Upstream plant electrification in O&G business

Eni SpA, Italy
Domenico D'Acierno, Eni SpA
Marco Ferrari, Eni SpA

11-May-2021

Company's activity:

Eni is a integrated energy company whose dedication to the energy transition translates into tangible actions aimed at achieving the total decarbonization of products and processes by 2050.
The object of the project are the processes / services of the production site located in Fano plant. The plant came into operation in 1985, for the treatment of natural gas from the offshore production of various platforms in the central-northern Adriatic sea.

Key customer segments and value propositions:

Being an energy company, the reduction of GHG emissions and the safeguard of the environment are part of company's value proposition, as well as the safeguard of health and safety.
Ensuring the operational continuity was highlighted as part of the value proposition.

Gas compressor station in Fano

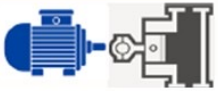
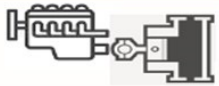
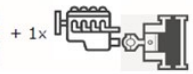
Situational analysis

- GTs run @ very low load-factor
- GTs low performance (≈50% Vs design)
- Site under ETS
- Centrifugal compressors oversized

Project description

- GTC trains revamping in order to improve the energy performance of gas compressor system.
- Reduced gas consumption and increase gas volume sold.
- Reduced GHG emissions
- Reduced O&M complexity and costs

O&G Upstream plant – Gas compressor station in Italy

Fano Revamping Scenarios		
Scenario A	2x 	Replacement of gas turbines of the compressor unit with electric motors
Scenario B	2x 	Replacement of gas turbines of the compressor unit with electric motors and re-bundle of centrifugal compressors to avoid recirculation
Scenario C	2x 	Replacement of gas turbines of the compressor unit with electric motors and centrifugal compressors with alternative compressors
Scenario D	2x 	Installation of endothermic motors coupled to new alternative compressors
Scenario E	1x  + 1x 	Installation of internal combustion motors coupled to a new alternative compressor to replace a single line (postponed investment)

Fano Gas Plant (DICS) was selected for the development of M-Benefits pilot project due to the following reasons:

1. **The plant was subjected to Energy Assessment in 2019. The Energy Audit highlighted the opportunity of site electrification;**
2. **The site engineering department had already evaluated several options to revamp the plant. All these intervention options, however, did not appear to have sufficiently attractive economics for approval.**

Value-Cost-Risk Analysis

The different scenarios have mostly similar benefits and risks, but vary in intensity. A comprehensive, qualitative analysis of the value proposition of the interventions and their impact on costs and risks is reported below.

Production Reliability
GHG Emissions reduction
Contribution to Company's Vision and Strategy (*)

Electricity price risk
Risk of electricity supply interruption
Reduced risk of accidents and occupational disease (*)

Maintenance cost reduction
AIA associated costs reduction
CO_2 cost reduction (ETS)

** NEB not quantified and economically valorized*

Quantified and valorized Multiple benefits

NEBs	KPIs identified	Economic Impact
Maintenance Costs reduction	Maintenance Cost/year	Reduction up to 3.000 k€/year
Higher production reliability, fewer downtimes	Lost production days due to scheduled maintenance downtime/year	Reduction up to 2.600 k€/year
GHG Emissions reduction	CO2 Emitted cost/year (ETS Scheme)	Reduction up to 1.975 k€/year
AIA (Autorizzazione Integrata Ambientale) no more required	Monitoring cost/year	Reduction up to 82 k€/year
Project eligible for White Certificates	Energy savings (toe)/year	Up to 6.400 k€ /year for the first 5 years

Non-Energy Benefits (NEBs) - Not quantified

Some NEBs have been validated on qualitative basis only, currently none Key Performance Indicator allows to quantify several multiple benefits that could be included in the business plan.

Non-Energy Losses (NELs)

Potential risks	Risk analysis
Increase puchase of electricity from the national grid	Acceptable
Potential electrical disconnection from the national grid	Acceptable

Financial analysis-Scenario A

Energy-Only Benefits	
Net present value (NPV; discount rate 6%)	9'000 k€
Internal rate of return (IRR)	6%
Simple payback	11 years

All Benefits	
Net present value (NPV; discount rate 6%)	23'000 k€
Internal rate of return (IRR)	15%
Simple payback	6 years

Discount rate: 6.4 %

Investment duration: 20 years (i.e. the number of years taken into account to compute NPV and IRR)

