Creating winners among nations and companies

Abidjan, November 4, 2013, Odd Ivar Biller
Norsk Hydro - co-builder of nation

- Front runner in industrialization of Norway
- Based upon natural resources
- Multi business operations till 2008
  - Oil & Gas
  - Hydroelectric power
  - Fertilizers
  - Petrochemicals
  - Aluminium
  - Magnesium
  - Fish farming
- Today a major aluminium company in the world
  - Captive power production
Global reach

Norway
- 900,000 tpy hydro-powered aluminium production
- Technology and R&D centers
- Hydropower developments
- Rolled products, recycling and remelting

Continental Europe
- Leading upstream and midstream positions
- Europe’s largest rolled products producer
- Technology and R&D centers
- Recycling network

Extruded Products
- 50% ownership in Sapa - global leader in extruded products

North America
- Alouette aluminium smelter in Canada, expansion potential
- Remelting

Brazil
- World-class operations and resource base
- Bauxite and alumina growth projects
- Albras aluminium smelter

Middle East
- Qatalum 1 in production
- Qatalum expansion opportunity

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Australia
- Primary aluminium production
More than a century of innovation and development
Courage, Respect, Cooperation, Determination – and Foresight

- **1905**
  - Hydro established
  - Produces nitrogen-based industrial fertilizers using own hydropower

- **1950**
  - Alnor, Karmøy
  - Creates Hydro’s first aluminium smelter in Norway

- **1963**
  - Oil discovery in the North Sea
  - Hydro to become one of the leading producers of oil and gas

- **1969**
  - Merger with ASV
  - Also acquires five extrusion plants in Central Europe

- **1986**
  - Acquired German aluminium giant VAW
  - Hydro becomes largest aluminium company in Europe

- **2000**
  - Opening Qatalum
  - A modern world-class 600,000 mt aluminium smelter, with Hydro technology

- **2002**
  - De-merger of Hydro Agri to create Yara
  - World-leading fertilizer company

- **2004**
  - Acquires Vale’s aluminium assets
  - Fully integrated company, from bauxite mining to downstream manufacturing

- **2007**
  - Merging Hydro’s Oil and Gas activities with Statoil
  - Transforming Hydro from a conglomerate into a focused aluminium company

- **2010**
  - Merging Hydro’ Extrusion activities with Sapa
  - Creating the world’s leading aluminium solutions provider

- **2013**
  - Alumina refinery
  - Acquired a 34% interest in Alunorte, Barcarena - Pará

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Norway and Qatar- «paralell lives» as petroleum nations

- New oil & gas nations mainly from 1st oil shock 1974
- Substantial production of oil and gas
- Exporting similar amounts of natural gas
- Different strategies for use of petroleum resources
- Norway few gas based industries and other domestic use of natural gas
- Qatar extensive gas based industries and gas fired power
  - Hydro present in Qatar with fertilizers since 1972
  - Vinyl petrochemicals since 1998
  - Aluminium since 2008
Difficult to emulate success stories

- National strategies depend on
  - resource base and characteristics
  - market conditions
  - status of industrial and national developments
  - individual national priorities
Norway - geography and demography

- Same geographical size as Cote d’Ivoire
- Distance from South to North the same as Abidjan- Dakar
- Large areas of mountains, and large number of islands
- 5 million inhabitants dispersed all over the country
Norway- industry development

- Resource based industries
  - Hydro power development and production
  - Fertilizers and metallurgical industries based on water power
  - Fertilizers and petrochemicals based on imported oil products
  - Fisheries, fish farming and fish processing industries
  - Oil & Gas field development
  - Gas based petrochemical industries
  - Oil & Gas service industries
- Shipping and shipbuilding
Norway a large exporter of natural gas

- All petroleum activities take place on seabed of continental shelf
- 100 billion standard cubic meters per year (bscm/y) of piped gas
- Equivalent to 30 pct of global LNG exports, same as Qatar
- One LNG train far north
- 8100 km of gas pipelines
Norway- ownership of oil & gas and related industries

• **Discoveries and first developments by foreign oil companies**
• **Oil and oil products belonging to concession holders**
• **Norwegian companies with relevant industry experience to become front players upstream and downstream**
• **Norwegian companies oil & gas field operators from late 1970’s**
• **Norwegian companies owners of petrochemical industries**
• **Long standing cooperation with local technical universities**
• **Good basis for own research and development**
Norway- limited use of gas as feedstock for industry

- Separation of condensate and NGL from dry gas on all landing points
- Refining of NGL through fractioning only at first landing point
- Third largest export terminal for LPG in the world
- LPG shipped to petrochemical plants in eastern Norway
- Ethylene cracker, olefins and polyvinyl products
- Fertilizers based on LPG
- Methanol plant on one landing point
Norway- reasons for limited use of gas as feedstock

