Climate Action Tracker

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Natural Gas in India

A pathway towards reducing India's dependency on gas

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Summary

Gas is a fossil fuel and not a viable 'bridge' for the energy transition. Yet, we continue to see expansion and investments in fossil gas around the world.

The Indian government has recently announced that it plans to increase its share of gas consumption, and transform the nation into a "gas-based economy". It has set a target to increase the share of gas in its energy mix from 6% in 2021 to 15% by 2030.

With the planned increase in gas consumption, India will likely need to significantly increase gas imports, as domestic production has remained stagnant, and invest in capital-intensive gas infrastructure. This exposes India to risks such as a carbon lock-in, stranded assets, and energy insecurity.

In this report, we have analysed India's potential savings on gas imports and an improved trade balance in a 1.5°C compatible low gas scenario. Our analysis shows that if India aligns with a 1.5°C compatible pathway, it would lead to gas import savings of USD 9–24 billion in 2030 under various price and import assumptions. This would result in average annual import savings of USD 5–12 billion between 2021–2030 under various import assumptions.

Modelled domestic mitigation pathways for India derived from global 1.5°C compatible pathways show significantly lower gas development across end use sectors (industry, transport, buildings), supported by rapid electrification of end use sectors, with a shift to renewables in the power sector.

To meet its growing energy demand, India could scale up its efforts to build its renewable energy capacity, rather than relying on fossil gas. A shift to renewables comes with other benefits, beyond climate protection, such as job creation and energy independence for the country. This could be achieved by redirecting funds meant for gas infrastructure to increasing electrification and developing new technologies, like green hydrogen and battery storage. International climate finance will be needed to support India's economic transformation.

Ambitious renewable capacity provides an opportunity to increase the rate of electrification to meet energy requirements in end-use sectors (industry, buildings and transport). The use of green hydrogen for non-energy purposes is another opportunity, especially given the Indian government is already developing policies to increase the use of green hydrogen in the industry sector.

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1 Introduction

Meeting the Paris Agreement's 1.5˚C goal requires the decarbonisation of the global energy system. This means immediately peaking emissions and reducing them by about half by 2030.

Gas is a fossil fuel and not a viable 'bridge' for this energy transition. In Paris Agreement compatible pathways, unabated coal and gas in primary energy peaks by 2020 and then starts a rapid decline. Globally, gas usage needs to be reduced by more than 30% below 2020 levels by 2030 (Hare et al., 2021).

Yet, governments are still approving new gas developments, taking the world in the opposite direction of where it needs to be headed. Gas accounts for the largest increase of global fossil CO2 emissions, contributing 42% of emissions growth from 2010 to 2019. In 2020, the natural gas industry accounted for around 60% of methane emissions from fossil fuel production (Hare et al., 2021). The overall impact of methane emissions, which have a higher global warming potential than CO2, is even larger when considering the risk of methane leakage along the natural gas supply chain, in addition to the upstream emissions (Balcombe et al., 2017).

Globally, fossil gas demand continued to grow at 4% in 2021, after a drop in 2020, with Asia's growing markets expected to drive growth between 2022–2025 (IEA, 2021c). China and India, the world's first and third biggest primary energy consumers, are projected to lead in gas consumption from 2022 onwards (IEA, 2020a). With a large population and high dependency on fossil fuels in the primary energy mix and electricity generation, India is one of the largest emitters of greenhouse gases, yet one of the countries with the lowest per-capita emissions, and one that struggles to supply its population with reliable energy.

The Indian government has recently announced that it plans to increase its share of gas consumption, and transform the country into a "gas-based economy" (Ministry of Petroleum and Natural Gas, 2021a). This presents a significant challenge for a transition to a 1.5°C emissions pathway for India.

India's draft 2021 liquefied natural gas (LNG) Policy shows that it plans to increase the share of fossil gas to 15% of total primary energy consumption by 2030, up from the current level of 6%, with LNG set to be the biggest supplier of this future gas demand (Ministry of Petroleum and Natural Gas, 2021a).

Further, India's 2018 National Electricity Plan points to the potential of natural gas to achieve a "low-carbon" transition of the power sector, and to support an increased penetration of renewable energy through grid balancing (CEA, 2018). As a result, the Standing Committee on Energy recommended reviving natural gas-based power plants that had been stranded due to the low domestic supply of gas (Ministry of Power, 2019, 2021).

India is a major importer of gas. India's domestic supply of natural gas is below its demand and has been declining since 2010 (IEA, 2021d; Ministry of Petroleum and Natural Gas, 2021b). Imported LNG has met nearly 70% of the country's increase in demand since 2014 (IEA, 2021b).

The country plans to continue to rely on fossil gas imports in order to meet some of its energy needs. Our analysis shows this reliance is not sustainable: it will create an additional burden on the country's balance of payment.

To reduce the risks, India needs to rapidly change its current, fossil-gas-based trajectory and transform its economy to rely more on renewable energy sources. This will not only ensure energy security and independence, but will also save India crucial foreign exchange as it reduces expenditures from natural gas imports, along with reduced risk of gas infrastructure to remain stranded.

In this report, we provide an economic estimate of import savings if India were to align with a 1.5˚C compatible Low Energy Demand pathway. This scenario would lead to a gas import savings of USD 9–24 billion in 2030 under various price and import assumptions. This would result in average annual import savings of USD 5–12 billion between 2021–2030 under various assumptions.

Accelerating the transition to renewables would also provide India scope to strengthen its Nationally Determined Contributions (NDC) 2030 targets. In 2021, India proposed strengthening its targets to reduce the carbon intensity of the economy to 45% below 2005 level by 2030 from the earlier goal of 33–35% and increase non-fossil capacity in power generation to 500GW by 2030. But has not yet submitted an update to the UNFCCC. While the proposal is an improvement compared to India's first NDC targets, it still falls short of its fair share contribution to limiting warming to 1.5˚C target and only brings its 2030 target to the level of its current policies.

The Climate Action Tracker rates India's current overall climate performance as "Highly insufficient" (Climate Action Tracker, 2021). If the government were to formally submit its proposed targets to the UNFCCC, its overall CAT rating would become "Insufficient".

India would need stronger targets and emissions cuts in order to be consistent with a 1.5˚C pathway, and would need international climate finance to get there. As we show in this report, this would mean significantly lower gas development, supported by rapid electrification of end use sectors, with a shift to renewables in the power sector.[1]

Box 1: Description of scenarios used in this report

In this report, we use the IEA's Stated Policies Scenario (STEPS) from the 2021 World Energy Outlook as the current policies scenario for India, which includes its plan to accelerate renewable energy capacity in the power sector with its ambitious 450 GW renewable energy target, along with the National Hydrogen Mission and Draft LNG Policy targets (IEA, 2021d).

