

TECHNOLOGICAL CHANGE AND SOCIETY INTERDISCIPLINARY



RESEARCH CLUSTER

Visit to the Baker Hughes campus in Florence

19 January 2023

Participants:

- Isaure Marie LANGLOIS D'ESTAINTOT (Researcher, LAW)
- Marco DEL PANTA RIDOLFI (Secretary General)
- Philip HANSPACH (Researcher, ECO)
- Réka HESZTERÉNYI (Trainee, CCU)
- Thomas James KNEEBONE (Research Associate, RSC)
- Eleni NERANTZI (Researcher, LAW)
- Nicolas Laurent Bernard Max PETIT (Cluster leader, Professor, LAW)
- Anca RADU (Researcher, LAW)

- Giovanni SARTOR (Cluster leader, Professor, LAW)

Schedule:

- 9.30 arrival at the Florence Learning Centre and welcome coffee
- 10.00 presentation of the company with a focus on sustainability issues
- 10.45 15 minutes' walk to the industrial site
- 11.00 visit of the industrial site
- 12.15 returning to the Learning Centre
- 12.30 end of the visit

Activity memo by Réka Heszterényi

Presentations

Company overview by Paolo Ruggeri (Vice president of Nuovo Pignone and Institutional Affairs Director)

- Baker Hughes (BH) was created in 2017 by a merger between Baker Hughes and GE Oil & Gas
- As of today, Baker Hughes is an energy technology company, who makes energy safer, cleaner and more efficient for people and the planet.
- It is present in 120 countries with 54 000 employees
- One of the key metrics at Baker Hughes is the so called "HSE perfect day", which means days without accidents or injuries to people or environment. Baker Hughes had in 2021 204 HSE (Health, Safety and Environment) perfect days worldwide.

Oilfield Services&Equipment

The OFSE segment provides products and services for onshore and offshore oilfield operations across the lifecycle of a well, ranging from exploration, appraisal, and development; to production, rejuvenation, and decommissioning. The segment is organized into four product lines: Well Construction, which focuses on drilling and its components (drill bits, drilling fluids, and drilling services); Completions, Intervention, and Measurements, which encompasses well completions, wireline services, and pressure pumping services; Production Solutions, which spans artificial lift

systems and chemicals; and Subsea & Surface Pressure Systems, which facilitates the safe and reliable control and flow of hydrocarbons from the wellhead to production facilities.

Beyond its traditional oilfield concentration, OFSE is expanding its capabilities and technology portfolio to meet the challenges of a net-zero future. These efforts include expanding into new energy areas such as geothermal and CCUS, strengthening its digital architecture and addressing key energy market themes, and never wavering from a longstanding and recognized commitment to safety and execution.

Industrial & Energy Technology

The Industrial & Energy Technology (IET) segment combines a broad array of domain expertise, technologies, and services for industrial and energy customers. Our solutions unlock the ability to transform, transfer, and transport energy efficiently, while capturing and cutting emissions, solving a fundamental challenge behind the energy transition: reducing environmental impact, while maximizing efficiency, productivity, and reliability.

The IET organization consists of four solution platforms which all build on Baker Hughes existing and strong foundation of rotating equipment, electric-power, pumps, valves, gears, sensor, precision instrumentation, and industrial software technologies and services:

- **Gas Technology:** *Solutions that deliver reliable gas at the highest efficiency*

IET is a leader in designing, manufacturing, testing, and installing Gas Technology solutions that serve the entire gas value chain including on/offshore, pipeline, LNG, gas storage and gas distribution.

- **Industrial Technology:** *Improving industry productivity and ensuring reliable quality and safety*

IET provides Industrial Technology solutions that serve a broad array of industries including petrochemical & refining, nuclear, aviation, automotive, mining, cement, metals, pulp and paper, and food & beverage.

- **Climate Technology Solutions:** *Decarbonizing energy and hard to abate industries*

IET's Climate Technology Solutions span carbon capture, utilization and storage, hydrogen, clean power and emissions management capabilities to enable energy operators as well as broader industry, in particular the hard-to-abate sectors to achieve a reliable, net-zero energy system.

