



Overview of LNGnet Technical Assistance Projects – monetisation of flare gas

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Overview of session

- **Introduction:** What is gas flaring, why does it happen, and how much gas is flared?
- **Case study:** overview of Technical Assistance project on commercialisation strategies for flare gas in Nigeria
- **Ongoing work:** Second phase of Nigerian work, SE Asia

Associated petroleum gas (APG) is extracted alongside oil as a secondary product. It is often flared, not processed



Presence of gas increases pressure in the pipeline system



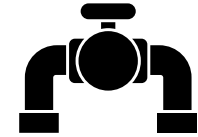
The gas is disposed of as it would be unsafe not to do so



The gas content is usually a small fraction of the reservoir



APG often contains chemical impurities which impair its quality



Gas processing and transportation infrastructure is expensive

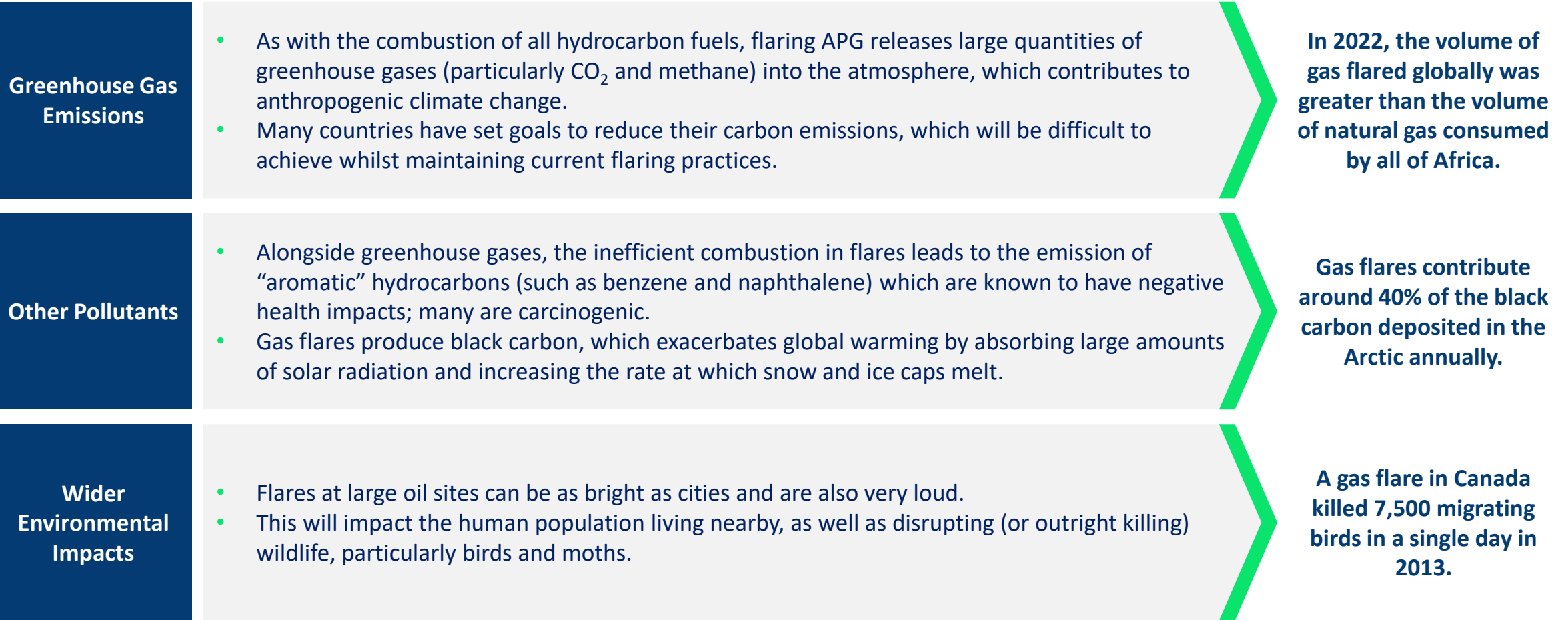


The gas is disposed of as it would be economically unviable to process it

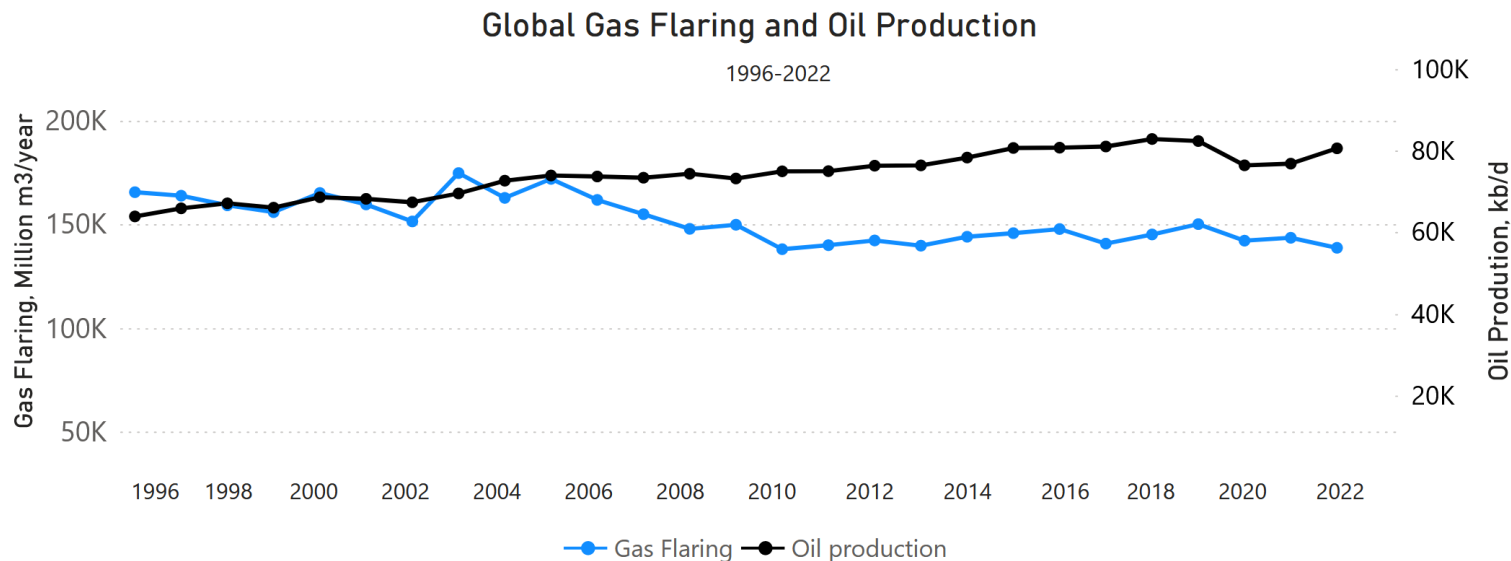


APG is disposed of through flaring

Flaring APG has adverse environmental effects



Global Progress in reducing flaring has stalled since 2010, though flaring intensity has reduced

