



DAY 1: BUSINESS SESSION

GLOBAL COMPETITIVENESS AND
THE CHEMICAL INDUSTRY:
WHAT ABOUT EUROPE?

MONDAY 6 OCTOBER 2014

OFFICIAL OPENING



TOM CROTTY
EPCA President from June 2014
INEOS GROUP



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“We have a record number of registrations this year. Almost 2800,” said EPCA president Tom Crotty, welcoming delegates to Vienna. “But I’m not sure whether this is a sign of a recovery in the industry, or whether in the face of adversity it’s better to have strength in numbers!” Certainly, the global chemical industry is seeing seismic change, with massive shifts in global demand and in energy supply, Crotty noted. For this reason, the meeting’s presentations would focus on how the European petrochemical sector can remain competitive in the face of these changes and the new challenges they bring.

When EPCA met in Vienna back in 2005, the focus was on the impact of investment in low-cost Middle East production capacity. There were predictions that a tsunami wave of imports would herald the demise of European petrochemicals, the Ineos director recalled. “But it didn’t happen, because China mopped up this production.” However, today’s picture is very different. China has invested heavily in base chemicals production and its economic growth is slowing, which is impacting imports. Furthermore, Crotty

continued, the development of shale gas has transformed the competitiveness of the US chemical industry, and now Europe faces a potential wave of imports from two regions benefiting from low-cost production.

At this point, he put the meeting into the hands of moderator Nadine Dereza to introduce the speakers to offer their perspectives on the competitive challenges facing their companies and the industry and how best to respond.



NADINE DEREZA
Moderator

KEYNOTE SPEAKERS



GRAHAM VAN'T HOFF
Executive Vice-President
SHELL CHEMICALS

VISION OF AN UPSTREAM INTEGRATED GLOBAL CHEMICAL PRODUCER

Does Europe's chemical industry have the right ingredients to stay competitive despite the region's difficult economic struggles? This was the question posed by the annual meeting's first keynote speaker, Graham van't Hoff, Shell Chemicals' executive vice-president.

He believes it does, but sees two major challenges – the cost of production, and the potential threat of North American shale gas. To these, he identified six key responses: leveraging clusters, technology investment, refinery integration, advantaged feedstock, a better industry image, and gaining the support of policymakers. If the industry gets it right, the Shell executive believes the chemicals sector “can play a key role in re-industrializing Europe and in securing a sustainable future for the region.”

When van't Hoff joined the industry in 1984, there were fears that new Middle East production capacity based on cheap feedstocks would destroy the European petrochemicals sector by 2000. However, “Today, the European chemicals industry appears to be alive and kicking. It is a €558 billion industry providing over 1 million direct and nearly 5 million indirect jobs in Europe.” But while Europe's chemical sales have doubled since 1992, its market share fell from 30.5% in 2002 to just 17.8% in 2012.

Did Europe get lucky, or take measures to remain competitive? Probably a combination of both, said van't Hoff. As Middle East production grew rapidly, demand in Asia, and particularly China, also grew well ahead of expectations. Europe also had some good fundamentals, including highly energy-efficient plants, a productive labor force, and a vast, differentiated product portfolio.

Today, Europe has to grapple with increased production costs, including feedstock, fixed and variable costs. For example, IHS reckons that in 2008 an average European cracker cost 20% more than its global equivalent, van't Hoff noted. By 2014, this cost gap had risen to 45%, and by 2018 is expected to be

“THE CHEMICALS SECTOR CAN PLAY A KEY ROLE IN RE-INDUSTRIALIZING EUROPE AND IN SECURING A SUSTAINABLE FUTURE FOR THE REGION.”

at least 55%, due mainly to hydrocarbon and energy costs. Europe also faces a widening energy cost gap: industrial electricity prices are more than double US prices, and 20% higher than China's; industrial gas prices are 3 to 4 times above US and Russian prices, and 12% higher than in China. Given the close relationship between chemicals and manufacturing industries, rising energy costs will have impacts across Europe's economy.

“While the availability of ethane in the Middle East is now clearly less abundant,”

the Shell executive said, “North America has re-established itself as a low-cost petrochemical manufacturing region due to the so-called ‘shale revolution’. Since 2009, absolute price differentials between hydrocarbon streams have increased, and recent crude-gas spreads of \$14/mmbtu (oil vs. Henry Hub) have created a particular downside for the European chemical industry. These crude-gas spreads are expected to continue and favor US ethane crackers against European naphtha crackers.”