- High landed natural gas prices Europe
- Long term oil indexed take-or-pay contracts
- Low pipeline transportation costs
- Oil companies until recently owners of pipeline network
- Export prices for LPG high
- LPG transportation cost low
- High net back prices for buyers
- Oil companies joint interest with Norwegian state through 78 pct tax rate on revenues
  - Lower taxes on profits for onshore industries
- Owners of the gas not part of the downstream industries
  - ConocoPhillips participating in the methanol plant
Norway- limited use of dry gas for energy

- No use of dry gas for heating and cooking
- Natural gas is not used as fuel for cars
- Limited production of electricity from gas fired power plants
  - One for general consumption, 430 MW, not in use
  - One for electrification of offshore petroleum production and onshore treatment
Norway - abundance of «white gold» = hydropower

- 20-25 000 MWH utilized capacity
- More than West Africa capacity with 300 million people
- 100 pct of electricity consumption depending on precipitation
  - 55 pct heating and cooking,
  - 25 pct energy intensive industries,
  - 20 pct for other industrial usage
- 130 000 km of grid, three times the distance around Equator
Electricity grid under harsh weather conditions
Qatar story- main take-away

How can countries which do not have an industrial base build up a leading portfolio in the world of oil and gas industry and associated industries from scratch?
THE TRUE ESSENTIALS TOWARDS A PROMISING FUTURE

Home page - Qatar Industrial Manufacturing Company
Qatar - Geography and demography

- Tiny geographical area, 140 x 60 km
- 250,000 nationals
- Migrant work force of 1.7 million not allowed to stay
- Largest GDP per capita in the world
Qatar Fertilizer Company – QAFCO

“QAFCO's inception in 1969 as a joint venture company to produce chemical fertilizers was the first and a significant step in Qatar's industrial diversification program to utilize its abundant natural gas resources.”

[From Qatar Petroleum's internet home page]
Hydro in Qatar - QAFCO

- First industrial joint venture partner with the state of Qatar
- Then 110,000 inhabitants - full independence from Britain in 1972
- In production 1972
- Qatar 75 pct, Hydro 20 pct, Hambros Bank London 5 pct
- Hydro providing technology, project management, operational experience – and doing marketing
- Qatar Petroleum to deliver dry gas as feedstock
- Hambros to deliver financing with British export credits
- QAFCO is today the world's largest fertilizers complex
- Produces 20 times more ammonia and urea than 40 years ago
- Capacity extensions based on project finance
Hydro in Qatar - Qatar Vinyl Company (QVC)

- In production in 2001
- Partner together with Qatar Petroleum (QP) and Atochem
- Production of VCM- and EDC, building blocks for PVC
- Hydro - project manager
- Marketing agreements with Hydro and Atochem
- QP to provide ethylene as raw material and infrastructure
- 2007: QP exercise of Right of First Refusal after Hydro sale of petrochemicals business
Hydro in Qatar- Qatar Aluminium Company (Qatalum)

- Qatar Aluminium Company (Qatalum) in production from 2010
- 600,000 tons per year, total project cost $6 bn
- Hydro and QP 50/50 ownership
- Hydro delivering technology, project management, operational experience
- Hydro doing marketing
- QP supplying gas for power and infrastructure
- Both partners key in obtaining project financing
Qatar Petroleum- history

- Established in 1974
- Flying start taking over all oil and gas fields expropriated 1974-1976
- Established production from onshore Dukan oil field and non-associated gas field
- Associated and non-associated natural gas transported to the Eastern coast
- Dry components used as feedstock for Qatar Fertilizers Company -“stranded gas” at very cheap prices
- No alternative use; 1974: 60 pct flared, 1979 :5 pct flared NB
- Domestic use of NGLs for petrochemical industries 1976
- Big leap forward with LNG projects from 1998
Qatar industrial development- LNG

- The largest exporter of LNG in the world (77mn tonnes/y)
- The gigantic North field which was discovered in 1971
  - 15 pct of global gas resources
- Export of LNG from 1998
- Gigantic investment over 15 years
  - Norway build-up of equal piped volumes over 30 years
- May increase production capacity by 10 pct with no extra investments
North Field- largest natural gas field in the world
Qatar industrial development- petrochemicals

- Early production of NGL from oil and gas
- Fertilizers from based on dry gas 1973
- Ethylene and olefins from 1975
- Polyvinyl production from 1998
- Production doubled from 2006-2012
- Strip out" plants with more than 60 derivative products
- Money machines with more than 50 % net profit margin
- National company (Muntajat) in charge of marketing of all chemical and petrochemical products from 2013
Qatar industrial development - dry gas industries