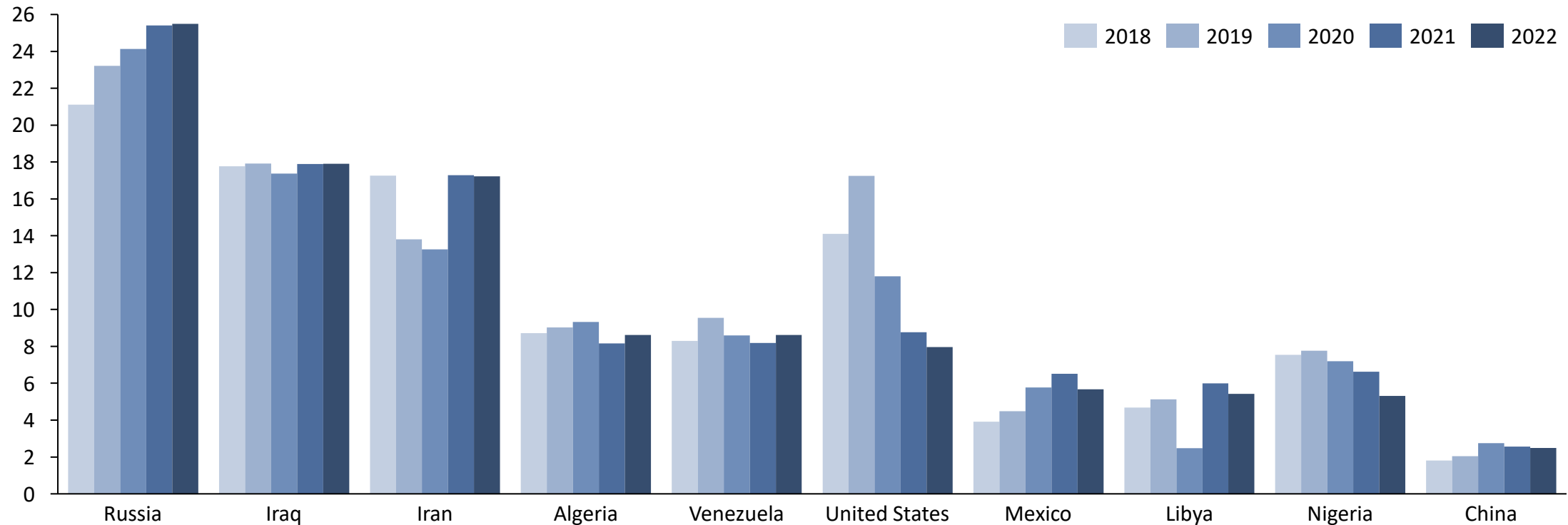


- Oil production has increased since 2010, so even a stagnation in absolute gas flaring volume represents a decrease in flaring intensity
- International initiatives provide additional incentive to reduce gas flaring on top of targets set by individual governments- for example:
 - In 2015, World Bank launched the Zero Routine Flaring Initiative, endorsers of which account for c.60% of global flaring
 - EU regulation agreed in late 2023 outright bans routine flaring, and restricts non-routine venting and flaring to unavoidable circumstances

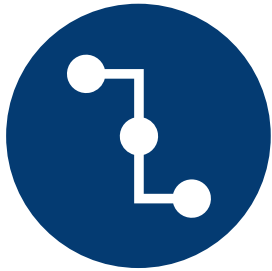
Reproduced from World Bank - <https://www.worldbank.org/en/programs/gasflaringreduction/global-flaring-data>

Russia, Iraq and Iran are the three nations with the highest reported volumes of flared gas.

Top 10 nations by volume of gas flared, 2018-2022 (Bm³)



Gas which would otherwise be flared can be utilised and monetised, given sufficient support.



Network supply

Incorporating the APG into the national natural gas supply network

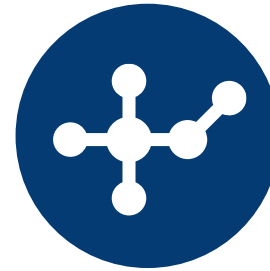
Connecting to an existing gas network saves on infrastructure construction costs and allows local consumers to make use of the gas.



Fuel production

Utilising the APG by turning it into fuels such as LNG, CNG or LPG

These fuels have a range of uses and emerging commercial markets, and can be used for upstream production.



Industrial chemicals production

Using APG as a feedstock for the production of industrial chemicals (e.g., ammonia, methanol)

This supports local industry, and the chemical by-products can have a range of useful social impacts (e.g., fertiliser, biofuels).



Power generation

Burning the APG, but using the energy released to generate electricity

The generated power can be used on-site to support and reduce the costs of oil extraction, or fed into the national grid.

LNGnet provided Technical Assistance to clients to assess flare gas commercialisation strategies

LNGnet Technical Assistance Contribution

- Funded by the European Union to promote liquid, flexible, transparent and sustainable global LNG trade.
- LNGnet has a mandate to provide technical assistance to support this goal, so partnered with local stakeholders to explore flare gas commercialisation options.