To compare the current policies scenario with Paris Agreement compatible pathways and to illustrate alternative low-carbon development options for India, we selected two pathways from the 1.5˚C national pathway explorer: the Low Energy Demand pathway and the SSP1 Low CDR Reliance pathway (Climate Analytics, 2021). These 1.5˚C pathways were selected due to their low deployment of carbon dioxide removal (CDR) approaches, both globally and within India, and for their consistency with current levels of gas use. [1]

One limitation with global models, such as the ones used to derive our selected 1.5˚C pathways for India, is their limited ability to capture national realities in terms of mitigation options and rapid technological advancements. On the other hand, bottom-up national models take into consideration rapid technological changes, often using models with hourly and even spatial resolution; however, they often only focus on the energy sector. Results from global models provide valuable insight in evaluating global progress towards the achievement of Paris Agreement's long term temperature goal of limiting warming to 1.5˚C, as they consider all relevant emissions and sectors.

1 These 1.5˚C pathways are from the IPCC Special Report on Global Warming of 1.5˚C published in 2018. They do not include the scenario database of the IPCC's Sixth Assessment Report.

2 Natural gas and the energy transition in India

India's Draft LNG Policy 2021 outlines plans to increase the use of LNG in various sectors, including sectors currently not using LNG, such as mining and transport. This policy also advocates for free marketing of LNG for the transport sector.

In 2019, more than three quarters of India's primary energy supply came from fossil fuels, with coal dominating at 45%, followed by oil (25%) and a small share of gas (6%) (IEA, 2021d). The new gas policy will change this picture to a larger share of gas in most economic sectors with a switch from coal and oil to gas.

The current policies scenario, based on IEA's STEPS from the World Energy Outlook 2021, shows the share of natural gas in primary energy supply will continue to increase and reach 9% by 2030 and 11% by 2050 (IEA, 2021d).

To be on a Paris Agreement compatible pathway, India would need to increase its share of renewable energy in its primary energy mix to 46–51% by 2030 and up to 53–76% by 2050 from 2019 level of 23%. Its share of unabated fossil fuels in the primary energy mix should start to decline from 2020, with unabated gas declining after 2030 (Climate Analytics, 2021).

Some bottom-up analyses confirm that energy efficiency, renewable energy and electrification will be important in achieving a low carbon pathway in India. However, these studies also show a high share of fossil fuels in primary energy in 2030 and 2050, as coal remains in the system, and the renewables share is reduced (Mittal et al., 2018; Vishwanathan et al., 2018; Vishwanathan & Garg, 2020).

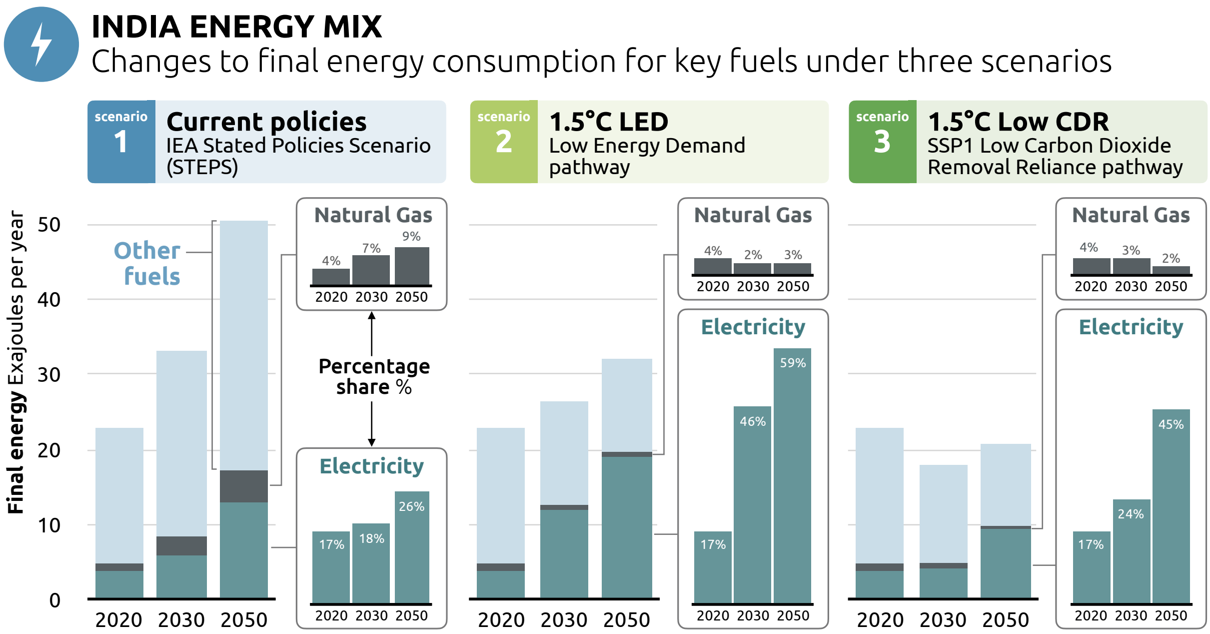

Figure 1: Final energy consumption under current policies scenario and selected 1.5˚C pathways (Climate Analytics, 2021; IEA, 2021d). Final energy was calculated for both current policies and selected 1.5°C pathways as the aggregate of industry, buildings and transport final energy consumption for comparability.[2]

2 This does not include final energy consumption categorised as "Other" in the IEA World Energy Outlook 2021 that includes agriculture and other non-energy uses. "Other" final energy accounts for about 10% of India's total final energy consumption in 2020.

Our selected 1.5°C pathways show a high rate of electrification for India which will lead to a share of electricity in final energy consumption to 24–46% by 2030 and 45–59% by 2050 (Figure 1). The recent IPCC report also points out that electrification of transport and industries will be important in accelerating decarbonisation of these sectors.

Under current policies, however, the share of electricity in final energy consumption in India grows slowly, reaching only about a quarter of final energy by 2050.

The transformation of the energy sector by increasing renewables creates an opportunity to increase the electrification rate to meet energy requirements in end use sectors. Renewable hydrogen offers another opportunity for the use of green hydrogen for non-energy uses.

2.1 Natural gas in end-use sectors

While the share of natural gas in India's final energy consumption has largely remained flat in recent years, at around 4%, overall energy demand has risen rapidly, and there have been significant shifts in demand for natural gas in specific sectors of the economy.

The use of natural gas in the industry sector has seen around a 40% increase between 2011 and 2019 including both energy and non-energy use (MoSPI, 2021). With increased expansion of the city gas distribution (CGD) network[3], natural gas use in the buildings and transport sector has nearly doubled over the past decade (12% in 2011 to 22% in 2019) with particular share of 11% from transport sector (MoSPI, 2021; NGV Global, 2018)

These increases have, however, been partially offset by a fall in the use of fossil gas for power generation. Nearly 60% of India's fossil gas-based power generation capacity is facing extreme financial pressure and is operating on very low capacities on account of the lack of affordable gas (IEA, 2021b).