- **Industrial Asset Management:** *Optimizing industrial asset performance with simple, flexible, connected hardware and software solutions*

IET's Industrial Asset Management Solutions combine sophisticated hardware technologies with enterprise-class software products and analytics to connect industrial assets, providing customers with the data, safety and security needed to optimize operations reliably and efficiently.

A more than 180-year long history of innovation that started in Florence

1842: Pignone foundry first established in Florence

1911: Start of designing and manufacturing compressors

1954: ENI acquires Pignone, renames it Nuovo Pignone, and brings it into the energy market space

1961: New manufacturing facility in Vibo Valentia and new pump production site in Bari

1994: General Electric (GE) acquires Nuovo Pignone expanding its production capability to gas turbines

2006: Digital and Advanced services iCenter is inaugurated in Florence

2011: LNG mega module construction yard established in Avenza

2013: iCentre expands in Houston and Kuala Lumpur

2017: Baker Hughes, a GE company, is formed upon completion of the merger between GE Oil&Gas and Baker Hughes

2019: New Baker Hughes, an Energy Technology Company is introduced following the GE separation

Baker Hughes in Italy

- Around 5000 employees (producing 4,6% of the GDP in Tuscany)¹ plus 30 000+ working in the supply chain;
- Global centre for excellence in engineering, development and production of turbomachinery, pumps and valves and aftermarket services including digital;
- Manufacturing plants (IT): Talamona, Florence, Avenza, Massa, Cepagatti, Bari, Casavatore, Vibo Valentia.

Key products & Service Portfolio for Baker Hughes developed in Italy

- Drivers and expanders
- Compressors, pumps, and valves
- Integrated solutions for CO₂ reduction
- One-stop-shop auxiliary equipment
- Module solutions

6 technology development trajectories supporting the decarbonisation of industry:

1. Hydrogen
2. Energy storage
3. Efficiency (always the first step), energy recovery, reduction of gaseous emissions
4. Geothermic energy
5. Carbon dioxide capture, utilization and storage and oxyfuel technologies
6. Cutting-edge manufacturing processes (additive manufacturing technologies, robotics, internet of things and Artificial Intelligence)

Focus on sustainability

- Sustainability definition: “meeting the needs of the present without compromising the ability of future generations to meet their own needs.” (UN Commission)
- Environmental, social, and governance (ESG) criteria are a set of standards for a company’s operations to show progress on sustainability priorities
- Baker Hughes is also working on maximising the social benefit based on ESG metrics under the slogan “*We take energy forward*”.

¹ Read more here: <https://www.investintuscany.com/2022/03/09/28-5-million-euros-at-nuovo-pignone/>

Commitment to sustainability

- a) Driving carbon footprint reduction
- b) Health, Safety and Wellness
- c) Committed to Diversity, Equity and Inclusion (BH recognised by Forbes as a female friendly company)
- d) Ethics, Compliance and Transparency
 - + Corporate Responsibility Framework

Benefits of sustainable operations:

- Reduced costs: an effective sustainability strategy can affect operating profits by as much as 60% by minimizing costs of raw materials and water usage via improved waste management;
- Attraction and retention: strong ESG propositions aid in attracting and retaining high-quality talent;
- Increased sales: business and commercial customers want to buy from organizations with clear sustainability policies;
- Access to funds: financial institutions are increasingly concerned with and look more favorably on those with compelling ESG programs;
- Risk mitigation: mitigates risk through training and creation of risk and performance measures, ensuring reliable business operations;
- Improves reputation: improving trust with the public by effectively acting on and communicating company values;
- Continuous improvement: increased transparency through the reporting process highlights important functions within the company that need to be improved;

“All in. Carbon out.”: Carbon Out is a global program aimed at educating and engaging all employees on sustainability practices that will reduce Baker Hughes’ direct and indirect emissions footprint. In particular, BH wants to achieve:

- 50% reduction in Scopes 1 & 2 emissions (what BH can control) by 2030
- NET ZERO in Scopes 1 & 2 emissions by 2050

- Reduction of Scope 3 emissions in progress (emissions generated indirectly across the value chain including upstream activities from suppliers and downstream activities from use of products/services by customers)

We asked: *Was BH involved in lobbying for the energy transition at the EU level?*

Yes. BH is indeed part of several European trade associations, and consider them key to the success of the sector e.g. Hydrogen Europe, “ETN”.²

We asked: *Is it realistic for a company that has invested so much in gas to completely move away from it?*

The energy sector is changing, faster than ever before. The energy trilemma – solving for energy security, sustainability, and affordability – is rebalancing company’s priorities and creating a new path forward for the industry.

