Resources Policy 81 (2023) 103305

Contents lists available at ScienceDirect

Resources Policy

journal homepage: www.elsevier.com/locate/resourpol

Building Options for the Brazilian Pre-salt: A technical-economic and infrastructure analysis of offshore integration between energy generation and natural gas exploration

Vinícius Oliveira da Silva [a], Stefania Gomes Relva [e,*], Marcella Mondragon [b], André Bergsten Mendes [c], Kazuo Nishimoto [c], Drielli Peyerl [b,d]

[a] Energy Group of the Department of Energy and Electrical Automation Engineering of the Polytechnic School, University of São Paulo, Av. Professor Luciano Gualberto, Travessa 3, n° 158, Prédio da Engenharia Elétrica, São Paulo, Brazil
[b] Institute of Energy and Environment, University of São Paulo, Av. Professor Luciano Gualberto, n° 1289, São Paulo, Brazil
[c] Department of Naval Architecture and Ocean Engineering of the Polytechnic School, University of São Paulo, Av. Prof. Mello Moraes, n° 2231, São Paulo, Brazil
[d] University of Amsterdam, Science Park 904, Amsterdam, the Netherlands
[e] Polytechnic School, University of São Paulo, Av. Professor Luciano Gualberto, Travessa do Politécnico – n° 380, São Paulo, Brazil

ARTICLE INFO

Keywords:
Natural gas transportation
Offshore power generation
Offshore natural resources exploration
Gas-to-Wire
Brazilian pre-salt
Energy integration

ABSTRACT

The objective of this work is to evaluate the technical-economic and infrastructure aspects for the Brazilian Pre-salt natural gas use. Factors like technology maturity level, fuel and facilities costs, and electricity market are analyzed; the levelized cost of energy (LCOE) of two possibilities are calculated: (i) offshore Gas-to-Wire (GtW) and (ii) molecular natural gas outflow through the pipeline with onshore thermoelectric generation. This work also discusses the possibility of natural gas (NG) transport via liquefaction, considering the Floating Liquefied NG (FLNG) technology for national and international market. The LCOE of GtW technology is higher (67–87 US $/MWh) than onshore plants (43–69 US$/MWh) for Pre-salt area, higher than the historical energy price of Brazilian NG thermoelectric generation (44 US$/MWh), but, in general, lower than Brazilian NG energy auction price cap (84.5 US$/MWh) and lower than some values found in the literature for onshore plants (42–124 US $/MWh) abroad Brazil. FLNG technology is still new, there is no scale, few players use it, and it does not seem to be a feasible option for Pre-salt NG now. It is concluded that elements such as political uncertainties of the international natural gas market, the high CO_2 rate in the Pre-salt's natural gas mixture, and the difficulties in implement deep-sea infrastructure are challenging elements for the three possibilities analyzed. The Brazilian market discussion is relevant since it is a greenfield natural gas area in need of development. Thus, it is of upmost importance to implement a comprehensive energy policy to address offshore-onshore energy integration regulation and technological developments for the offshore transmission systems, and CO_2 content separation process.