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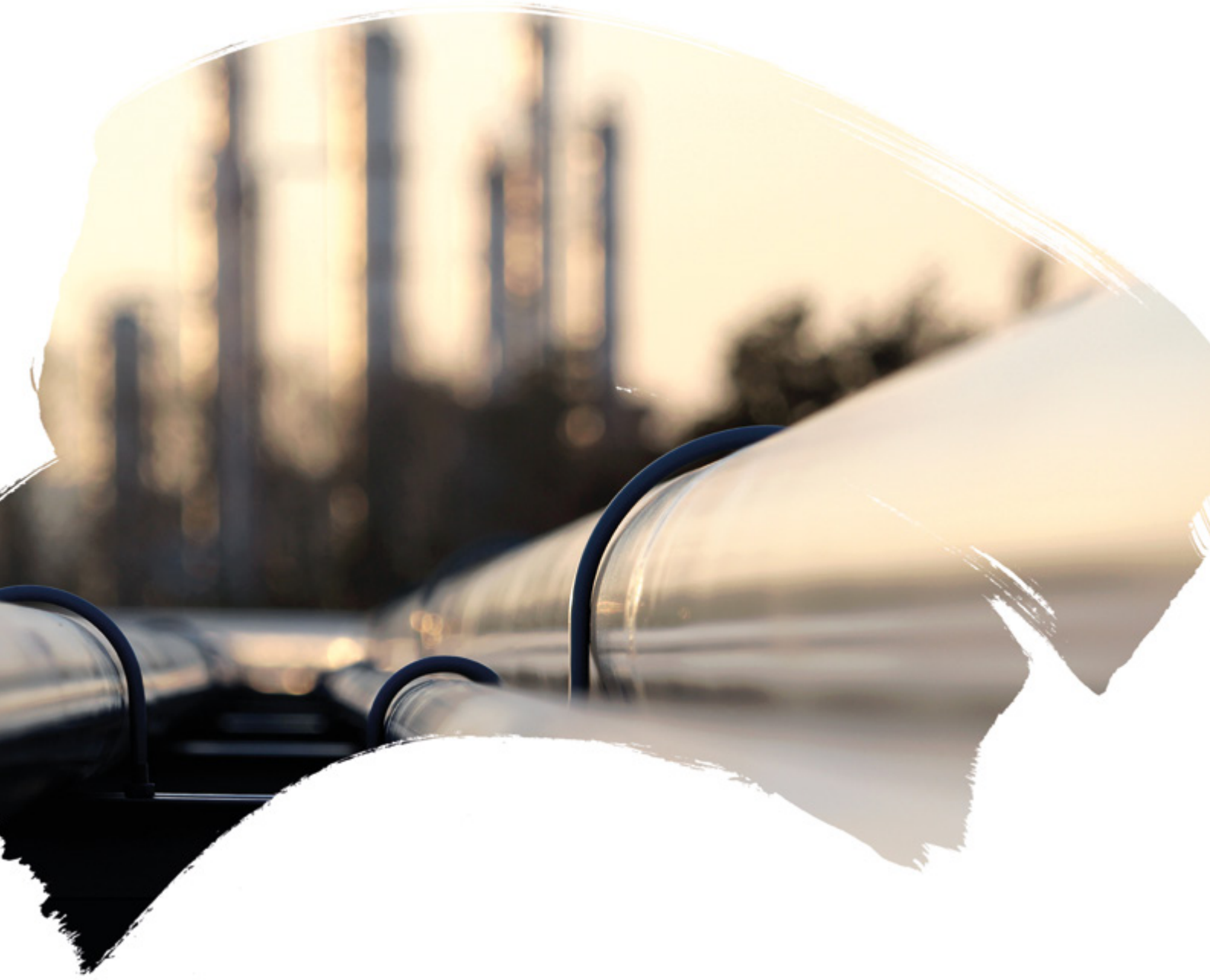
IS GREEN IN THE PIPELINE?

