FLNG
Changing the rules of the game

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Matthias Bichsel became Projects & Technology Director on July 1, 2009. In this capacity, he is responsible for Shell's contracting and procurement as well as technology development and deployment. In addition, he has oversees Shell's safety and environmental performance.

He joined Shell in 1980 after obtaining a doctorate in geology from the University of Basel, Switzerland.

Matthias has worked for Shell companies and affiliates in Bangladesh, Oman, Canada, Indonesia, the USA and the Netherlands. In 1995, he became director of Petroleum Development Oman, looking after exploration and deep oil-field developments. In 1999, he transferred to Houston as managing director of Shell Deepwater Services.There, he was involved in all aspects of deepwater exploration and development on a global scale. From 2002 to 2006, he was Executive Vice President in charge of global exploration. And from 2006 until his current appointment, he was Executive Vice President - Technical for Shell Exploration and Production.

He is a member of the American Association of Petroleum Geologists and the Society of Petroleum Engineers, where he is Member of the Industry Advisory Council. In 2011, he was appointed an honorary professor at the Chinese University of Petroleum, Beijing.

A Swiss citizen, Matthias was born in 1954. He is married to Suzanne, and they have a daughter.

Floating liquefied natural gas (FLNG) is still very new. In fact, it's never been done before. In this presentation, Projects & Technology Director Matthias Bichsel introduces CNOOC executives to one of Shell's most important projects in this area. Prelude FLNG is a game changer for the energy industry, bringing new natural gas resources within reach.

Good afternoon, everybody. It's a real pleasure to be here today.

I want to thank CNOOC for hosting this event. Thank you, in particular, to Wang Jianxiang. When we got together in The Hague a few months ago, we knew we wanted to do a workshop. And we knew we wanted it to be about coal gasification. But we also wanted to engage in a broader conversation about technology development and innovation.

One of Shell's most innovative technologies is floating liquefied natural gas. I'll start this afternoon's programme with one of our most important (and exciting) FLNG projects.

We call it "Prelude".

Then we'll turn our attention to coal gasification. You'll hear from my colleague Ding Hiu Kwong, who will be giving his presentation in Mandarin.

Finally, Gerald Schotman, our Chief Technology Officer, will talk about Shell's technology-development programme. He'll explain how Shell plants the seeds of technology, tends to their growth, prunes their branches and ultimately harvests their fruits.

After that we'll open up the floor to questions.

It's time for me to introduce you to Prelude.

A game changer

We'll play a short video and when we come back, I'll walk you through some of the innovative designs and technologies that make this FLNG facility a world's first. We at Shell believe it's a game changer for the energy industry.

The first of the features highlighted in the film is the subsea system. Never before has an LNG plant sat over the field supplying the feedstock. The gas goes from wellhead to LNG plant in minutes rather than hours. Keep in mind that only 3 kilometres separate the wellheads from the Prelude facility.

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This means we couldn't count on the usual buffer capacity inherent in a long pipeline to moderate gas-flow fluctuations. Things like hydrates, wax and sand, which can clog up flowlines, have to be avoided at all cost. Even the production rates of the individual subsea wells have to be carefully adjusted with control valves. This was challenging, but this experience has allowed us to better understand the dynamics of the flows.

You've also noticed the turret. It's one of the most critical components of this project, not the least because it receives the flexible risers that bring all the well fluids into the facility. Its swivel design will allow Prelude to remain fixed over the sea floor while the facility re-orients itself according to wind and sea conditions. This way, Prelude can stay safely moored at sea even during the most powerful cyclones.

What you're seeing is the largest part of the turret leaving Dubai just a few weeks ago and a significant milestone for the project. I know it's hard to really appreciate the size of the turret this way; that's why I wanted to take you inside Prelude.

It's the largest turret of its kind – about the same diameter as the Hall of Prayer for Good Harvest in the Temple of Heaven, but almost three times as tall. You need something that size when you're trying to anchor a 600,000-tonne floating facility to the seabed.

But even a sophisticated mooring system can't prevent the facility from rising and falling with the ocean swells, which makes the transfer of the LNG at sea particularly tricky. You have two floaters to deal with: Prelude and an LNG carrier. We had to devise a safe and reliable offloading system.

We opted for a double-counterweight loading arm that can extend down as far as 10 metres to reach the LNG carriers. It will swivel, rotate and follow the motion of these carriers for the time it takes to offload the super-cold liquid.

Let me show you how it's done.