Typical Scope of Projects

- Considered routine gas flaring commercialisation options in the context of the EU objective to support developments in line with the Paris 1.5 °C global temperature increase limit.
- Commercialisation options included: growing LNG capacity, growing CNG capacity, growing LPG capacity, and growing industrial capacity (power, ammonia, and methanol).

Conceptual Studies

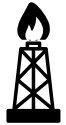
- These were time-limited conceptual studies which aimed to provide an overview of potential commercialisation options and their application to the flare sites.
- Further work would be needed before project development roadmaps could be defined and initiated.

A range of commercialization options were considered

Technology	Requirements to make the value chain feasible	Key Takeaway
LNG	Construction of large-scale infrastructure to reach the NLNG plant in Bonny Island or construction of a greenfield LNG facility closer to the flare sites	Made challenging by the high capital investment and complexity of large LNG plants; modular design could however overcome some of these issues
FLNG	Large volumes of flared gas offshore with no realistic monetisation options that rely on transportation to the shore	Potentially the most suitable way to monetise large volumes of offshore flare gas that cannot otherwise be addressed; likely only an option in specific circumstances
Ammonia	Large volumes of flared gas and significant capital investment in the construction of a greenfield ammonia plant	Good option for larger assets that generates higher economic and social benefits than direct oil and gas exports
Methanol	Large volumes of flared gas and significant capital investment in the construction of a greenfield methanol plant or the development of pipeline infrastructure to the upcoming methanol plant in Brass Island	Good option for larger assets that generates higher economic and social benefits than direct oil and gas exports
Power	Development of new natural gas power plants along with downstream transmission infrastructure underpinned by sufficient creditworthiness of buyers	Large-scale power generation assets could generate material benefits to the local population, but investment is more challenging than export routes
Small-scale LNG	Sites with small flare volumes that cannot be easily be collected into a volume sufficient to justify other development concepts; an anchor customer is the most effective route to incentivise development of the value chain	Allows the commercialisation of volumes from small isolated sites and the value chain is highly flexible and easily scalable; requires access to small-scale liquefaction technology
CNG	Sites with small flare volumes that cannot easily be collected into a volume sufficient to justify other development concepts and sufficient potential demand (mostly in transport) to absorb the volumes of gas produced	Allows the commercialisation of volumes from small isolated sites and the value chain is highly flexible and easily scalable; sufficient demand is only likely close to larger population centres
LPG	Development of distribution infrastructure in many parts of the country and willingness from households to invest in hardware such as cooking stoves and cylinders	Allows the commercialisation of volumes from small isolated sites and the value chain is highly flexible and easily scalable; feasibility depends on quality of flared gas

The Nigeria study identified replicable commercialisation options for large and small flare volume sites

Optimal commercialisation strategy is related to site characteristics



High flare volume sites

Concept 1 – Large industrial development

- Sites with significant volumes of gas flared (>20 MMscf/d) can be used to develop **large downstream assets such as ammonia and methanol plants**
- Three potential variations of this concept can be considered
 - A. Merchant plant developed and operated by client
 - B. Tolling plant developed and operated by client
 - C. Client plays role of aggregator