- Largest GTL (gas to liquids) operations in the world
  - “Clean diesel”
- Gas fired power stations with 8000 MW
  - (½ of West African capacity)
- Power intensive industries
  - steel
  - cement
  - aluminium (captive power)
Qatar Industrial Developments- adjoining businesses

- Aluminium extrusion
- Metal coating
- Ferro alloys
- Bricks for construction
- Energy dependent industries
Qatar industrial development - job creation

- Construction phase huge demand
  - Shell GTL – 52 000 persons on site at peak
  - Qatargas II, LNG 30 000 person
  - Qatalum aluminium smelter – 20 000 persons
- Operations less labor intensive for direct employees
  - Qatalum 1700 own or contractor personnel
  - QAPCO with 6 petrochemicals plants altogether 1200 employees
- Large service industries during constructions and operations
- Large consumer demand created
Qatar industrial development- national strategies 2030

• Oil & gas from 55 pct of GDP to 25 pct
• Production of petrochemicals and chemicals to be doubled from 2012-2020.
  • Aiming at becoming the 3rd largest in the world by 2020
• Supporting infrastructure
  • Two Industrial Cities for large industries
  • New Doha harbor
• Qatar Science and Technology Park
  • Home for more than 30 international technology companies
• Education City with branches of foreign universities
• Qataris in skilled positions («Qatarisation»)
Qatar industrial development- success factors

- Qatar Petroleum very competent national oil company (NOC)
- National champion
- Owner of all oil and gas deposits in Qatar
- At least 50% partner of oil & gas operations and related service- and industrial activities
- Size of North field allows for composition of multiple LNG partnerships
- No need to compensate foreign partners for finding the resources
- QP developing part of the North Field for production of gas solely for domestic use
- Careful selection of partners
- Often the same partners for upstream and downstream ventures
- Allows for alignment of downstream interest between QP and partners
- Partners with technological-, project management-, operational capabilities
- Partners with market outlets
- High score for combating corruption
Qatar industrial developments - «strategic alliances»

- Qatari LNG and derivative industry benefits from the presence of some of the largest international companies
- Exxon Mobil, Total, ConcoPhillips, Shell, Marubeni, Mitsui partners in different Qatargas LNG trains
- ExxonMobil sole «strategic partner» in Rasgas
- Shell as partner in Qatargas LNG and GTL
- Total as partner in LNG and petrochemicals
- Customer representatives from Japan and Korea as partners in production and transportation of LNG and construction of platforms and shipping fleet – Marubeni and Mitsui
- Careful selection of non-LNG partners in gas and power based industries, Kobe steel, Chevron, Gulfstream, Air Liquide, Norsk Hydro
- Hydro invited to become partner on two occasions; North Field oil; aluminium
Qatar industrial development - QP owner strategies

- Majority ownership in all partnerships
- Equity partner on equal terms
- Export finance and project finance
- QP in the driver’s seat, wants to “own the company”
- Chairman of the Board of Directors and CEO
- Foreign partner
  - technology, operating experience and market outlet
  - secondment of personnel
  - not «operator»
  - project manager on contract
- Qatari petroleum engineers and other professional educated in the US and Europe operating across the value chain
- No own research department until 2009
Joint learning from Qatar and Norway

- Importance of ownership models upstream and downstream
- Oil and gas in ground belongs to property owner, often national states
- Oil and gas streaming from wellhead belong to concession holders, sometimes for defined period of time
- Royalties may be paid in kind
- Concession owners normally own all products which can be derived
- Provisions for “landing” of oil and gas onshore host country
- Oil companies regularly require certainty wrt right to dispose of oil & gas
- Try to establish onshore partnerships with license holders
- Option agreements as part of PSA’s for certain volumes or percentage of gas discoveries with pricing mechanisms allowing for domestic use of gas
West Africa geography and demography

- 15 countries
- 11 countries bordering the ocean with potential oil and gas resources
- New petroleum discoveries in Niger
- 300 million inhabitants

[Map of West Africa]
West Africa- Norsk Hydro’ presence in the region

- 2005: Hydro wanted to explore seabed outside Ghana
- Considered whole basin to be very prospective
- Evaluated area of Jubilee field
- Expertise in oil & gas and production and transportation of electricity
- Co-owner of gas fired power station in Norway
- West-African oil & gas and electricity attention later diverted
- Building Systems through 50% owned Technal of France
- Previous HydroChem fertilizers now owned by demerged Yara
West Africa- natural gas resources