Sensing gas' potential contribution to climate change mitigation



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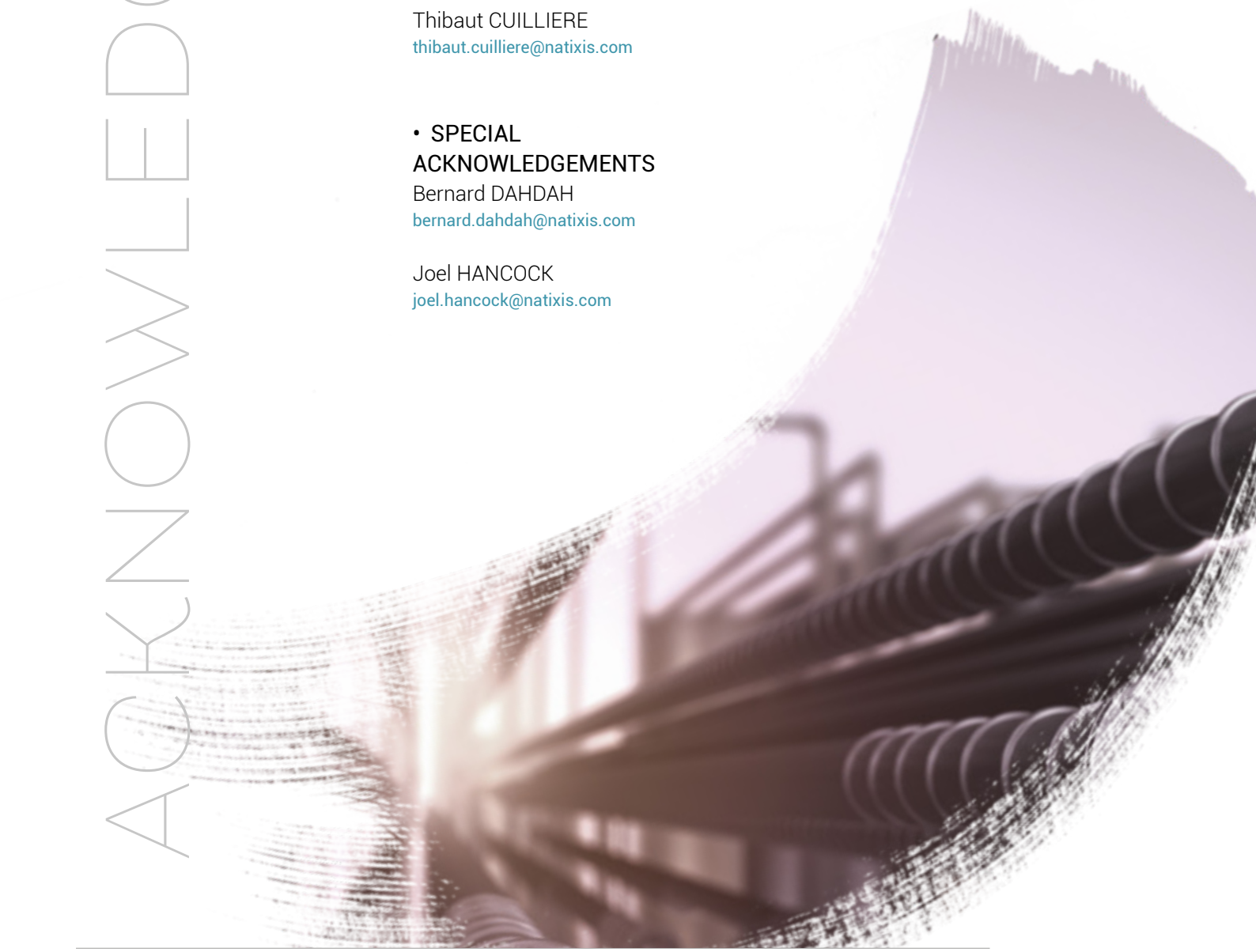