Industry

Industry is the biggest consumer of fossil gas in India where, apart from being used for energy purposes, it is used as a feedstock for manufacturing fertiliser and petrochemicals.

While fossil gas only accounted for 5% of industrial final energy consumption in 2020, the current policies scenario, based on IEA STEPS, shows a five-fold increase in gas use by 2050, reaching 13% of industrial final energy consumption (Figure 2). The government policy think tank NITI Aayog estimates that the iron and steel sector could be a key consumer of fossil gas, which is expected to meet around 27% of the sector's total energy requirement by 2047 (NITI Aayog, 2019).

In contrast, our analysed 1.5°C scenarios show a limited role for fossil gas in industry, contributing just 3–4% to industrial final energy consumption in 2050 (Figure 2).

3 City Gas Distribution (CGD) Network is an interconnected network of pipelines to supply natural gas in the form of piped natural gas. It has four distinct segments: Compressed Natural Gas (CNG) predominantly used as transport-fuel, and Piped Natural Gas (PNG) used in buildings for cooking, commercial and industrial segments. The Petroleum and Natural Gas Regulatory Board (PNGRB) Act, 2006, grants authorisation to entities for developing a CGD network, including a PNG network in a specified geographical area of the country.

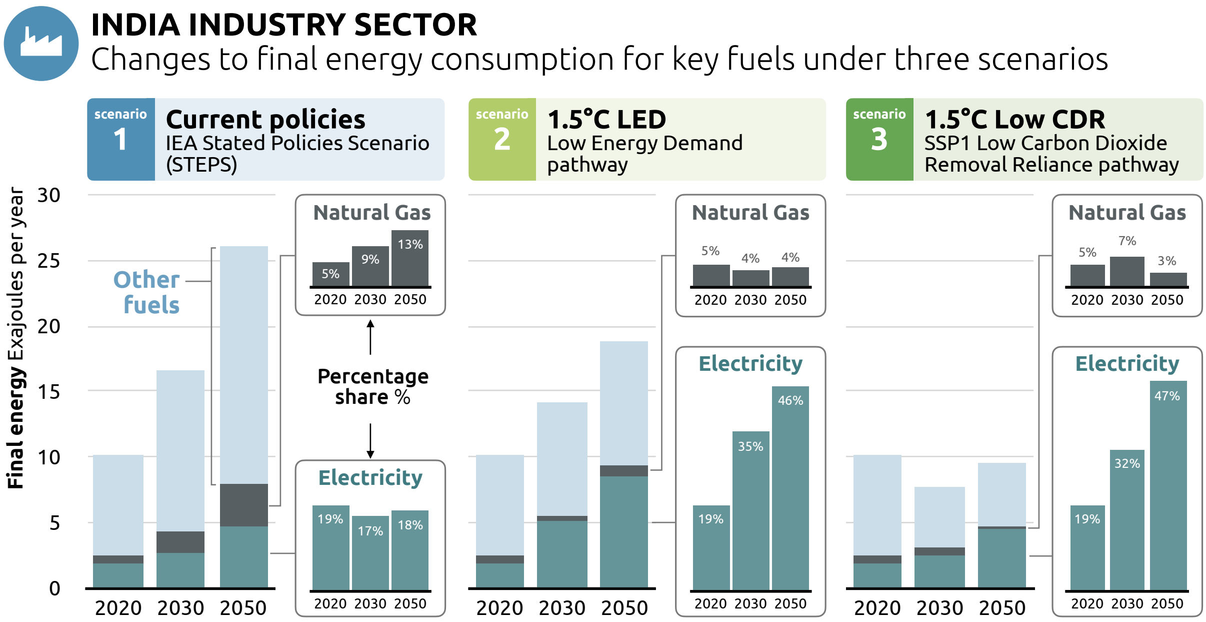

Figure 2: Final energy in the industry sector by source under current policies and selected 1.5°C pathways (Climate Analytics, 2021; IEA, 2021d).

At present nearly two-thirds of the industry sector's total energy demand is for meeting direct heat requirements in various processes and uses fossil fuel as feedstock. This presents an opportunity where the sector could be electrified, particularly for the Micro, Small and Medium Enterprises sector (MSMEs), which contributes more than one third of the manufacturing output in India (CII, 2021; Pal & Hall, 2021).

Electricity demand from industry has steadily increased since 1990 and in 2020, it was around 20% of final energy consumption in industry (Climate Analytics, 2021). Our selected 1.5˚C compatible scenarios show the share of electricity in the industrial energy mix in India needs to increase to more than 30% by 2030 and more than 45% by 2050 (Figure 2). This high electrification rate is also closely tied with a rapid increase in renewable generation, discussed below.

By comparison, our current policies scenario shows that while total electricity demand will continue to increase, its share in industrial final consumption will remain fairly stagnant. The power sector under current policies would also still rely heavily on fossil generation.

High industrial electricity prices in India often act as a barrier to the adoption of technologies that could enable the electrification of industries (IEA, 2020b). However, this could be managed by generating electricity from renewables, as the renewable energy tariff is falling significantly in India.

India's demand for natural gas as a feedstock account for 40% of total gas demand and 70% of industrial gas demand. India's industry sector could benefit from using cleaner technologies, such as green hydrogen to replace natural gas as a feedstock for the production of steel, ammonia, methanol and fertilisers. Although our selected 1.5˚C scenarios do not show any development of hydrogen in India (Figure 2), this is likely due to outdated model assumptions on the relative cost of green hydrogen and does not mean it has no role to play. The Indian government is already providing policy incentives to increase the use of green hydrogen, particularly for industrial use (See Box 2).

Box 2: Green hydrogen's emerging role in India

In August 2021, India launched its National Hydrogen Mission (NHM) to scale up green hydrogen production and utilisation. With the NHM, India intends to produce three-quarters of its hydrogen from renewable resources by 2050.

In the Union Budget 2021–22, INR 250 million (USD 3.25 mn) was allocated for the research and development of hydrogen energy. Further, in February 2022, the Ministry of Power announced its Green Hydrogen Policy. One of the main components of this policy is to waive the inter-state transmission charge (ISTC) for 25 years for green hydrogen projects commissioned by June 2025, which goes beyond the existing policy of waiving ISTC for renewable energy until 2025.

This is an important step towards ensuring price competitiveness of green hydrogen as the cost of hydrogen produced using electrolysis is also sensitive to the cost of electricity.

There is currently no domestic manufacturer of electrolysers in India; however, the government is planning to implement a Production-Linked Incentive scheme for their manufacture. The government also plans to introduce a mandatory 'green hydrogen purchase obligation' for industrial users (Ministry of External Affairs, 2021).

The Ministry of Power has already mandated a gradual increase in the use of green hydrogen by replacing fossil fuels in refineries and fertiliser plants (Verma, 2021). The mandate on green hydrogen as feedstock for the fertiliser sector is to have a share of green hydrogen of 5% by 2023–24, growing to 20% by 2030. For refineries, these targets are 10% and 25%, respectively. In the transport sector, Indian Railways has also invited bids to explore whether diesel-fuel trains could operate using hydrogen fuel cells (PIB, 2021).

