions and contractual arrangements to suit different projects.

Downstream, the role of international oil companies has also changed. From providing money, project and operating expertise and marketing, through to delivering technology, we now see an increasing emphasis on contributing to business and industrial skills development, and to economic and social development.

Before I return in more detail to the basic ingredients for successful petrochemicals growth platforms, we should look at how the competitive environment is changing, because this has implications for the global industry.

The most important underlying factor is the need to respond to the global Energy Challenge, because it will have a major impact on future petrochemicals development.

Within Shell, we use five words to sum up the energy challenge: more energy, less carbon dioxide.

That's because there is now broad international agreement that by 2050, our world will require double the energy we use today, but also need to halve its greenhouse gas emissions to prevent catastrophic climate change.

Conventional oil and gas stocks are predicted to decline from 2015 onwards, which means we'll need to access oil and gas reserves that are harder-to-reach and more expensive to exploit.

And we'll also need to exploit other existing energy resources, such as coal and nuclear, while seeking to increase the input from renewables such as wind, solar, wave, hydrogen and biofuel and bio-feedstocks.

However, forecasts suggest fossil fuels will still account for up to 70% of global energy consumption through to and well beyond 2050. And if Industry uses more fossil fuels, then CO<sub>2</sub> emissions will rise unless we develop and implement technological solutions to lower, mitigate and manage their output.

For the chemicals sector, which is both heavily reliant on oil and gas for feedstock and energy and, for base chemicals, a significant generator of carbon dioxide, our response to the energy challenge will determine the future shape of our industry.

While much of our efforts to develop new feedstock and technology are focused on the energy challenge over the medium and long term, most of us will have been focusing on much more immediate challenges.

Over the past year, the chemical industry has faced one of the most challenging periods in its history. The combined effects of the economic slowdown, the global financial crisis and a cyclical industry downturn, add up to a "perfect storm", which continues to pose major challenges for petrochemicals.

There is also considerable uncertainty relating to the development and implementation of climate change policies and the scope and costs of attendant regulations and tax regimes.

Although this is a tough time for the petrochemical industry, with demand still constrained as a consequence of the global impacts of the credit crunch and recession, the long-term outlook for growth is still bright with growth predicted in all regions - albeit to varying degrees.

If we consider the local context, there is considerable petrochemicals growth potential across the Middle East and Africa, particularly as governments seek to

add value to abundant natural resources in an effort to achieve broader economic growth to create jobs and prosperity for a growing population.

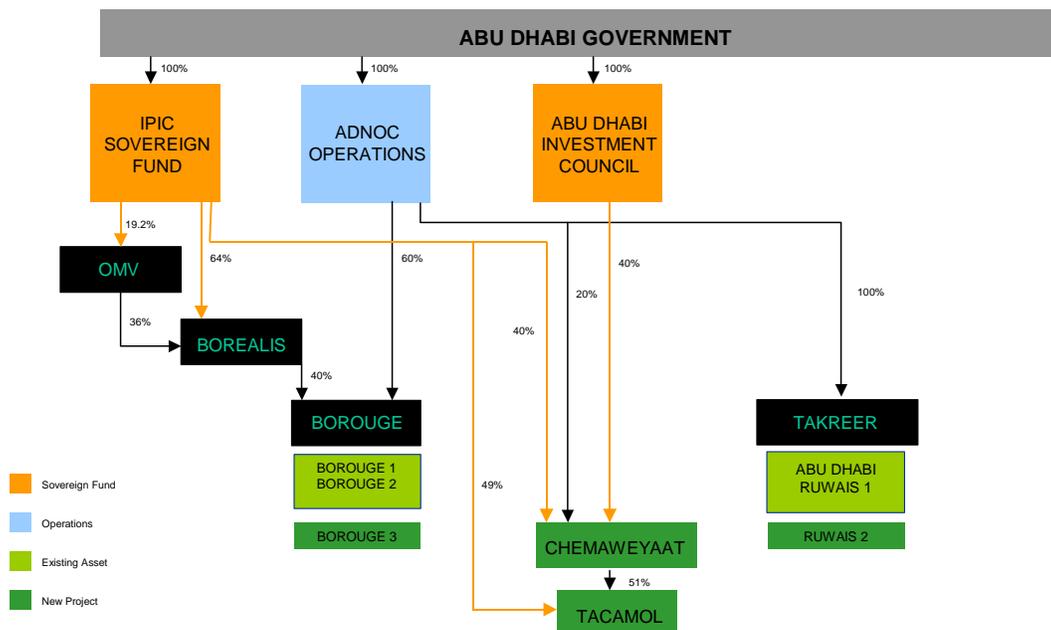
Let's have a look at three regional examples of how petrochemicals are being used to upgrade energy resources and foster economic development. First, in Saudi Arabia, then Abu Dhabi, and finally Qatar.

In Saudi Arabia, for example, the government has ambitious plans to diversify its economy by developing industrial clusters - including automotive, appliance, construction, flexible packaging and metals processing.