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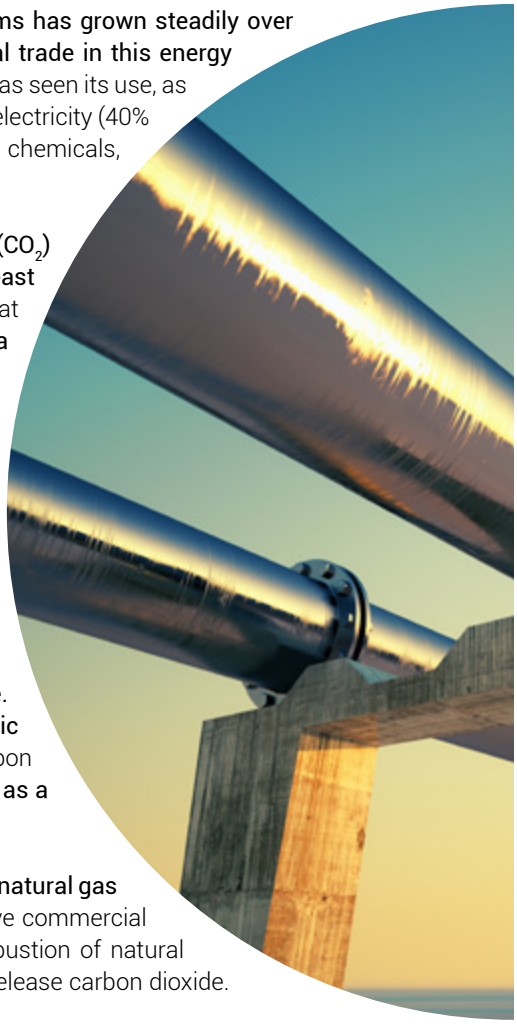
SENSING GAS' POTENTIAL CONTRIBUTION TO CLIMATE CHANGE MITIGATION

EXECUTIVE SUMMARY



The place of natural gas in contemporary energy and economic systems has grown steadily over the past four decades, in parallel with the development of international trade in this energy commodity. Long considered an unwanted by-product of oil, natural gas has seen its use, as a fuel and/or feedstock, extend to activities as varied as the generation of electricity (40% of current use) and heat, the production of steel, cement, hydrogen and chemicals, being used also in transportation, and so on.

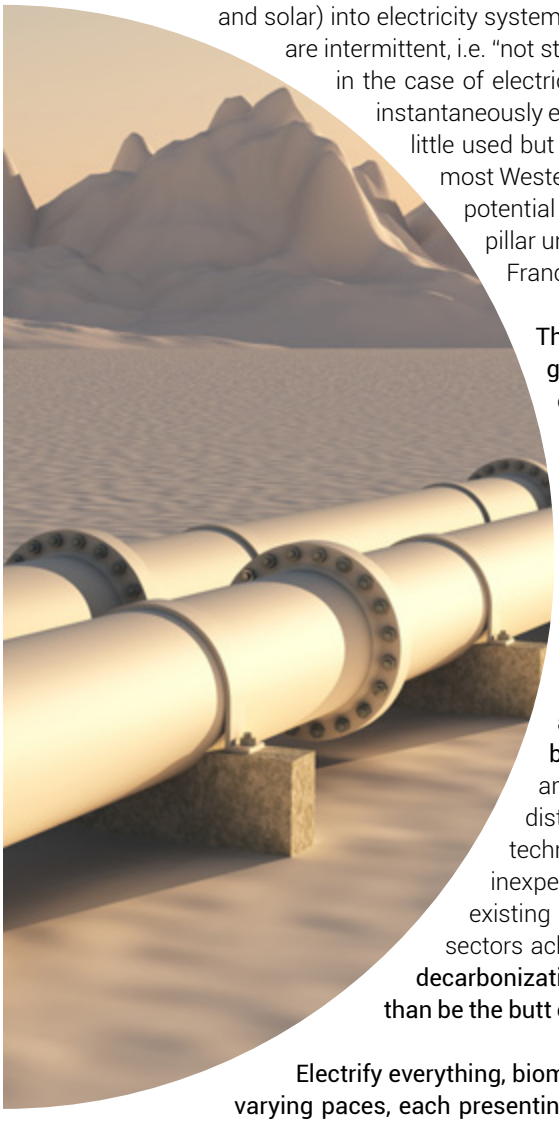
The combustion of natural gas emitting 30% less carbon dioxide (CO_2) than oil and 45% less than coal, this fossil fuel is presented as the least harmful of fossil fuels. Furthermore, in a context where initiatives to combat climate change are being ramped up, **natural gas is often promoted as a "transition fuel"**. With this in mind, increased recourse to natural gas to the detriment of oil and coal would constitute a first phase in the process leading to the achievement of carbon neutrality by 2050, an absolutely necessary condition for achieving the objectives of the Paris Climate Agreement signed in 2015 (in particular keeping the increase in global average temperature to well below 2 °Celsius above pre-industrial levels in this century).