Planned new crackers based on cheap ethane feeds plans could raise US ethylene capacity 40% to around 40 million t/y, and make North America a major ethylene derivatives exporter, said van't Hoff. South America and Europe would likely each receive 40% of these exports, with China being the destination of last resort, in part due to the Middle East's freight advantage. With US PE imports into Europe expected to double to 4 million t/y in 5-7 years, Europe could be facing PE capacity cuts of up to 2 million t/y, and knock-on cracker rationalization.

However, the outlook is not totally gloomy, said the Shell Chemicals EVP. North America looks to be facing steep cost increases, skilled labor shortages and productivity challenges, which may check exports. Many North American players have major plants in Europe, which may be limiting US shale gas impacts in Europe, although US companies could cut European output and import instead.

Having outlined these two key challenges, van't Hoff suggested how Europe's chemical industry should respond, by building on strong fundamentals to enhance competitiveness. “We should continue to leverage our clusters...such as the Antwerp-Rotterdam and Rhein-Ruhr clusters, down to Ludwigshafen and Marl,” said the Shell manager. Competitive clusters are more robust, as they are well integrated in terms of logistics, ownership and derivative units; and they have low cost to serve.



GRAHAM VAN'T HOFF
Executive Vice-President
SHELL CHEMICALS

However, smaller clusters with fragmented ownership may struggle, and producers with less derivatives integration would be more exposed to the merchant market and need to secure enough contractual volume to ensure full asset utilization.

Van't Hoff also pointed to significant value in integrating refineries and petrochemical plants. Shell, for example, draws strength from mega sites in the Netherlands, the US Gulf Coast, and Singapore, and continues to invest in enhanced integration between Moerdijk plants and the Pernis refinery, and in Rheinland. He continued: "Globally, chemicals has and is expected to continue to be a high-growth hydrocarbon outlet, with growth forecast at 50% over the next 10 years, compared to oil products at 10%. In Western Europe, chemical demand is stagnating, but fuels demand is worse, declining at 3% per year." Europe – like many other regions – has surplus gasoline, with no obvious 'new home' for that extra volume. An efficient refiner would switch its attention to aromatics and discover growth and margins from petrochemicals.

Producers should also seek more advantaged, lighter feedstock, such as LPG, although structural changes are required for feedstock flexibility. From 2010 to 2013, natural gas liquid (NGL) cracking rose 13% to 31%, with coastal plants accounting for about 41%, and non-coastal for only 13%.

The first wave of Europe's 'going lighter' strategy was mainly through LPG; the second wave is through cracking imported ethane.

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However, not everyone can import ethane, as investments in onshore logistics, vessels, and import facilities are required, making it a viable option only for a few water-based locations with easily adaptable cracker infrastructure.

Beyond feedstocks, the industry must continue to invest in developing chemicals technology – for more efficient and flexible production, new products and a greener

global economy. It must also work harder to tackle its image problem with stakeholders, and make policymakers understand its key role in economic growth, and that competitiveness needs to be the touchstone for all EU policies.

"Europe needs coherent, non-conflicting energy and climate policies, aligned across the EU, that deliver secure and competitively-priced energy, without creating an overly burdensome regulatory environment," said van't Hoff. He also said Europe needs a consistent and predictable legislative framework that does not drive away investment, and urged a focus on regulatory efficiency. "The cost of compliance with REACH should be addressed and other national and EU legislative initiatives should be consistent with this objective. These should be streamlined, so as to deliver the same level of protection to workers and consumers, but at the lowest possible cost. And the conditions and needs of small and medium-sized enterprise have to be taken into account in such a process."

The Shell executive also urged the EU to step up its support and encouragement for young people to choose a scientific education, and fully implement the single market for jobs.



DANIELE FERRARI
Chief Executive Officer
 VERSALIS SpA
and Chairman
 MATRICA SpA

VISION OF A REGIONAL PETROCHEMICAL PRODUCER UNDER TRANSFORMATION

Opening his presentation, Daniele Ferrari noted that the European chemical industry is struggling, and is threatened by a number of “game changing” developments impacting competitiveness.