The current costs of producing green hydrogen in India range from USD 3.6–5.8/kg depending on the renewable energy mix, similar to the global average of USD 2.5–6/kg (Biswas et al., 2020; KPMG Global, 2019). Some reports predict that with new policy support the cost of green hydrogen will drop by 40–50% and will be able to bring it down to under USD 2/kg by 2030 (Livemint, 2021; The Economic Times, 2022).

Buildings

Historically, demand for gas in India's building sector has not been very high, largely due to lack of access. However, with increased expansion of the city gas distribution (CGD) network, natural gas use in the buildings sector has more than doubled over the past decade and now makes up around 10% of gas demand. The current policies scenario shows a continued rise in gas demand in the buildings sector out to 2050 (Figure 3).

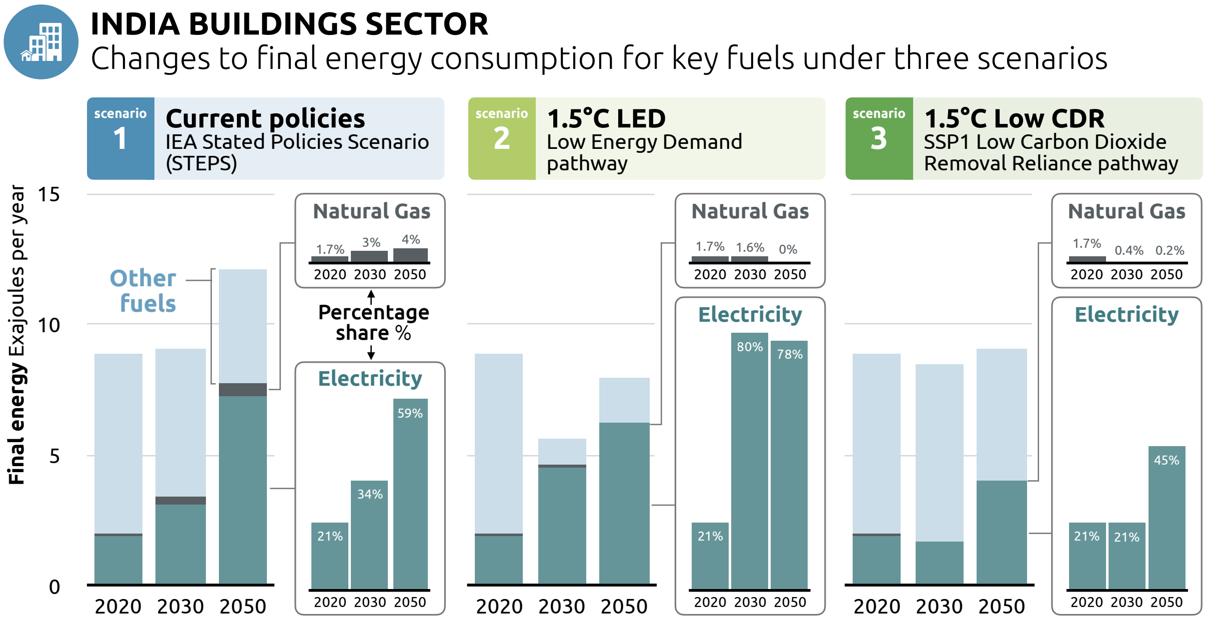

Figure 3: Final energy in the building sector by source under current policies and selected 1.5°C pathways (Climate Analytics, 2021; IEA, 2021d).

Solid biomass is still an important energy source, mainly used for cooking, with a share of around 55% of the buildings sector's energy mix in 2019 (Climate Analytics, 2021). Around 35% of the population doesn't have access to clean cooking fuel or cookstoves (World Bank, 2021), and the government has been accelerating and promoting the use of liquified petroleum gas (LPG) for cooking through various policies. The official record says 100% electrification has been achieved but there's caveats in the definition of electrification and the real picture is way below this (Agrawal et al., 2020).

Our selected 1.5˚C pathways show rapid electrification of the buildings sector is needed, with the share of electricity in final energy use reaching about 20–80% in 2030 and 45–78% by 2050 (Figure 3). This enables a reduction in the share of fossil fuels, with negligible gas in the buildings sector by 2030. Electrification of the buildings sector in 2050 under current policies is higher than in the 1.5°C Low CDR scenario which is slower to move away from solid biomass; however, the 1.5°C LED scenario shows a higher level of electrification can be achieved.

The IEA's STEPS scenario shows that the share of electricity in the buildings sector energy mix would reach 34% by 2030 and 59% by 2050 under current policies; however, in this scenario the power sector still depends on fossil fuels (see section 2.2). The high electrification rate seen in the 1.5°C pathways we've analysed and the falling tariff of renewable energy together provide India with an opportunity to transition from biomass to electricity as an energy source for cooking, in a cost-effective way (Patnaik & Tripathi, 2018).

Transport

India's transport sector is dominated by oil with natural gas playing a relatively minor role. The use of compressed natural gas (CNG) in the transport sector has increased over the past years and is prevalent in 11 out of 29 states constituting 11% of the CGD network (NGV Global, 2018).

The total final energy consumption of India's transport sector has increased by around a factor 5 between 1990–2019, (IEA, 2021a) primarily based on fossil fuels (oil). Our selected Paris Agreement compatible pathways show a rapid electrification of the transport sector, with the share of electricity in the sector's energy mix increasing to about 40–90% by 2050 (Climate Analytics, 2021) (Figure 4), following a replacement of gas and other fossil fuels in this sector.