The bedrock for the development of these clusters will be the Kingdom's energy resources - oil and gas - and the downstream expansion of its petrochemicals sector to provide essential raw materials for these targeted new industries.

Currently, the Kingdom produces over 10 million tons of polyethylene and polypropylene each year, but the bulk of this is exported. With its significant existing integrated petrochemical assets, including the Shell-SABIC joint venture SADAF, being complemented by new petrochemical projects and plants coming to completion, under construction or in planning, the strategy is to increasingly use output to resource domestic industry. The future focus will be on expanding value-added chemicals manufacturing into areas such as specialty polymers, expanded polystyrene, SBR, polyurethanes, polycarbonates, which require expansion of local intermediates production, such as ldPE, EVA, MMA, PVC, TDI, MDI and higher olefins.

## Abu Dhabi petrochemical projects



Set in the context of the energy challenge, we can also see that Saudi Arabia's economic development plans offer significant growth opportunities for the petrochemicals sector.

For example, the automotive sector is looking to achieve better energy efficiency and lower CO<sub>2</sub> emissions, both of which are targets our industry can help achieve. Additives and lubricants that use chemicals are helping fuel to burn more efficiently and engine and moving parts to last longer. Plastics, composites and advanced materials are enabling vehicles to become lighter, cutting fuel needs and CO<sub>2</sub> emissions, and to become more durable as stronger petrochemical products replace metals.

Construction and appliance industries offer similar opportunities. With buildings estimated to be responsible for up to 40% of energy use globally, the potential contribution of chemicals-based insulation products to energy efficiency and lower CO<sub>2</sub> emissions is significant.

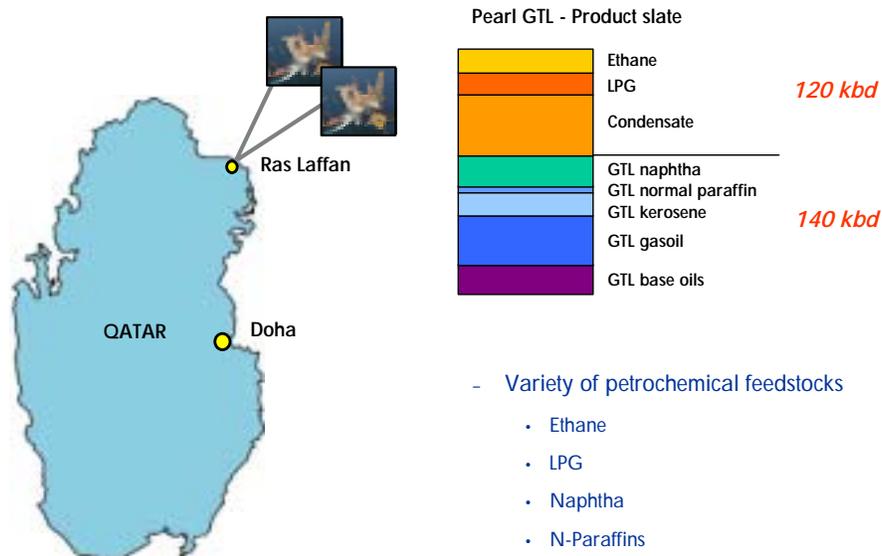
Despite being among the world's leading oil and gas producers, to date Abu Dhabi's petrochemical output has been restricted to polyethylene production at the Bourouge plant in Ruwais, which uses ethane feedstock that Shell helps to supply as a shareholder in GASCO.

But as we know, the Emirate has plans for a petrochemicals mega-project to be implemented by Chemaweya, a joint venture between state-owned companies and Borealis. The plan is to build a chemicals industrial city - with 12 world-scale petrochemical production units - to provide key materials for other integrated industrial sectors. Once completed, it will place Abu Dhabi among the ranks of the world's biggest petrochemical producers. It will also serve as a key engine for its economy through to 2030 and beyond.

Qatar, too, is in the process of significantly expanding its existing petrochemical capabilities as a means of adding value to its gas reserves. Having pioneered GTL technology for over 30 years, Shell is now engaged in a joint venture with Qatar Petroleum, developing the world's largest GTL plant in Qatar.

## Chemical feedstock as a growth platform

### *Pearl GTL - Qatar*



Pearl GTL will produce 120,000 barrels per day of upstream liquids - including ethane and LPG. The GTL process then produces 140,000 barrels per day of transport fuels, base oils for lubricants, naphtha and a unique paraffinic naphtha offering much superior olefin yields to refinery produced naphthas and a world-scale n-paraffin unit that will feed linear alkylbenzene (LAB) plants around the world.

Having looked at some examples of upstream/petrochemicals integration, let's look at some refinery/petrochemicals opportunities in the region.