North American producers have seen their energy costs reduced by shale gas, which could account for 35% of US energy production in 2035, and will increase US exports of gas and polyolefins. The Middle East has access to low-cost feedstocks and is increasing integrated downstream capacity, while China continues to invest in chemicals production. But he said it is also important to recognize the impact of Latin America’s focus on renewable feedstocks. The region is already producing about 33% of the world’s bioplastics, and renewable feeds offer big opportunities for the Brazilian petrochemical industry.

Despite being energy-efficient producers, European manufacturers are losing competitiveness in the face of a “deadly spiral” of related energy factors, Ferrari continued. The spiral started with the boom in US shale gas production which had cut US gas prices, lowered US coal prices and seen a drop in CO₂ prices caused by the economic crisis, leading to more imports of US coal into Europe. This change in the European powergen mix has seen coal increase and gas decline, which is increasing CO₂ emissions despite over €60 billion in subsidies for the renewable energy sector. The end result is a dramatic energy cost gap, whereby in 2013 European gas prices

were three times higher than in the US and European power costs were double US levels.

In addition, the European industry has to cope with a strong institutional and bureaucratic burden, Ferrari said. “We have about 3 or 4 European Commission directorates overlapping on energy matters. We have 74 EU directives and regulations, and dozens of different national legislative initiatives. This situation is not sustainable. The EU’s 2020 energy policy was supposed to support competitiveness and sustainability. But it was based on some erroneous forecasting, and we’re not getting there.”

Versalis’s CEO said EU energy policy should be addressing a major issue: the lack of integration in the energy market. Today, there are 28 separate gas markets in the EU, when what is needed is a United States of Europe for gas. Europe already imports over 60% of its gas requirements and between 2020 and 2025 this is likely

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to rise to 80%. What’s needed is a well-functioning and interconnected energy market to improve the competitiveness of the EU’s energy-intensive industry and the economy as a whole, Ferrari stated.

Energy is a really big deal for the chemical industry, which has already played its role in achieving efficiency, and reduced its energy intensity by 50% in the last 20 years despite increasing production by 60%. Now the EU is discussing a 40% reduction in greenhouse gas emissions by 2030, which would mean the industry achieving reductions of 70% from 1990 levels. “This is not sustainable, and an unrealistic target that risks further penalizing our industry,” Ferrari insisted. What

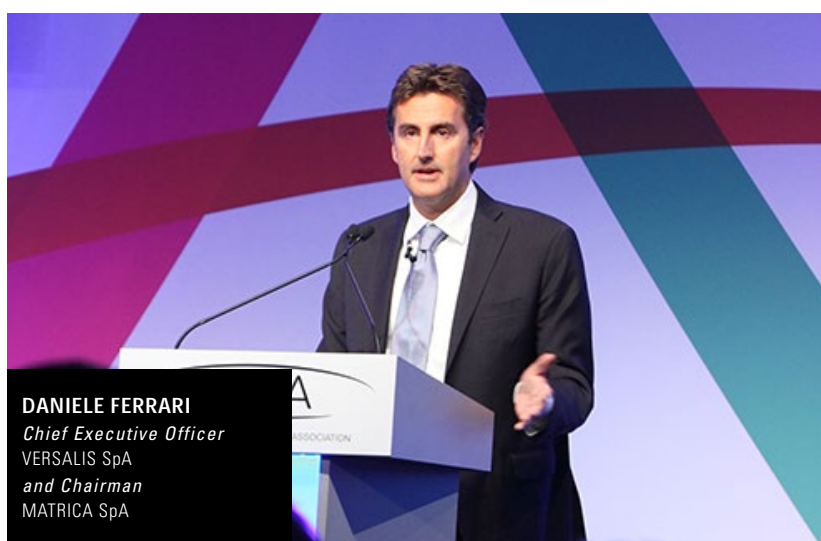
Europe needs is predictable, achievable, sustainable and integrated energy and climate policy, he said.

Right now, energy issues are putting European supply chains at risk, Ferrari continued. In plastics, for example, that means half a million jobs, and about €300 billion in turnover. Uncompetitive production factors in Europe will mean increased imports and relocation of players further down the value chain, he warned.