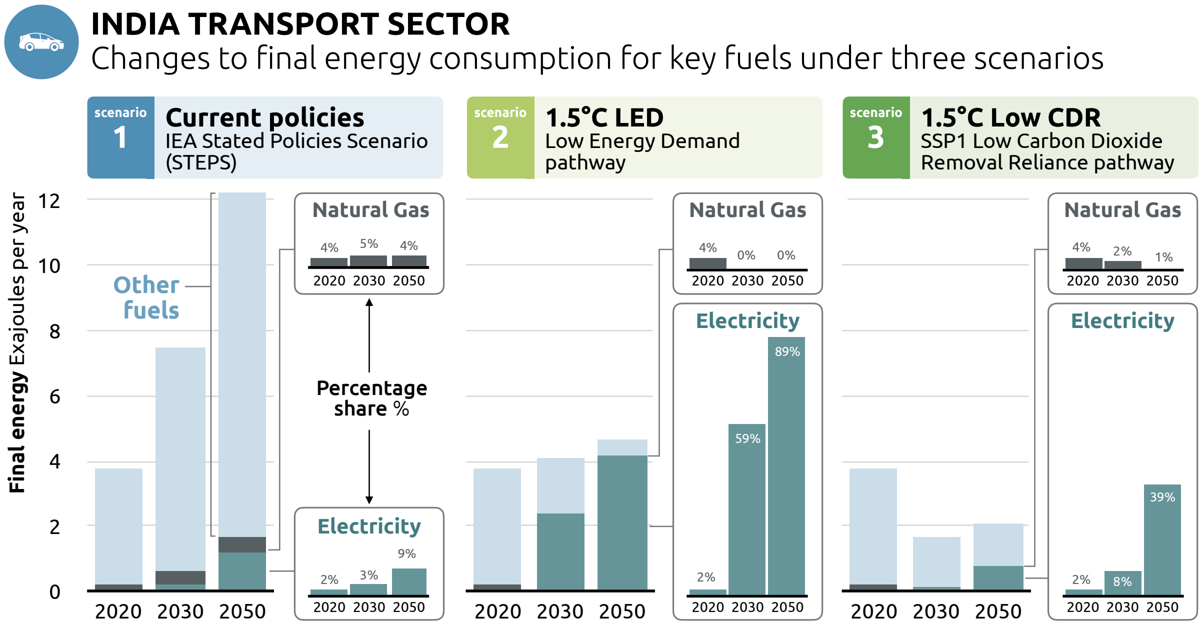

Figure 4: Final energy in the transport sector by source under current policies and selected 1.5°C pathways (Climate Analytics, 2021; IEA, 2021d).

India has a target of 30% share of electric vehicles (EV) in new car sales for 2030 (Clean Energy Ministerial, 2019). Studies are showing that Indian EV market will grow at a compounded annual rate of 36% by 2026 (Bhardwaj, 2021). To be compatible with the Paris Agreement, the share of EV sales (including two and three wheelers) needs to be between 80–95% by 2030 an 100% by 2040 (Climate Action Tracker, 2020).

2.2 Natural gas in the power sector

Fossil gas plays a relatively minor role in India's power sector, supplying only 4% of the generation mix in 2020. But substantial growth is projected under current policies: the IEA's STEPS scenario has gas-based power generation increasing to 120 TWh (75% increase from 2020) by 2030 and 172 TWh (150% increase from 2020) by 2050 (IEA, 2021a).

In the selected 1.5°C pathways for India, unabated gas-fired power generation peaks around 2030 (121–382 TWh) then declines to 61–92 TWh by 2040, and phases out almost entirely by around 2050 (Figure 5).

The current plans of replacing coal with fossil gas in power generation would undermine the ability of the power sector to achieve sufficient emissions reductions and pose a challenge for the transformation of the power system, with high risks of stranded assets in a Paris Agreement compatible world *(See section 3.2 for details).*

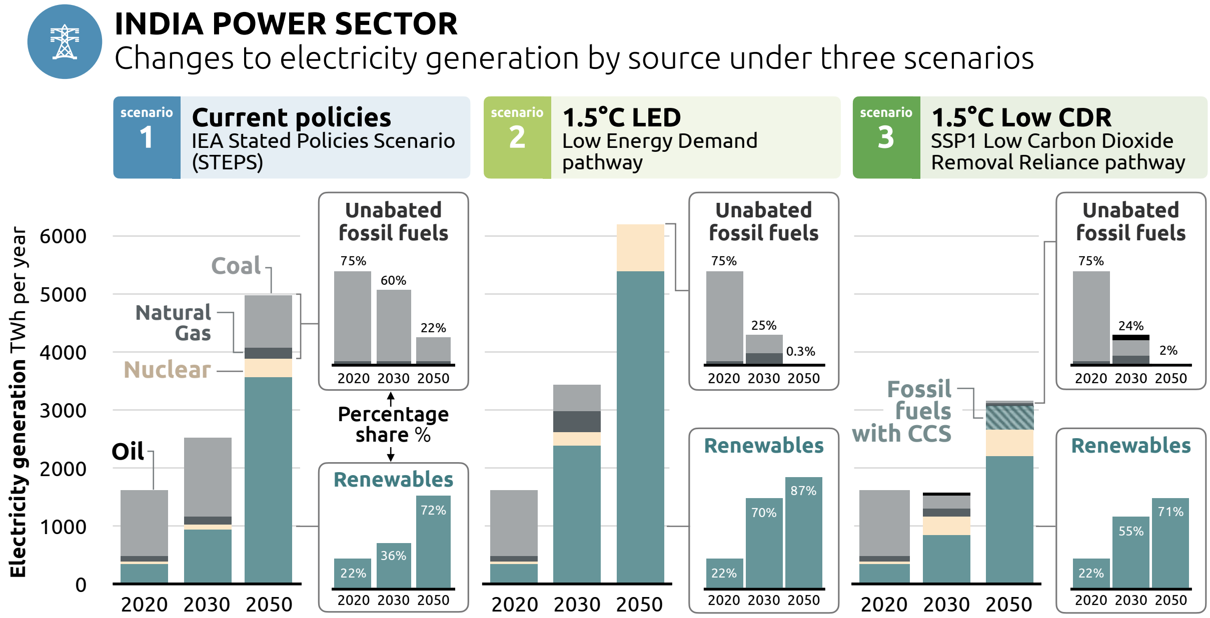

Figure 5: Electricity generation by source under current policies and selected 1.5°C pathways, showing unabated fossil fuels and renewable energy including biomass[4] (Climate Analytics, 2021; IEA, 2021d).

To achieve a Paris Agreement compatible pathway in the power sector, India would need to rapidly decline the emissions intensity of its power sector. In the selected 1.5°C pathways, India's share of unabated fossil fuels would need to decline to about a quarter of power generation by 2030 and be almost entirely phased out by 2050. Furthermore, it would need to increase its share of renewable energy to reach 55–70% by 2030 and around 71–87% by 2050 (Climate Analytics, 2021). A power sector dominated by renewables is important, not only for the decarbonisation of electricity sector, but also for decarbonising end use sectors as they increase electrification *(see previous section 2.1 on the end-use sectors).*

4 The "renewables" category includes biomass. Biomass with CCS is only present in the 1.5°C SSP1 Low CDR Reliance pathway, accounting for 4% of power generation by 2050.

3 Benefits from reduced demand of natural gas

3.1 Benefits from reducing reliance on gas imports

India is a net natural gas importing country as domestic natural gas production can only meet a portion of the demand. Since 2010, domestic production of natural gas started declining, and between 2010-2020 it has declined by around 40%, which has resulted in an increasing dependence on imports.

In 2019, India's domestic production accounted for up to 47% of total demand. Net imports of gas increased by 84%, from 18 bcm in 2011-12 to 33 bcm during 2020-21, which makes India the world's fourth largest LNG importer (Petroleum Planning and Analysis Cell, 2021).

IEA's STEPS scenario also indicates that India's LNG imports will increase by 123% (75.4 bcm) in 2030 and 223% (109 bcm) in 2040 under current policies.

