Modernising Energy Efficiency through Digitalisation
Webinar 5: the benefits of digital tools on an existing O&G field

IEA Webinar, 17 March, 2020
Overview

• Introduction
  - Tim Gould, Head Energy Supply Outlook Division, IEA

• Webinar 5: the benefits of digital tools on an existing O&G field
  - Luca Cadei, Deputy Field Manager of a giant onshore oilfield, Eni

• Questions and discussion
IEA Digitalisation & energy efficiency

How digitalisation can support & accelerate energy efficiency implementation:
• More effective policies and programmes
• Across end-use sectors (buildings, industry, transport)
• Supply side efficiency
• Systems efficiency

https://www.iea.org/articles/energy-efficiency-and-digitalisation

Online community

Events
• Workshops
• Webinars

www.linkedin.com/groups/13700212/

Actionable policy guidance
How to ask questions

Attendee Interface

Question box

Questions in English
Decarbonization and Energy Efficiency in Eni Enabled by Digitalization
The Benefits of Deploying Advanced Digital Tools on an Existing O&G Giant Oil Field in Italy

IEA webinar series “Modernising Energy Efficiency through Digitalisation”

Paris – 17 March 2020
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- About Eni
- About the speaker
- Digital transformation at Eni
- Our plant as an example
- How did we achieve our targets for the plant?
- What kind of benefits did we achieve in the specific domain of energy efficiency and plant sustainability?
- Conclusions
About Eni

> 30 000 people

Active in 67 Countries

€ 7.9 bln capex

Innovation in renewables

Exploration and Production

Gas & Power

Decarbonisation: embedded in our strategy

Refining & Marketing and Chemicals
About the speaker

Luca Cadei

Education:
• BSc and MSc Energy in Engineering from Politecnico di Milano

Working experience:
• Process Engineer – ExxonMobil
• Production Engineer – Eni HQ
• Deputy Plant Manager – Eni Upstream
• Program Chairperson – SPE Italian Section

Contact:
• luca.cadei@eni.com
Digital Transformation at Eni

- Energy Transition
- Efficiency
- Safety
Digital Transformation at Eni - Fundamentals

- Data Availability
- Computing Power
- Integrated team
<table>
<thead>
<tr>
<th>Where?</th>
<th>European Southern District</th>
</tr>
</thead>
<tbody>
<tr>
<td>Where?</td>
<td>European Southern District</td>
</tr>
<tr>
<td>Operational since</td>
<td>1996</td>
</tr>
</tbody>
</table>
| Max capacity | **OIL:**
| | $\approx 104$ kbbl/day |
| | **NATURAL GAS:**
| | $\approx 4,4$ M Sm$^3$/day |
| | **WATER:**
| | $\approx 4080$ m$^3$/day |
| What? | **processing oil & gas (acid gas)** |
| OIL sent to Refinery by pipeline | **NATURAL GAS:**
| - power generation at the plant | - sent into the Italian national grid |
| SULPHUR sold to private companies | ($\approx 40$ ton/week) |
| Average plant’s gas daily consumption: | $\approx 380$ kSm$^3$/day |
| Average plant’s electricity daily consumption: | $\approx 690$ MWh |
Giant Oilfield Considered – main features

**Wells**
- 35 active
- 25 producing
- 1 injector

**Network**
- Line 1
- Line 2
- Line 3
- Line 4
- DBN 2

**Gasoline Recovery & Stab. Unit**

**Oil/Gas/Water Separation**
- Line 1
- Line 2
- Line 3
- Line 4

**Gas Sweetening**
- Line 1
- Line 2
- Line 3
- Line 4

**Gas Dehydration**
- Line 1
- Line 2
- Line 3
- Line 4

**AGEU & Sulphur Recovery Unit & CANSOLV**

**Storage**
- Water Treatment
- Refinery

**Internal Consumption**
- Snam Network
- HP Fuel Gas
- LP Fuel Gas

**Turbo-Gas**

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Increase the efficiency and maximize the asset potential

Plant Digital Transformation

IOC

Enhanced Operators

e-Rabbit

e-DOF

Advanced Analytics

e-WP

Smart Safety

Focus IOC and Efficiency
How did we achieve our targets for the plant?
How did we achieve our targets for the plant?
Methodologies Developed – Energy Efficiency

Energy Analysis & Balance

- **V210**: Oil Stabilization
- **V330**: Gas Sweetening
- **V580**: Sulfur recovering
- **V220**: Oil export & storage
- **V360**: Gas Compression

### Energy Analysis & Balance

#### Main Parameters

- **Asset KPI**: *Stationary Combustion CO2 Emission (EI)*
  
  \[
  EI = \frac{\text{Fuel Gas} \times \text{Emission Factor}}{\text{Gross Hydrocarbon Production}} \quad [\text{tCO}_2/\text{kboe}]
  \]

- Detailed KPI were defined for the main equipment

- Raw data, Aggregated stats and hybrid variables
Example of the advanced analytics tool developed

Stationary Combustion CO2 Emission (EI)

Anomaly condition detected, below ranking of most impacting equipment

Eq. #1
Eq. #2
Eq. #3
...
Eq. #n

El target predicted by model

Gradient Boosting Regression algorithm
Example Energy Efficiency Model Output
• e-dea detects an anomaly in energy consumption, foreseeing KPI increase
• drill down into the root causes, indicating the equipment with bad performance (positive variation %)
• Operation team easily checks parameters and trends, knowing in advantage on which unit to look.
• Action to reduce energy consumption are implemented and monitored.
• The tool is also very useful to restore the optimal condition after a variation in the operating conditions
Digitally-enabled benefits on EE and sustainability

Field Macro Results

<table>
<thead>
<tr>
<th>KPI</th>
<th>Digital Solution</th>
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</thead>
<tbody>
<tr>
<td>Emission Reduction CO₂¹</td>
<td>IOC (e-DEA), e-DOF</td>
</tr>
<tr>
<td>Emission Events</td>
<td>IOC (Advanced Analytics, Monitoring), e-DOF</td>
</tr>
<tr>
<td>Emergency Flaring Mass²</td>
<td>IOC (Advanced Analytics, Monitoring), e-DOF</td>
</tr>
<tr>
<td>Unplanned Fac. Down Time</td>
<td>IOC, e-DOF, e-Rabbit</td>
</tr>
</tbody>
</table>

“The mix of production specialists know-how, together with the power and flexibility offered by the new digital tools allows to maximize processes efficiency.

It is now possible to anticipate process upsets, asset integrity issues or deviation from plant optimized parameters.

The user friendly interface, the tools accuracy and the collaborative digital environment created are the key of the results achieved”

- Site Operation team -

It is fundamental to highlight that the **field macro trends** are a results of several factors: operators sensibility improvement, digital tools, reinforcement of operators team, change management.

1 - CO₂ from Stationary combustion – net of plant SD on 2016-2017
2 - Flaring Events > 5000kg/h
Conclusions

- The brown oilfield considered has been a real «lighthouse»
- State-of-the-art software tools tailored locally by a diverse cross-functional team
- Benefits from digitalization are projected towards local communities and the environment
- Digitalization methods will improve as number of “lighthouses” increases
- The Digitalization and Digital transformation is still evolving on site and through the local community
- After more than 1 year of experience the transformation is tangible and is still based on the collaboration between operators, engineers, ICT a data scientists
Q&A session