So what should the industry do in response? Ferrari suggested three key options. First, in the short-term, pursue right - sizing and integration, which requires rationalization and consolidation, and – further downstream – by increasing or realizing the value of by-products. Second, over the medium-term, look to improve flexibility, by using cheaper cracker feedstocks such as ethane, and by streamlining the supply chain. Third, over the long-term, focus on the transformation of the production base, by making “Brownfield” investment in new industrial platforms, and by increasing differentiation and/or switching to “Green” production.

Ferrari then turned to some of the consequences for Versalis of pursuing these options. He noted that the company has some particular challenges because it is only partially integrated and is not a global petrochemical player. However, he believes Versalis is increasing its competitiveness by making changes. “The most obvious choice for us was to optimise the asset base and have the right scale, and look for downstream integration and portfolio specialization.”

At Priolo, Versalis has improved integration, reducing ethylene cracking and closing the polyethylene assets, and focusing on some higher value products in the C9 and C5 chains, embarking on a technology joint venture. At Brindisi, which is already integrated with captive use of C2 and C4 cuts, the effort has been limited to feedstock flexibility and downstream further specialization of the product portfolio. Although it was unfortunate, Ferrari said that cracking and polyethylene facilities at Gela in Sicily, which were old and



DANIELE FERRARI
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uncompetitive, had been closed, and that the company's Sarroch facilities in Sardinia will be transferred and re-integrated with the adjacent SARAS refinery, according to a preliminary agreement signed last October.

Ferrari said the medium-term option of maximizing flexibility of lighter feeds is an interesting initiative. At Dunkerque, France, there is the potential to use ethane to produce up to 50% of ethylene from ethane. This will require some major logistics modifications – such as cryogenic storage and supply system – and changes to specific cracking elements.

Long-term sustainability requires a market-driven approach, Ferrari continued. By focusing on megatrends, it is possible to identify opportunities for alternative technology platforms related to energy, feedstock, environmental sustainability and intelligent materials. For that reason, Ferrari said, Versalis decided to develop integrated green platforms – via win-win plant reconversions – for new bio-based products at two of its sites.

At Porto Torres in Sardinia, the Versalis-Novamont joint venture, Matrica, has invested in an oxidation green chemistry platform, with a biorefinery-based integrated biochemical complex to produce biochemicals for

applications in bioplastics, biolubricants and personal care, and as additives for rubbers and polymers. At Porto Marghera, Venice, Versalis and its partner, Elevance, are jointly investing in a metathesis green chemistry platform to make specialty products for applications ranging from personal care, detergents and cleaners and biolubricants to high performance oilfield chemicals.

Ferrari said there are interesting opportunities for European petrochemical companies, which have strong technologies used in production worldwide, to work with technology developers in other sectors of the chemical industry, such as agrichemicals, to develop new technologies, such as biochemistry. He said **Europe is at the center of a virtuous cycle of technology, and the industry should work to preserve its global leadership in technology** through a focus on R&D, licensing, and protecting and developing intellectual property, while improving existing technology and developing new routes to production and products with enhanced performance qualities. The Versalis CEO said this is what his company is doing through its elastomers joint ventures with Lotte in South Korea and with Petronas in Malaysia.

Ferrari also noted that European companies have helped push the technical properties of

polyolefins far beyond earlier expectations, enabling them to penetrate into high performance applications in the energy, electronics, automotive, IT and construction sectors. Working with customers and other partners, the industry is transforming itself into a solution provider.

Bio-based chemistry offers the opportunity to create a circular business model, starting with agricultural materials that can be converted into valuable products, the Versalis chief executive said. He said it is possible to develop an efficient value chain – using non-food crops produced on marginal land and processed in smaller plants depending on regional, local or structural conditions – to maximize the exploitation of biomass. For its part, Versalis has partnered with Genomatica to develop a complete end-to-end process for biobutadiene production. Versalis will build the first commercial plant and the technology will be available for licensing, Ferrari said.

Before concluding, Ferrari mentioned the joint venture project Versalis has with Yulex to produce a range of products from guayule, a renewable and hardy non-food crop, from which a wide range of products can be manufactured, from rubbers and latex, to energy, soil and construction additives, biochemicals and pharmaceuticals, insecticides, and paints and coatings. Although he doesn't see bio-based chemicals replacing petrochemicals, Ferrari believes they do offer additional sources of value and opportunities to enhance competitiveness.