The current trajectory of more gas imports increases India's exposure to various risks and would mean losing out on the socio-economic benefits that come with a renewable energy pathway. While there are many benefits that could be gained from the transition, in this report we focus on energy independence, and related gas imports savings.

Energy independence by reducing reliance on gas imports

India met around 50% of its gas demand through imports by spending USD 9.5 bn in 2019, 6% of its 2019-20 trade deficit. Increasing dependence on gas imports is a threat to India's energy independence and security. Import dependency may lead to vulnerability in the case of international political changes.

In 2019-20, India sourced roughly half of its gas needs from foreign suppliers, primarily from West Asian producers in Qatar, UAE and Oman. In recent years, India has been expanding energy ties with other gas exporting countries: to increase diversity in its suppliers it has gradually reduced the share of total imports from Qatar to 41% (90% in 2014-15) and included African exporters (Nigeria and Angola) along with the US and Australia.

Until India diversifies its energy supply sources to be dominated by domestic renewable energy, abundantly available within its borders, it will remain exposed and vulnerable to geopolitical risks and the volatility in global gas prices, which can rise irrespective of where India is buying gas from, especially when compared to the declining costs of clean renewable energy technologies (IRENA, 2021).

Recent global events like the COVID-19 pandemic and Russia's illegal invasion of Ukraine have revealed that reliance on imported fuels can increase the risk of energy insecurity and dampen economic growth. India needs to fuel its economic growth by substituting fossil fuel demand with renewable energy alternatives. The tariff on renewable energy in India is already lower than that of thermal energy and this brings into question the competitiveness of fossil fuels.

Spot LNG prices have seen extreme volatility in the past two years, and that has become a major concern for all gas importing countries, including India. In May 2020, the price of LNG dropped to a record low of below USD 2/MMBtu mainly due to pandemic-induced low demand and in November 2021 during the recovery period it reached USD 36/MMBtu (CME Group, 2022). In early March 2022, it further increased to USD 59/MMBtu in the wake of Russia's invasion of Ukraine (Ng & Reynolds, 2022).[5]

Given the recent massive hike in the spot price, there's a high uncertainty that it will stabilise below USD20/MMBtu any time soon (Jain, 2022). This volatility in gas prices not only poses a risk for India's trade balance, but an even bigger risk for end-use sectors. Volatile gas prices can increase the operating costs in the industry and power sectors and for the CDG network, further affecting product competitiveness.

5 For detail in spot price volatility please see Technical Annex.

The Indian government should see this unpredictability and volatility of gas prices as an opportunity to enable non-fossil alternatives such as renewables and green hydrogen for gas-dependent sectors such as industry. This volatility, combined with growing gas imports, comes as a huge financial burden on the country.

Potential import savings in 1.5°C compatible scenario

In the context of increasing dependence on imported natural gas and LNG price volatility, we estimate the import costs that could be saved by moving away from fossil gas in a 1.5°C compatible pathway. We use the IEA STEPS scenario as a current policies scenario, for comparison, and the Low Energy Demand scenario from the 1.5°C National Pathways Explorer as an illustrative 1.5°C compatible low gas scenario (see Box 1 for details). Based on different assumptions of domestic production levels (details are in technical annex) we present two import cases:

- **Low import case:** Gas imports and production develop as projected in the IEA STEPS scenario. This shows gas production more than doubling from 28 bcm in 2020 to 58 bcm in 2030 (more than 100%).
- **High import case:** Gas production only increases 25% from 2020 to 2030.

To better reflect differences between contracted gas imports and spot market imports, we assume, under our current policies scenario, that for the period 2021–2030, 60% of gas imports are supplied through contracts while 40% are purchased through the spot market. This is a conservative estimate as various sources are reporting that India's spot market exposure is around 40–50% (Jain, 2022; Sher et al., 2021).

According to the annual report of LNG importers, in 2020 India has imported 56% of its LNG through the spot market (GIIGNL, 2021). While we assume this share remains constant, the absolute volume of contracted gas imports increases across our scenarios, reflecting the current development of India's LNG companies to increase supply under long term contracts (Dutta, 2021; Times of India, 2021). The total import cost calculation is done using the contract price and high and low spot price cases. The spot price of natural gas imports over a period of twenty years is rather complex as the future price of natural gas depends on the policies and circumstances in other countries and regions. We have tried to stay conservative in our price assumptions and present a wide range.[6]

Under the current policies scenario with low natural gas imports, import costs increase to USD 22–35 bn under different spot price assumptions by 2030, about 140–285% higher than the 2020 level. Under the high import case, import costs reach USD 29–46 bn in 2030, about a 210–400% increase (Figure 6) In the Low Energy Demand 1.5°C scenario for India, gas import expenditures in 2030 are much lower: around USD 13 bn under the low import case, and USD 20–22 bn under the high import case.

6 For detail on the price assumption please refer to the Technical Annex.

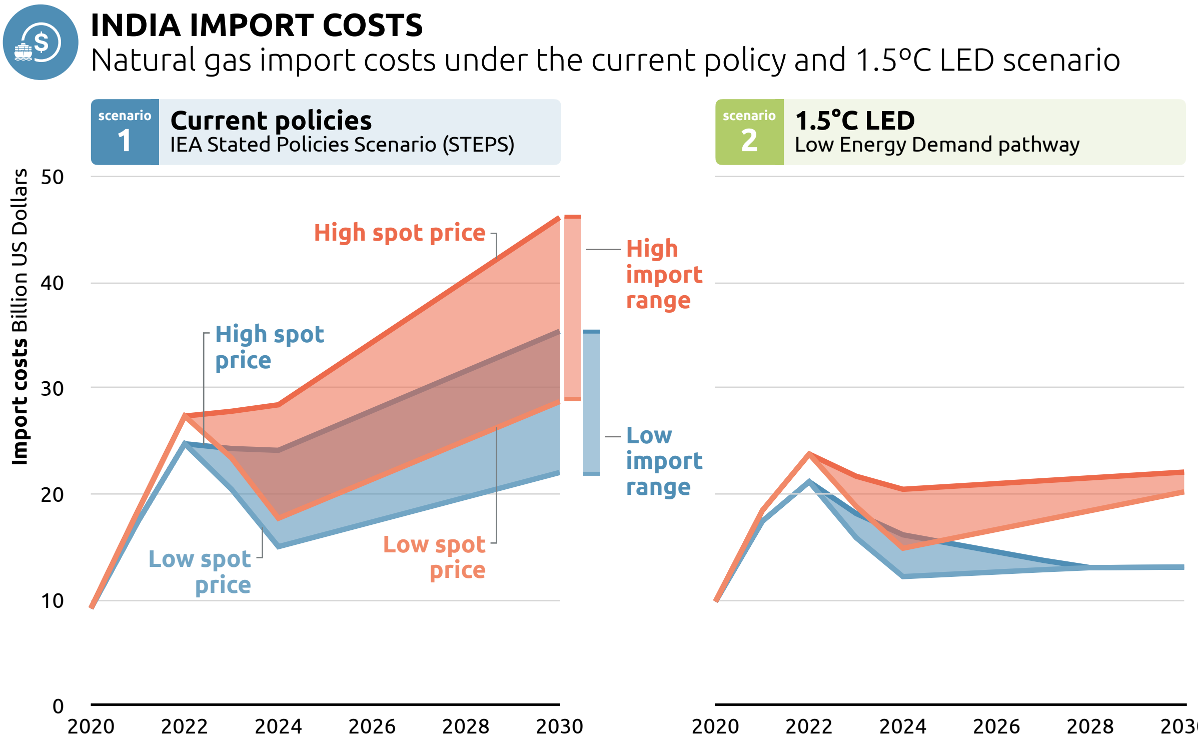

Figure 6: Natural gas import costs under different pricing assumptions under the current policies scenario and 1.5°C scenario (USD bn).