- Presently large quantities of natural gas only in Nigeria
  - 18 million tons of LNG per annum, 25 pc of Norwegian or Qatari exports
- Potential new discoveries in other coastal states
- Important to develop strategies for domestic use of gas early on
- May influence how the exploration licenses are drafted for alignment of interests
- How should natural gas resources be utilized?
- Mosambique and Tanzania more like Qatar with huge deposits
- West African associated or non-associated gas resources expected to be smaller
West Africa - employment in industrial projects

- Onshore more bricks and mortar
- Onshore construction and civil works need more local content
- Offshore oil and gas platforms, often constructed piece by piece abroad
- Recent steel platforms with topsides towed from Asia
- Assembled onshore production country and towed to offshore location

Doha, Qatar - 14 September 2013: Four offshore platform topside modules, started their long journey by sea from Ulsan, South Korea to Qatar’s North Field
West Africa - industrial use of wet gas substances

• NGL need not be separated from oil before offshore or onshore loading
• NGL need to be separated before LNG can be exported
• NGL may look to be a profitable business on its own, or as LPG
• NGL or LPG can be exported or used for domestic gas based industries
• Demand for petrochemical and chemical products expected to increase
West Africa- use of dry gas for LNG or industrial?

- Economies of scale may require that volumes are not separated
- Expectation of LNG supply glut in the late 2020’s?
- US may become a very large exporter of LNG
  - application for exportation close to 80% of present global exports
- Australia, Mozambique, Tanzania, Iran and Russia with plans
- China with shale gas for own consumption by 2030?
West Africa- dry gas for fertilizers

- Smaller volumes requirements for ammonia/ fertilizers than for LNG
- Community effects larger than for LNG plants
- Supplies to domestic agriculture
- Opportunities for support industries and suppliers
- Variety of derivative products, like industrial gases
  - Fertilizer project in Gabon coast for 1.1 million tons per year
- Nigeria announced a combined refinery and fertilizer project of $9 bn
- Partner selection important
  - Qatari example
West Africa- dry gas for electricity

- ECOWAS, the West African region has a potential for hydroelectric production capacity of 26 000 MW, of which only 16% is currently used.
- Thermal generation necessary to move from 15 000 to 100 000 MW providing for 350 W/capita level of Brazil
- Limited resource of coal
- Huge gas supply quantities required
- Import of LNG probably not sustainable
- West Africa Gas Pipeline (WAGP) 700 km
- Main purpose to provide for power generation
- WAGP failed to deliver the level of gas agreed by its partners due to various issues including high moisture
- The success of the project hinges on gas policy in Nigeria
Electricity in Ghana

- The Volta River Dam with 1020 MW installed capacity
- Bui Gorge with an installed capacity of 400 MW
- 80 pct of Volta River Dam for Valco aluminium in 1967
- Aluminium smelter closed down due to shortage of supply
- VRD now 100 pct for general consumption
- Two oil fired thermal power plants
- Cross-subsidizing of feed tariffs hydropower and thermal power
- Grid system reaching 50 pct of population
- Benefits of industrial use as base load in power system
Electricity in the Ivory Coast

- Installed capacity of 1,200 MW
- Exporter to Benin, Burkina Faso, Ghana, Mali and Togo.
  - 600 MW generated by 6 hydroelectric facilities
  - 500 MW gas fired from independent power producers
- Over 60 new power projects
  - 2700 MW gas fired
  - 1000 MW hydropower
  - renewable energy with biogas; waste to energy; photovoltaics; and biomass
- Increased transmission network planned
West- Africa- gas fired power vs solar

- Solar cheaper per unit installed but more expensive per MW
- More direct solution for inland areas than a series of power plants along the coast
- Solar plants $ 5 M per 1000 MW
- Advanced natural gas cycle plants $ 1M per 1000 MW
- With Henry Hub of gas price of $ 3.50 annual bill plus fixed cost= $ 300 mill per year.
- Gas bill needs to be much lower for domestic use in Africa
- Gas power plants better to develop national and regional grid
- Solar power cannot turn these emerging market nations into industrialized economies
- But can be important supplement in rural districts
Aluminium production in West Africa

- Steady supply of electricity needed
- Power interruption may have catastrophic consequences
- Gas resources be long term
- Qatalum consumption of 1000 MW / 1,4 bcm per year for 600 000 tonnes
- Large investments - Qatalum $ 6 bn
- Green field capacity of critical size
- Prevailing business conditions difficult
- Low electricity prices needed long term
- Reopening of Valco against alternative use of power
- Power efficiency of old smelter lower than new technology
- Remelting in new plants as alternative