Financial analysis-Scenario C

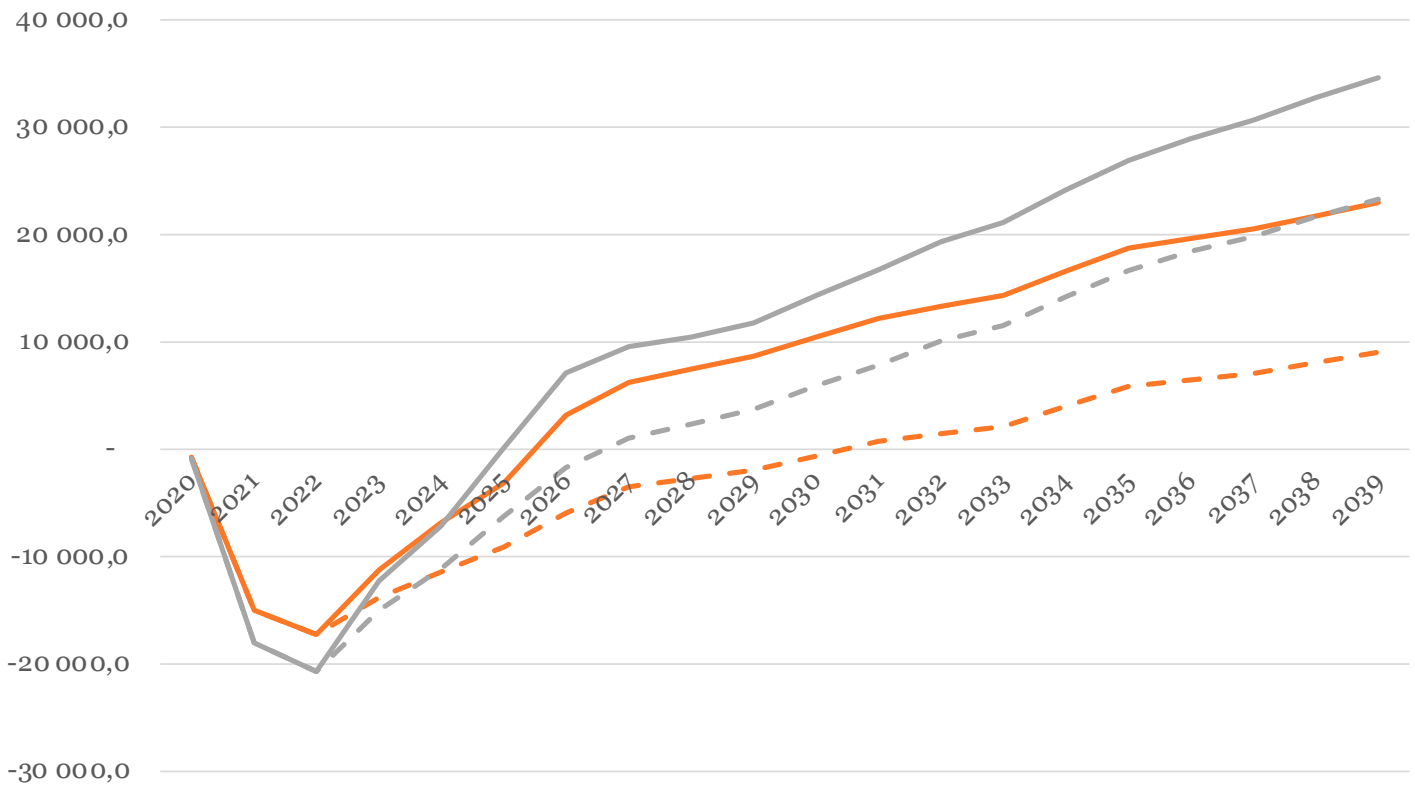
Energy-Only Benefits	
Net present value (NPV; discount rate 6%)	23’700 k€
Internal rate of return (IRR)	12%
Simple payback	7 years

All Benefits	
Net present value (NPV; discount rate 6%)	34’600 k€
Internal rate of return (IRR)	18%
Simple payback	5 years

Discount rate: 6.4 %

Investment duration: 20 years (i.e. the number of years taken into account to compute NPV and IRR)

Comparison between conventional economic analysis and M-Benefits approach (with NEBs)



Replacement of Gas Turbines with Electric Motors

SCENARIO A	Standard	With NEBs
NPV (k€)	9'000	23'000
IRR	6	15
PBT (years)	11	6

Replacement of Centrifugal Compressors driven by GTs with Reciprocating Compressors coupled to Electric Motors

SCENARIO C	Standard	With NEBs
NPV (k€)	23'700	34'600
IRR	12	18
PBT (years)	7	5

Energy analysis

Pre-project

Energy consumption:

Energy carriers impacted by the project:

Electricity, natural gas

Consumption:

Electricity: 0 kWh/y

Natural gas: ≈ 212 GWh/y (current value, increasing in the coming years)

Post-installation

Energy consumption after site plant electrification (Scenario A)

Estimated primary energy savings:

≈ 172 GWh/y (*)

Estimated financial savings:

≈ 1'700 k€/year (*)

* Average value, Energy and financial savings are not constant over the years.

Conclusions & Feedback

- **Highlight of operational aspects** that are not considered by the tools/procedures normally used for projects economic analysis;
- **Support on energy efficiency projects** that often, using traditional methodology, do not produce sufficient economic indicators for their approval;
- **Involvement of top management** that allows for the creation of a **value proposition**;
- Involvement of **specialists from multiple disciplines** allows for a broader view of the project (interdisciplinary);
- **Diffusion of Know-how related to energy efficiency** and increase in the company's sensitivity/interest in sustainability issues (**commitment**);
- Difficulties in **economically valorize some benefits**, in particular NEBs related to HSE aspects and Corporate Strategy;

Contact

Marco Ferrari – Eni SpA
Ph. +39 0252063120
Mail: marco.ferrari1@eni.com

Domenico D'Acierno– Eni SpA
Ph. +39 0252045809
Mail: domenico.d'acierno@eni.com

Implementing partner:
Livio de Chicchis, FIRE (dechicchis@fire-italia.org)

www.mbenefits.eu