Touting natural gas as a "transition fuel" is, however, controversial. The concept of "energy transition" is as much about the point of arrival – i.e. achieving carbon neutrality by 2050 – as the specific pathway – i.e. a specific process for decarbonizing contemporary energy and economic systems, the first phase in this process being an exit from the most carbon intensive fossil fuels, namely oil and coal. **Any analysis of the role of gas as a "transition fuel" must therefore embrace these two dimensions**.

If we look at the angle of the transition' desired point of arrival, the role of natural gas can only be very limited. In the absence of clear timeline for an extensive commercial rollout of carbon capture and storage (CCS) systems, though the combustion of natural gas emits less carbon dioxide than oil and coal, this fossil fuel does still release carbon dioxide.

Furthermore, an analysis of its life cycle reveals there are undesired climate externalities along the value chain (mainly taking the form of fugitive methane emissions during the Upstream and Midstream operations), compounded by what are still widespread practices in the industry (flaring and venting when associated with oil at the time of extraction), meaning that natural gas can have a bigger climate footprint than oil and even coal, in rarer instances though for the latter. From this standpoint, **its use therefore depletes the planet's carbon budget**, being the absolute amount of carbon dioxide emissions that can be emitted while still having a likely chance of limiting global temperature rise to 2 °Celsius above pre-industrial levels.

When one now considers the transition process under way to decarbonize the global economy, gas plays a more concrete role, though this is still dependent on specific local contexts and should be considered in a limited time window. Recent experiences in the United States and Saudi Arabia show that substituting natural gas for coal or oil in electricity generation has improved carbon intensity in the sector, but without really setting in motion an energy transition strategy / policy aimed at reducing the dependence of these economies on fossil fuels. In the case of **Saudi Arabia, the increased role of natural gas in the domestic energy system can even be seen as having optimized oil's situation rent.** In this country, the replacement of old, oil-fired plants by state-of-the-art combined cycle gas turbines (CCGTs) can indeed be seen as having allowed a more economically efficient use of natural resources since less fuel is eventually burned to generate electricity and eventually more hydrocarbons are available for export. **By contrast, in Western Europe, where energy transition initiatives and policies are far more advanced, natural gas is playing an important role in the decarbonization of existing systems**. Directly, through the flexibility provided by CCGTs, natural gas is contributing to the efficient integration of renewable energies (wind and solar) into electricity systems, such integration proving all the more challenging as these sources are intermittent, i.e. "not steerable" and continue to enjoy fast-paced expansion. Even better, still in the case of electricity generation, natural gas offers a means to just about totally and instantaneously exit coal. As shown recently by Spain, with the simple presence of often little used but fully operational CCGTs, gas can be substituted overnight for coal in most Western European electricity systems, without any incidence on supply. The potential offered by gas needs to be underlined inasmuch as it is an implied pillar underpinning the coal exit policies now being implemented in Germany, France, Italy as well as the United Kingdom.