Baker Hughes believes that can meet those objectives together with its customers and relevant players in the industry and policy level. As demand for energy increases, the world is demanding more from energy, making it more sustainable, more reliable, more abundant, and more accessible.

We have always been an industry in transition – managing volatility, advancing technology and innovation to power the world’s progress and economic development. The key lies in technology: as an energy technology company, Baker Hughes delivers the highest efficiency solutions and advances the path towards energy decarbonization. Where there’s demand, our company delivers: by anticipating future energy trends, and leveraging our unique product mix, we aspire to make Baker Hughes the provider of choice in the energy industry of the future (e.g. BH supports the NEOM project in Saudi Arabia, which aims at developing a hydrogen-based ammonia plant)³.

Baker Hughes offers also 100% hydrogen turbines and steam turbines for geothermal applications.

Focus on sustainability II

Greenwashing is the process of **providing misleading information** about how a company’s products are **environmentally friendly**.

² More about ETN here: <https://etn.global/>

- **Greenwashing is claiming that a company's products are environmentally friendly without having an evidence.**
- Companies with greenwashing behaviors might wrongly claim that their products are produced with an amount of recycled materials or have efficiency increase.
- The fact that environmental claims might be partly true can exaggerate customer's perception on how company is environmentally friendly.
- *At Baker Hughes, the legal sustainability and energy transition teams have launched a new [greenwashing prevention policy](#) - applicable across the entire Baker Hughes enterprise - to safeguard us from the reputational and legal risks from any misleading or inaccurate sustainability claims made by our employees or teams externally.*

Life Cycle Thinking – we learned that at Baker Hughes the life cycle assessment methodology is adopted.

Whenever analyzing the environmental impact of a product, a way to reduce risk of greenwashing is to **assess overall life cycle impact as per ISO14040** “Environmental management — Life cycle assessment — Principles and framework” and **ISO 14067:2018** “Greenhouse gases — Carbon footprint of products — Requirements and guidelines for quantification”.

We then discussed some examples of LCA, e.g. on gas turbines.

Visit of the industrial site

After the presentations and putting on the safety shoes and glasses, we were offered a tour of the industrial site..

First, we visited the Innovation Lab has three main areas: *sustainability and environment, material and additive manufacturing* laboratory.

We proceeded to the assembling area where the compressors are assembled with the shafts and the impellers applied to them and were introduced to a low-speed balancing rotor. Every technology produced by Baker Hughes is customized on customers' needs.

Next, we visited the impellers bay where electro-discharge technology is used.

At the “Manufacturing Intelligence Centre” we discovered that +6B data is collected yearly from 775 assets to analyse the KPIs and find the long-time top offenders. The data is used for “predictive maintenance” so problems can be identified before machines stop working. There is

also a real life-cycle assessment performed based on energy consumption data and an AI department. The data collection is also important for reaching the net zero goal by 2050.

We inquired whether the energy output was adjusted during the energy crisis and received the reply that Baker Hughes was indeed affected but covered the expenses. They also took this chance to find more opportunities to reduce energy costs.

We arrived at the next area where NovaLT turbines are made. NovaLT™16 turbine can start-up and burn gas blends up to 100% hydrogen. It can also switch from natural gas to blends or 100% hydrogen with no hardware changes.

After the visit, the participants organised a debriefing to sum-up the main take-aways of the visit. Among the benefits, they mentioned that they visit allowed them to understand better the technicalities, connect theory with practice and also offered a networking opportunity.