Concluding, Ferrari outlined four key routes to remaining competitive. Have a fully integrated up/downstream platform, with good geographical reach and an energy efficiency base in continuous evolution. Focus on capacity right-sizing and re-positioning, and take a fast and pragmatic approach to rationalization. Foster a deep research and innovation culture, and use it to generate regional megatrend-driven products and feed international growth. And finally, take an early adoptive and creative attitude towards renewable technologies, and target performance products based on specific building blocks.



PROFESSOR XAVIER SALA-I-MARTIN
Chief Economist & Senior Director,
 WORLD ECONOMIC FORUM
Editor of the WEF Competitiveness Report,
Professor of Economics at Columbia University

In an entertaining, thought provoking presentation, Xavier Sala-i-Martin, urged the chemical industry to pursue competitiveness through innovation. But he warned his audience not to confuse research and development as a substitute for innovation, or to confine the search for creativity within R&D departments. Drawing on Amar Bhidé's work in *On the Origin and Evolution of Business*, the economics professor noted that 72% of great business ideas come from workers, 20% from regular citizens and just 8% from formal R&D. And while R&D generates lots of ideas, many are not implemented due to an over-cautious approach to failure.

Looking back through history to 13th century China encountered by Marco Polo, Sala-i-Martin described a society that had developed technologies well in advance of those in Europe, with paper money, fireworks, water canals, and the printing press. Yet 800 years later, this once great empire had become a very poor nation, which seemed to have been bypassed by the renaissance, and scientific and industrial revolutions. "So what happened?" asked the professor. China centralized and monopolized knowledge,

focusing all talent through and towards the benefit of government, which was a massive disincentive for the generation of new ideas, he said.

For this reason, Sala-i-Martin expressed serious concerns about what he sees as today's centralization of knowledge in Europe via the EU's Bologna Process, which is aimed at achieving comparability in the standards and quality of higher education, but is diminishing competition between universities and contributing to a decline in the reputation of European universities: "Fifty years ago, all the best universities were in Europe. But today only the UK's Oxford and Cambridge are among the world's best, and none are from continental Europe." He also berated European politicians and policymakers for putting too much emphasis on R&D as a means to growing GDP, and also for focusing R&D spending on two areas – telecommunications and biomedicine. "Every city in Europe wants to be a new silicon valley, or to focus on green energy."

"72% OF GREAT BUSINESS IDEAS COME FROM WORKERS, 20% FROM REGULAR CITIZENS AND JUST 8% FROM FORMAL R&D."

As an example of the failure of business to innovate and to optimise ideas, the professor pointed to the IT and mobile phone company, Nokia. Ten years ago, a Nokia was the mobile phone of choice, and the company was a leading sector investor in R&D and also the world's number 5

R&D investor in all fields. "If you look at Nokia's patents, it shows they had enough innovative ideas to have developed the iPhone, but failed to implement them," said Sala-i-Martin. This eventually led to the sale of its mobile devices business to Microsoft, by which time 98% of the company's value had been lost.

Success through innovation is not limited to businesses at technology's leading edge, the professor noted. The clothing giant, Zara, the circus company, Cirque de Soleil, furniture company, IKEA, and the global coffee shop operator, Starbucks, are great examples of old, traditional businesses reinvigorated by people with innovative ideas and new ways to attract customers, adding: "No scientists were involved in generating these innovative ideas. They did not come from R&D. They came from a shirt salesman, a clown, a student, and

PROFESSOR XAVIER SALA-I-MARTIN
Chief Economist & Senior Director,
 WORLD ECONOMIC FORUM



from teachers and poets." Sala-i-Martin also highlighted Facebook, commenting that this success story was the result of students taking an idea and running with it rather than the output from a company's R&D division. The key to staying competitive, the professor said, is having ideas and implementing them.

A major challenge facing Europe is the lack of a single market and excessive regulation, the professor suggested. The EU has a multiplicity of tax regimes, infrastructures, markets, and labor rules, among other diversities. "Go to the US, you need to buy one phone. In Europe, you need 27 different phones, or pay roaming fees, 27 lawyers, 27 accountants, 27 insurance companies. Europe also relies too heavily on banking to finance innovative projects, but the banks are risk-averse."