In the year 2019-20, India had a net expenditure of USD 9.5 bn for natural gas imports, around 5% of India's merchandise imports (Petroleum Planning and Analysis Cell, 2021). In 2019-2020 India's trade deficit was about USD 162 bn (Ministry of Commerce and Industry, 2021).

Without a significant shift to renewable energy, a higher dependence on fossil gas would increase the potential balance of payment risk and raises questions around macroeconomic stability. Our estimate shows that if India were to align with the 1.5°C compatible Low Energy Demand pathway, this would lead to fossil gas import savings of USD 9–24 bn in 2030 under various price and import assumptions. In such a scenario, the average annual import savings from 2021 to 2030 would be USD 5–12 bn under both the low and high import cases (Table 1).

Table 1: Average annual expenditures under current policies scenario and selected 1.5°C pathway and average annual savings between 2021–2030 (USD billions)

	Low spot price case	High spot price case
Low import case		
Current policies	$19.24 bn	$ 27.48 bn
1.5°C	$14.39 bn	$ 15.59 bn
Import savings	**$4.85 bn**	**$ 11.89 bn**
High import case		
Current policies	$23.18 bn	$ 33.46 bn
1.5°C	$18.40 bn	$ 21.29 bn
Import savings	**$4.78 bn**	**$ 12.18 bn**

3.2 Reduced stranded assets

Investments in the natural gas value chain are not 1.5°C compatible. Investment in gas infrastructure creates lasting dependence on technology and resources that are neither economically nor socially attractive. Research suggests different risks along the supply chain of natural gas (NewClimate Institute, 2021).

For India, upstream and LNG exports are irrelevant, given the absence of domestic reserves. As described in previous sections, India still plans a substantial increase in the use of gas supplied through imports, exposing itself particularly to incompatibility risks, lock-in risks, and transition (stranded asset) risks.

India plans substantial investments in pipelines and LNG import terminals, as well as in the power sector for gas power plants. It has plans to invest USD 60 bn to develop gas infrastructure between 2021–2025, including for pipelines, LNG terminals and CDG networks (The Economic Times, 2020). There are more than 18,000 km of gas pipelines under development in India, more than doubling the size of the existing network.

India is developing 67.5 Mt/yr of LNG import capacity, compared to the current 47.5 Mt/yr in operation (Global Energy Monitor, 2022). In the power sector, electricity output from gas-fired power plants is expected to increase by more than 50% by 2030, and even more strongly afterwards in the IEA STEPS scenario (see section 2.2).

India's plans to expand import and downstream gas infrastructure are subject to significant transition risks. In particular, new and existing natural gas infrastructure is at risk of stranding—the premature write-down or devaluation of assets (Caldecott et al., 2014). The lifetime of natural gas infrastructure often spans many decades, and repurposing for green hydrogen faces severe limitations (NewClimate Institute, 2021).

Meanwhile, the cost of renewable electricity generation is already at record lows in India, and IRENA illustrates that solar electricity is already stranding coal-fired power plants (IRENA, 2021). We have not found similar analyses related to natural gas power plants for India, however, research on power plants in the United Kingdom and Germany indicates that gas power plants are at a similar risk (Sims et al., 2021).

The planned large-scale investments in natural gas infrastructure stand in stark contrast to investment needs under 1.5°C scenarios, where grid investments, the expansion of renewable energy, storage and electrification are a priority. If India spends its resources on fossil infrastructure, it not only risks economic losses, but it may also find itself under-resourced in terms of gathering finance for the energy transition.

4 Conclusion

India's gas import dependency continues to grow, further exposing the country to geopolitical and economic risks. The government has taken significant steps to support gas import growth through the expansion of LNG terminals and re-gasification capacity, as well as infrastructure development to facilitate LNG transportation. However, developing this gas infrastructure is not aligned with Paris Agreement 1.5˚C compatible pathways, and will lead to risk of carbon lock-in and stranded assets in a Paris Agreement compatible world.

The unpredictability and volatility of gas prices puts India in a vulnerable position. India needs to rapidly change this by implementing measures for secure energy supply and increase its energy independence. This change in its development trajectory could also result in financial savings from avoided gas imports.

Our analysis shows that by reducing its gas imports India could save around USD 9–24 billion in 2030 from the import of fossil gas under various price and import assumptions. This would result in average annual import savings of USD 5–12 bn between 2021–2030 under various assumptions.

These import savings, combined with unspent investment currently planned for gas infrastructure, could instead be channelled towards supplying the population with sustainable energy. Although India's renewable electricity is growing at a faster rate, it could still do more, given its abundant renewable resources (Birol & Kant, 2022), and this will require investment not only in renewable resources, but also in the development and deployment of advanced technologies like green hydrogen and grid scale battery storage. International financial and other support will be essential to enable India to achieve these crucial transitions and get onto a 1.5°C pathway, and in doing so to reap the benefits of a clean and secure energy system.

Annex — Import savings methodology

India imports its natural gas through two channels, long term contracts and the short-term or spot market. Prior to 2016, LNG contract prices were fixed to the Japanese Crude Cocktail (JCC) via a pre-determined formula. Since 2016, long-term contracts for imported gas have been revised to the Brent Crude oil price and there has been a considerable increase in spot market trading as spot prices of Asian LNG market were around 27% lower than contract prices between 2016–2020 (Jain, 2022).

India's expenditures on gas imports are calculated for two scenarios under a range of gas price and gas import assumptions for the period 2021 to 2030 (Climate Analytics, 2021; IEA, 2021d).

- IEA STEPS 2021 is used as a current policies scenario.
- "Low Energy Demand" from the 1.5°C National Pathways Explorer is used as a 1.5°C compatible, low gas scenario.

IEA STEPS (WEO2021) provide values for gas supply, production and imports and Low Energy Demand provides primary energy values for gas, harmonised to IEA historical data (IEA, 2021d). Import savings are calculated as the average annual savings for the period 2021–2030. A summary of key assumptions is presented in Table 2 below.

Table 2: Assumptions on natural gas production and price.