Low flare volume sites

Concept 2 – Small-scale LNG distribution

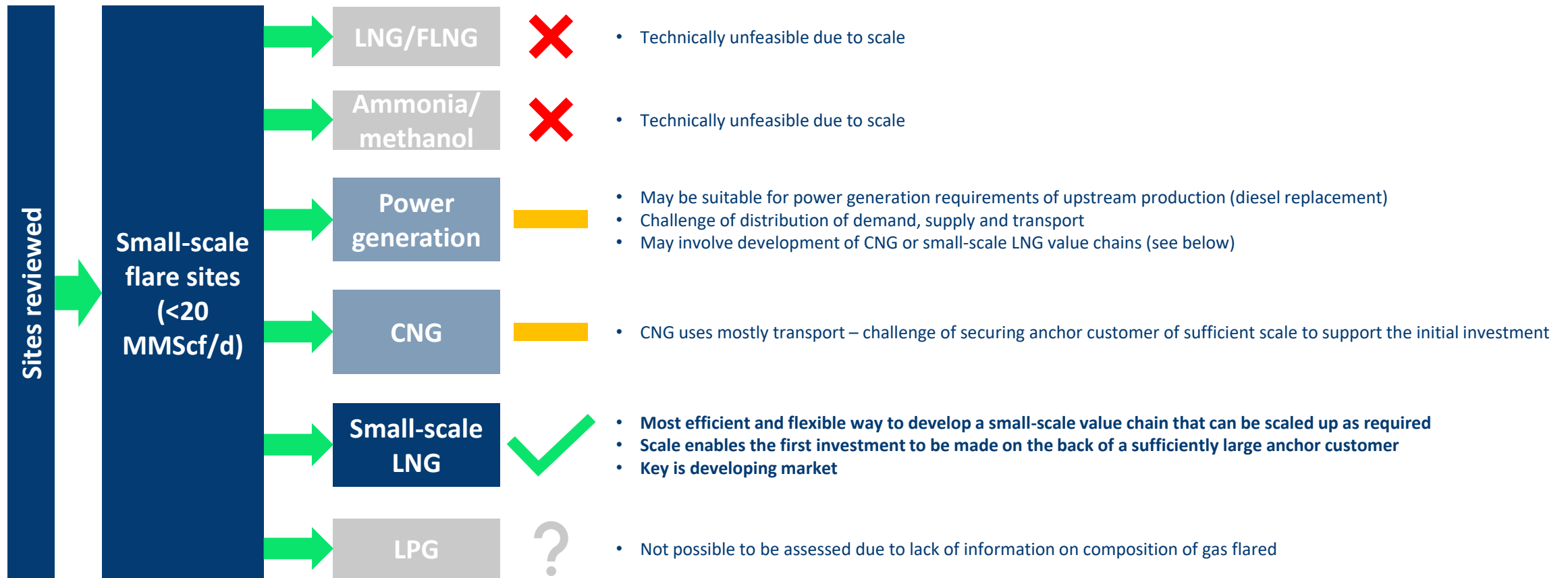
- Isolated sites with small volumes of gas flared (<20 MMscf/d) are best suited for **on-site liquefaction and transportation via trucks**
- Two potential variations of this concept can be considered
 - A. Client develops small scale LNG distribution business
 - B. Purchase of small-scale LNG supply

Ammonia or methanol production emerged as the commercialisation concept most suited to large-scale flare sites.



NOTE: This assessment pertains only to the development of greenfield facilities as information on the ability to access nearby power plants, petrochemical assets and transportation infrastructure was not available during the development of this concept paper. If possible, the utilisation of existing assets is likely to take priority.

Small scale LNG production emerged as the commercialisation concept most suited to small-scale flare sites.



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Overview of ongoing projects

We are currently conducting a follow up project in Nigeria and have just started another in SE Asia

Category	Key Activities	1	2	3	4	5	6	7	8	9	10	11	12
1. Framing	<ul style="list-style-type: none"> • Identification of limited set of currently flared gas volumes to be monetised • Identification of monetisation routes identified in concept study to be further evaluated in this project • Discussion of strategic objectives 	1. Framing											
2. Discover	<ul style="list-style-type: none"> • Refining flare site, infrastructure, local market data • Develop understanding of Client's strategic priorities, appetite for investment; understanding of the challenges • Short-list of monetisation routes to be assessed in further detail 			2. Discover									
3. Assessment	<ul style="list-style-type: none"> • Economic assessment of each monetisation route • Assessment of risks / mitigations for each monetisation route • Describe potential partnerships • Identification of business model variants 							3. Assessment					
4. Roadmap to Development	<ul style="list-style-type: none"> • Timeline for development of each monetisation route • Key milestones and commitments required from stakeholders • Description of route to financing for each monetisation route • Route to engagement with potential partners 								4. Roadmap to Development				



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