Returning to education, within both national education systems and companies, the professor argued for a major overhaul in approach because there is a widespread tendency to kill natural curiosity and to suppress the asking of questions which generates answers and solutions.

"Schools haven't really changed in over 200 years. Go into a classroom, and you'll see the same desks, the same chairs, maybe even the same teachers!" But the way digital-age children learn and interact today is about connectivity, rather than the regimented systems of book learning familiar to their parents. Fostering learning and curiosity requires the application of new technology. He also attacked the hyper-specialization that is encouraged by education – at school, in universities, in the work place. In his own field, economics, he suggested that today's innovations

are coming from outside the discipline. There may also be an over-emphasis on science and technology in education and not enough focus on art, which relies on observation to see things as they really are or how they work.

Some of the best ideas in business don't come from R&D, but from talking and exchanging ideas – the water cooler effect, or the Medici effect – where the meeting of diversity generates innovation, said Sala-i-Martin. For this reason, some companies are creating their own universities for inter-disciplinary idea generation, or having innovation days, sometimes with external input. Finally, innovation relies on experimentation, which inevitably results in some failures. But trying and failing is a key to understanding and innovation, the professor argued. "We need to say: Learn from failure. Embrace innovation!"

QUESTIONS & ANSWERS SESSION





L eading the Q&A session, moderator Nadine Dereza asked the speakers for their views on the role of education in innovation.

GRAHAM VAN'T HOFF sees diversity as a key to innovation. "We need to attract people with new ideas. For Shell Chemicals, that means looking outside Shell, or outside the industry, or from inside Shell but outside the chemicals business." However, he accepted that people within Shell Chemicals also had good ideas, and suggested that the company also needs to bring in people with core competencies, such as chemistry and engineering, to protect its hydrocarbon assets.

"INDUSTRY NEEDS LESS GOVERNMENT INTERFERENCE AND MORE GOVERNMENT SUPPORT."

DANIELE FERRARI said that when he became head of Versalis the company lacked the drive for innovation. He agreed with Sala-i-Martin's contention that ideas are not only found through R&D efforts. "The answer is to go out and visit your plants, meet your people, or your partners and customers and create a culture open to ideas." He explained that he had given people his email and address and asked for their input. "After 3 days, my email inbox was full. But there were lots of good ideas, many from people working in our plants and in administration."

XAVIER SALA-I-MARTIN: Referring back to Cirque de Soleil, he said: "My message is: don't shut down R&D and hire clowns! Do R&D, but listen to others outside R&D too, and implement ideas."

NADINE DEREZA: "Google has Innovation Days. Could this industry do something similar?"

XAVIER SALA-I-MARTIN: "Parents should complement school education, for example, through using allowances as incentives. If my daughter can find problems and solve them, then she gets an allowance. It's a small-scale version of what happens in life. We have to innovate. Machines are eating up middle class jobs, and we're

seeing growing inequality between rich and poor, so to fill the gap people need to be creative."

NADINE DEREZA: "How are we going to switch more people onto STEM subjects and get them into the chemical sector?"

GRAHAM VAN'T HOFF: "We need better science education in primary schools and need people to understand that science is one of the foundations of society. People understand the contribution of pharmaceuticals but may not understand those of the chemical industry. We need to make science more interesting and we need to make the industry more interesting to attract the talent and innovators we need."

NADINE DEREZA: "What can government do to help boost competitiveness?"

DANIELE FERRARI: "We spend a lot of time trying to get government and politicians to understand our industry. We need to move them beyond a focus on plant-permitting and regulation and get them to understand the contribution we make to the economy. Right now, the bureaucratic burden is too high."

GRAHAM VAN'T HOFF: "We need to find new, better and faster ways to get our message across to governments to get their understanding and support."

XAVIER SALA-I-MARTIN: "I think the EU government does too much. It over-regulates, over-taxes, and over-intervenes. Industry needs less government interference and more government support. Government services are important, but they need to be more efficient."

NADINE DEREZA: "Finally, what would you all say are the priorities for competitiveness?"

GRAHAM VAN'T HOFF: "I think every company has to carve out its own basis for competitiveness, because we are all different. For Shell, it's about access to raw materials, finding options for value propositions, and focusing R&D in specific areas."

DANIELE FERRARI: "I agree with Graham. Look to compete on your natural strengths, and apply creativity."