		Values	
Assumptions	**Unit**	**Low**	**High**
Natural gas production in 2030	percentage change from 2020	25%	107%
Natural gas contracted price (2021–2030)	USD/MMBtu	US$9.50	US$9.50
Natural gas spot price in 2030	USD/MMBtu	US$ 7.09	US$ 20.00
Share of gas imports from the spot market under current policies scenario	percentage of gas imports	40%	40%

Spot market share assumptions

Gas imports purchased through the spot market, about 40–50% of India's gas imports, are subject to high price volatility. Globally, gas price volatility could continue in the near-term due to factors such as the on-going war in Ukraine and surging demands to support economic recovery from the COVID-19 pandemic, while long-term price projections remain deeply uncertain. Although Asia spot LNG prices averaged lower than Brent-linked prices from 2016 to 2020, they were also more volatile. Therefore, reductions in gas demand would first impact gas imports through the spot market, then imports through contracts, and finally domestically produced gas.

To better reflect differences between contracted gas imports and spot market imports, we assume, under our current policies scenario, 60% of gas imports are supplied through contracts while 40% are purchased through the spot market for the period 2021–2030. This is a conservative estimate as various sources are reporting that India's spot market exposure is around 40–50% (Jain, 2022; Sher et al., 2021). According to the annual report of LNG importers, in 2020 India has imported 56% of its LNG through spot market (GIIGNL, 2021). While we assume the share remains constant, the absolute volume of contracted gas imports increases across our scenarios, reflecting the current development of India's LNG companies to increase in long term contracts (Dutta, 2021; Times of India, 2021). Under our 1.5°C scenario, we assume reductions in supply first reduce gas imports on the spot market.

Import volume assumptions

We present both a high and low gas import case for both our current policies scenario and our 1.5°C scenario. Assumptions on future import volumes are directly tied to projections for domestic gas production.

Our low gas import case assumes gas imports and production develop as projected in IEA's STEPS. This shows gas production more than doubling from 28 bcm in 2020 to 58 bcm in 2030 (more than 100%). We assume this is the higher range of future gas production because natural gas production in India has remained stagnant with no new substantial discoveries in awarded exploration blocks (Jain, 2022).

Our high gas import case assumes gas production only increases 25% from 2020 to 2030. Gas imports are then calculated for each year as gas supply minus gas production.

Gas import price assumptions

Gas import prices are differentiated between contracted imports and imports purchased through the spot market. Long-term contracts, supplying the bulk of imports not purchased through the spot market, are currently costing India about 9–10 USD/MMbtu (Jain, 2022). We therefore apply a price of 9.50 USD/MMbtu to the share of contracted gas imports for 2021–2030. We consider this a conservative estimate as the prices of more recently negotiated long-term contracts have been driven up due to higher spot market prices (Jain, 2022).

For spot market prices, we assume high and low average spot price cases to calculate expenditures in addition to the long-term contract price (Figure 7). As a proxy for the Asia LNG spot price, we look at the monthly average of LNG Japan/Korea Marker (Platts) futures price (JKM futures price) (CME Group, 2022). For 2021, we use the historical average JKM futures price and for 2022, we assume spot prices develop as projected by in the IEA's Gas Market Report, Q1 2022, averaging about 27 USD/MMbtu (IEA, 2021e) For the low spot price case, we assume prices stabilize at about 7 USD/MMbtu by 2024, equal to the five-year average of JKM futures prices from 2015 to 2019. For the high spot price case, we assume 2023 spot prices follow JKM futures in 2023, before stabilizing at 20 USD/MMbtu for 2023–2030. While this is significantly higher than historical spot prices prior to the recent spike, a number of long-term factors could contribute to this shift, such as lower levels of drilling and investment as demand grows and financial instability of the oil and gas industry (Bloomberg, 2021; Jain, 2022).

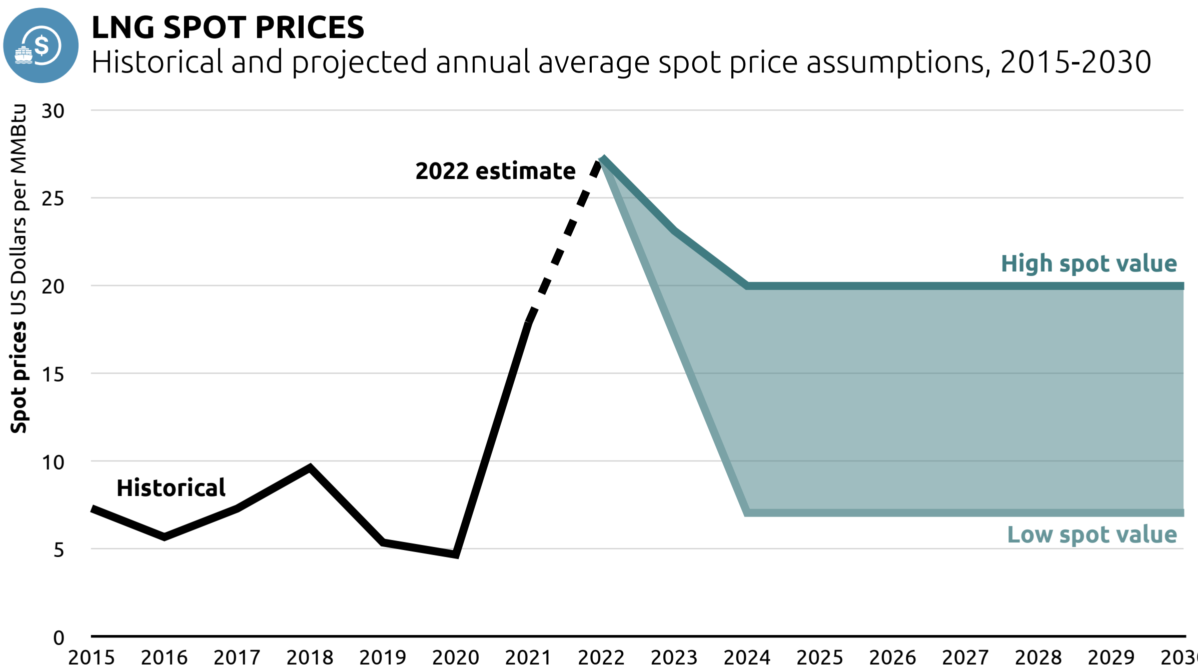

Figure 7: High and low spot price cases as annual averages (2015–2030). LNG Japan/Korea Marker (Platts) futures prices, presented as annual averages, were used as a proxy for the Asia spot LNG price.

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The Consortium

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Climate Analytics is a non-profit climate science and policy institute based in Berlin, Germany with offices in New York, USA, Lomé, Togo and Perth, Australia, which brings together interdisciplinary expertise in the scientific and policy aspects of climate change. Climate Analytics aims to synthesise and advance scientific knowledge in the area of climate, and by linking scientific and policy analysis provide state-of-the-art solutions to global and national climate change policy challenges.

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