The growing interest in low-carbon gases (mainly biomethane and green hydrogen produced by green electricity-powered electrolysers) offers new prospects for the gas sector. Stemming from the observation that **without tangible progress in CCS, natural gas is not compatible with a low-carbon economy given its release of CO_2 upon combustion, this interest also highlights the potential use of existing gas infrastructures to initiate a new phase of decarbonization of contemporary energy and economic systems**, supporting or complementing the "electrify everything" approach which is today favored to achieve carbon neutrality by 2050. Still nascent, **biomethane and even more so green hydrogen make it possible to envisage in the long term, through end uses as a fuel and/or feedstock, a decarbonization of the economy that goes far beyond the current energy uses of natural gas** in electricity generation and heating. With this in mind, existing natural gas transmission, distribution and storage infrastructures will play a pivotal role. By their technical and economic characteristics, they offer safe and, at this stage, inexpensive levers for (i) injecting biomethane and green hydrogen into existing systems; but also (ii) for achieving scale effects needed to help both sectors achieve commercial viability. **This role of "integrator" in advancing the decarbonization of the economy allows gas infrastructures to accompany rather than be the butt of these potentially disruptive evolutions in existing energy systems.**

Electrify everything, biomethane, green hydrogen… These options/industries are emerging at varying paces, each presenting specific advantages as well as constraints. Their multiplicity and their potentially conflicting character suggest that **no pathway has yet been defined for achieving carbon neutrality by 2050**. The long-term prospects offered by these options must not detract from the climate emergency: **to avoid further depleting the planet's carbon budget and jeopardizing even more any chance of achieving the objectives**

of the Paris Climate Agreement, the focus right now must be on those carbon emissions that are the most substantial and can be cut most easily. Despite recent changes in Western Europe and North America, the electricity sector still relies massively on those fossil fuels with the biggest carbon emissions, i.e. coal and oil. At world level, these fossil fuels still accounted for 36% and 3% of electricity generation, respectively, in 2019.

All in all, the potential contribution made by natural gas and associated infrastructures to energy transition needs to be considered in **an evolutionary manner**, taking into account the technological developments likely to offer the world economy a clear and optimized decarbonization pathway, while limiting the sources of stranded costs in the various sectors most exposed to possible technological disruptions. **These elements suggest that temporality and contextualization should be taken into account, but also specific requirements for industry players to objectify the positive contribution of gas to energy transition.** This leads to the following conclusions:

(i) Out to 2030, natural gas has a key role to play in exiting coal and oil in electricity generation, mainly in geographical areas (Europe, North America, Japan and, to a lesser extent, China and India) where the existing asset base is sufficiently diversified to allow trade-offs between fuels (i.e. using existing natural gas assets to displace coal and oil assets whenever possible). However, for the positive effect of this coal and oil exit to be objectively measurable, **it is important for the gas industry as a whole (Upstream and Midstream) to assert its ambition to reduce the climate externalities of the natural gas life cycle**, through shared objectives and specific action plans to curb sources of carbon and methane emissions along the value chain.

(ii) Past this horizon, assuming that CCS has still not shown any sign of attaining commercial maturity by 2025, developing the existing asset base in its current configuration (Upstream, Midstream, CCGTs) would have no environmental justification and would in fact perpetuate the carbon lock-in of economic systems.

(iii) In parallel, and probably until 2040-2050, gas infrastructures would play a crucial role in helping the biomethane and green hydrogen industries to attain maturity, without prejudging, to begin with, which of these would impose itself as the decarbonization agent of choice. By playing this role, gas infrastructures can promote the emergence of relatively disruptive technologies while limiting the stranded costs for asset owners as well as the final cost of the various transition initiatives/ policies eventually borne by the consumer.

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