On Saudi Arabia's east coast at Al Jubail, Saudi Aramco and Shell Saudi Arabia Refining Ltd (SASREF) operate one of the Kingdom's largest refineries, producing two key petrochemicals feedstock - naphtha and benzene - which help drive the Kingdom's styrenics value chain. SASREF supplies benzene to another Shell joint venture, SADAF, which is co-owned by Shell Chemicals (Arabia LLC) and Saudi Basic Industries Corporation (SABIC).

SADAF was created in 1980, began operating in 1984, and was the first petrochemicals company in the Kingdom to use previously flared gas. Also located in the Al Jubail industrial zone, the company operates one of the world's largest and most competitive petrochemical complexes.

Like any company, SADAF is always exploring ways to extend integration, and - for example - the company's chlorine value chain provides an opportunity for it to become an important player in the polyurethane sector.

There are also many new investments in the region that are being driven by refinery chemicals integration.

### **Shell Perspective**

While on the subject of integration, I will offer some brief insights into Shell's pursuit of the oil chemicals advantage, and the benefits it offers us.

A key element of Shell's strategy for chemicals has been to achieve a better geographical balance in our global manufacturing network by focusing recent and new investments in world-scale, integrated facilities in the Middle East and Asia-

Pacific and upgrading facilities in our historical heartlands of Europe and North America.

Today, close to 30% of our chemicals production capacity is in the Middle East and Asia Pacific, which gives us both regional feedstock and market access. And we are continuing to build partnerships with national oil and chemicals producers to strengthen our overall portfolio.

A good example of OCA at work is our new Singapore-based development, Shell Eastern Petrochemical Complex, which is currently undergoing commissioning for start-up early next year. If we think back to our three ingredients for growth, the project ticks the box on all three: integration, scale and technology.

SEPC will include a new world-scale ethylene cracker, and benzene and butadiene extraction units on Bukom Island. The world's largest ethylene glycol plant using Shell's OMEGA technology is being built on neighbouring Jurong Island.

Shell's existing refinery at Pulau Bukom will be modified to produce feedstock for the new ethylene cracker.

Singapore is already Shell's largest petrochemical production and export centre in the Asia Pacific region. And the new complex is strategically located to take advantage of existing infrastructure and to ensure maximum benefits are achieved by integrating the petrochemical site with the Bukom refinery. This will deliver advantaged feedstocks, operating benefits and valuable by-products.

Close proximity to markets and customers will ensure that cost efficiency and competitiveness are passed down the value-chain.

Oil-chemical integration is a key tenet of Shell's downstream strategy, which we believe gives us a competitive edge. Most integration value comes from directing hydrocarbons to the highest-value application, irrespective of traditional refining - chemical boundaries. Secondary or by-product streams from refining units can have their highest value as feedstock for chemical units. Likewise, by-products from chemical units can be most cost-effective as refinery feeds or fuel blending components.

Investing in hydrocarbon integration has also improved our operational flexibility, and helped maximise returns as feedstock economics shift. We're developing and deploying new optimisation tools that day-to-day enable us to maximise and coordinate hydrocarbon value across our integrated refining-chemical locations. This feedstock flexibility also brings customers the benefits of product supply security.

Extensive process design work at the Shell Global Solutions laboratories in Amsterdam and Houston has paved the way for innovation in heavy feed cracking, which is crucial to facilitating enhanced production. In Singapore, our Shell Eastern Petrochemicals Complex will use a higher percentage of heavier feeds compared to other liquid crackers. And nearer to home in The Netherlands, our Moerdijk cracker is being reconfigured to enable it to crack hydrowax from the Pernis refinery.

Heavy feed cracking of this nature will bring economic advantages, particularly in terms of producing more valuable by-products such as propylene and butylenes. It will also increase cracker capacity by 40%. However the trade-off is that heavy feeds are more energy-intensive to process, so the challenge is to focus on process efficiencies to reduce CO2 impacts.

As the need to reduce energy and other resources associated with chemicals processing increases, finding more efficient routes to products is critical. Catalyst technology can play a significant role here.

Using new catalysts developed by Shell in our ethylene oxide/glycols technology, for example, enables us to convert up to 90% of ethylene into EO. That's a 10% improvement over the previous generation of catalysts, and it also saves hundreds of millions of dollars and lowers carbon emissions.

We've used Shell technology and acquired technology to commercialise and license OMEGA, the world's most efficient process for MEG production. And our latest SMPO plants use 35% less energy for every tonne of chemicals produced while emissions to the atmosphere have been cut by 90%, and liquid and solid waste is almost 100% recycled.

## **Conclusion**

As I mentioned earlier, the Shell Group has a long history in the region, underlined by the scale of energy and petrochemical assets in which we have invested.

From a Shell Chemicals perspective, not only is there an abundance of natural resources to support petrochemicals growth, there is also strong government commitment to expanding this sector as a foundation stone for broader economic, industrial and social development.

We also see opportunities where our technologies can support the economic and industrial goals of MRHs, which include developing downstream and specialty chemicals sectors such as polyurethanes.

In the final analysis, Shell understands the increasingly important role the Middle East is playing in global petrochemicals and we are certainly keen to extend our partnerships in the region.