New Technologies and Product Innovation in Large Enterprises: a Few Insights

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BHGE – Engineering
Summary

• About me
• Baker Hughes, a GE company overview
• The market & the policy
• The Innovation Process
• A couple of different approaches
About Me

• Degree in Mechanical Engineering
• PhD in Energetics
• 15 years in verification Lab
• 3 years working on University collaborations and external technology development
Baker Hughes, a GE company overview
Once Upon a Time....

GE Oil & Gas
~65,000 employees

120 countries

The first and only fullstream company
Fullstream: What does it mean?

From reservoir to refinery. From the depths of the sea to the cloud
Fullstream

Rely on cutting-edge technology, digital solutions, and expert service across every segment

Upstream
- Evaluation
- Drilling
- Completion
- Production & optimization

Midstream
- Pipeline & storage
- LNG

Downstream
- Refinery
- Petrochemical & fertilizer
- Industrial power & processing

Digital
We Imagine the Future.
And always have.
Over 160 years of experience

1842: «Società anonima fonderia del Pignone» starts its activity in Florence

1954: Acquisition from ENI, name changes to «Nuovo Pignone».

1994: Acquisition from GE. $1 Billion orders and over 4500 employees

July 2017: From the merge between GE Oil & Gas and Baker Hughes International a new player emerges: Baker Hughes, a GE Company

Today: Nuovo Pignone, with its 5000+ employees is the global headquarter for the Turbomachinery and Process Solutions business
The market & the policy
3B Growth in global population by 2050

30% Of the growth in global energy demand from 2014-2040 is projected to be met by natural gas

1/4 Of the world’s energy is expected to be provided by oil in 2040...The era of oil is not yet over

30% Increase in energy demand by 2040

2/3 of global energy investment will be in renewables

(Source: IEA)
Policy Maker (EU for example)

-20% by 2020
-40% by 2030
-80/95% by 2050

CO₂ Emission reduction

Renewables
Decarbonization
Smart Grid
New Era in the power market ... renewables and gas dominant

**New Unit PowerGen**

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<th>Av. 2007-16</th>
<th>Av. 2017-26</th>
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<td>Gas</td>
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<th>(GW/yr)</th>
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**Global Indicators**

- **GDP** (Trillion $)
  - 2016: 76
  - 2040: 17
  - GDP growth: +124%

- **Electricity Demand** (1000 x TWh)
  - 2016: 25
  - 2040: 39
  - Electricity demand growth: +60%

- **CO2 Emission** (Gton/yr)
  - 2016: 13
  - 2040: 14
  - CO2 emission growth: +4%

- **New Era for power gen** ... outdated infrastructure, policy changes, decentralized power, digitalization

- **Clean energy transition** ... shift away from coal, gas-fired capacity overtakes coal by 2030, renewables adds @60% in 2026

- **LCOE parity** to be achieved by 2025 in largest economies (U.S, China and India)

- **Economic growth decoupling from energy demand** ... Structural transformation of industry... decrease in global energy intensity

- **Energy efficiency** ... Policies and technologies drive improvements ... EU, MCPD* to drive volume for small plants 1-50 MWt

- **Greenhouse gas emissions** ... power sector 40% of global CO2 emissions ... policies driving CO2 reduction ... dynamics varies across regions

New Era in the power market ... smaller, flexible, decentralized

From Centralized power

To Clean, Local power

- **Power generation** ... BHGE leadership position ... proven gas turbine <20MW and Steam Turbine technology
- **Energy recovery** ... ORC, super critical CO2 to convert heat to power and pressure let down
- **Energy Storage** ... BHGE’s to support the growth of renewable energy ... LSES
- **Low Carbon and heat efficiency** ... CCS with proven Chilled Ammonia Process to capture CO2

**New business models**, ad hoc financials solutions... capex to opex

**PREDIX**  *Digitization*, power integration, increase efficiency and productivity enhancement
The Innovation Process
Open Innovation is a pillar of an existing Innovation Management process.
Innovation @ BHGE
Innovation management is not only R&D and technologies but embrace organizations, processes and products.
Technology Roadmapping

MGTP
An Integrated holistic vision of product and technology development

- Product Strategy
- External Knowledge
- Enabling Technologies
- Project Planning
- Customer Technology session
- Competitive assessment
- Enabling Facilities

Multi Generation Technology Plan – 3 years outlook
A couple of different approaches
FASTWORKS and new ideas incubation

- Discover: More about your customer
- Develop: Faster, simpler ways to get better outcomes for your customers
- Act: Based on what you learn
- Learn: Early from your tests
Discover

Identify opportunity

Problem statement

Value proposition

Business model creation

Develop & Learn

Develop preliminary quick solutions

Early testing to validate assumptions

Kelly's Lemonade Stand: Refreshing Lemonade
Open Innovation

First, it’s a cultural revolution!
Enterprises can and must use «outside» ideas, as much as «inside» ones, and look for internal and external access to markets if they want to advance technologically.
The aim of any product or process development project is to take an idea from concept to reality by converging to a specific product that can meet a market need in an economical, manufacturable form.
Open Innovation - Types

**Outside-in**
Integration of/with external sources of competencies
Model *Want-Find-Get-Manage (WFGM)*

- *(W)* Desired from the Company to achieve growth targets
- *(F)* Look outside of the Company for the desired
- *(G)* Contractual access to the desired
- *(M)* Management of the open innovation relationship

**Inside-out**
Granting external use of ideas and internal innovations

**Revelation** (indirect return)
- Free sharing of skills and/or innovations without direct correspondence of financial returns *(F)* Look outside of the Company for the desired

**Commercialization** (direct return)
- Transfer of skills and/or innovations through sales or licensing
Open Innovation – Interaction models

**Challenge**
 Competition with pre-determined expiration and reward

- (W) Clear requirements
- (G) Pre-defined and non-negotiable contractual terms

**Open submission**
 Continuous acceptance of proposals to be evaluated

- (W) Generic requirements
- (G) Negotiable contractual terms
- (M) Management to be defined based on the agreement

**Scouting**
 Discovery and detection of competencies and innovations

- (F) Direct research
QUESTIONS?