What I'd like to do now is describe a couple more of innovative technologies that were not highlighted in the video, but are very important for Prelude.

Innovative technologies

To remove all the heat generated by compressors and other processing equipment, we came up with an idea for tapping the cold water of the ocean. An ingenious system will pump 50 million litres of seawater per hour up from under Prelude. It consists of 8 one-metre diameter pipes, a bit like octopus tentacles, dangling 150 metres beneath the facility.

Of course, these aren't just any regular pipes.

If you look closely, you'll see spiral fins wrapped around the corner pipes. Those prevent "vortex-induced vibration" – in other words, they stop the pipes from flopping around when the facility moves or water currents shift.

And this is precisely one of the main issues we faced: Prelude moves!

Even a gentle rocking motion could result in liquid sloshing that might disrupt processing equipment and affect the tank walls.

So we've made sure this doesn't happen on Prelude.

Our computer simulations and scale-model tests show that the tanks' design suppresses sloshing, even when the tanks are only half full. And we're talking tanks of massive proportions!

Yes, Prelude is big – so big, in fact, that most elements, like the turret, had never been built on such a scale. But let me pause for a moment and argue that what's amazing (and innovative) about Prelude isn't how big but how *small* it is.

I want to show you how Prelude compares with an onshore LNG plant of similar capacity.

The contrast is striking! Then the question is: where does it all fit on Prelude? And more importantly: how do you keep it all as safe as a land-based plant?

On land you can keep a safe distance between living quarters and more hazardous parts of the process.

Everything becomes much more challenging at sea.

My hat's off to our engineers, who reduced the footprint of the processing and cooling equipment – what we call 'the liquefaction train' – to one-quarter the size of those found onshore.

But they didn't stop there! They also stacked various pieces of processing and storage equipment on top of each other, which, I should stress, required quite a bit of ingenuity.

In the end, a patch of water no more than 488 by 74 metres in size was enough to fit everything necessary to produce, process and liquefy gas – big enough so that 5.3 million tonnes of valuable liquids (not only LNG, but also LPG and condensate) can be delivered every year for a quarter of a century.

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But what really makes this feat of engineering even more amazing is that the safety risks involved with this re-configuration are as low as reasonably practicable. We made sure to keep a safe distance between a highly protected accommodation unit and the most potentially hazardous parts of the process. This was a critical consideration when determining the overall size and shape of the facility.

Ladies and Gentlemen,

It all started with a simple enough question: what would it take to produce gas at sea, hundreds of kilometres off the nearest coast, turn it directly into stable liquefied natural gas, and finally transfer it onto ships to be transported directly to markets?

The promise of natural gas

At Shell, our goal has always been the same: to help realise the promise of natural gas and bring huge new energy resources within reach.

Thanks to FLNG, we're one step closer to making this a reality.

Many offshore gas fields – once thought too challenging – won't be out of reach anymore, not even when the amount of recoverable gas can't be predicted with complete confidence.

I realise this is all still very new; it's never been done before.

But I know it's just the beginning.

FLNG provides unprecedented flexibility.

We set out to develop FLNG design "packages" ready to be mixed and matched for a given field development from the start. This flexible approach to a standardised design has made it possible for Shell engineers to propose another FLNG facility specifically for "dry" gas fields. Because there's no LPG and little if any condensate to deal with in such a case, a lot of processing equipment has been removed to make room for a second gas-liquefaction train.

And that's not all. With FLNG, much of the risk in sizeable upfront infrastructure investment is no longer an issue. Plus, unlike land-based liquefaction plants, an FLNG facility can be redeployed to another field.

Changing the rules of the game

This can mean faster, cheaper, more flexible development and deployment strategies for resources that were previously uneconomic or constrained by technical or other challenges.

It changes the way we do business.

So it's no surprise other oil and gas majors are already following in Shell's footsteps.

Prelude shows the way forward. Built from components at several locations in different countries, and with different partners, it also shows how crucial collaboration is in shaping tomorrow's energy system.

One of your most famous poets wrote:

"You can enjoy a grander sight,
By climbing to a greater height".

This verse, I believe, describes what Wang Zhihuan saw and felt when he ascended the Stork Tower.

This resonates with me; it resonates with all those who aspire to change the way we do things.

FLNG changes the rules of the game, challenging all of us to climb to a greater height.

Thank you.

"At Shell, our goal has always been the same: to help realise the promise of natural gas and bring huge new energy resources within reach.".

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