

EXECUTIVE SUMMARY

Biomethane in full gear

In 2023, biomethane – also known as renewable natural gas (RNG) – has made further progress towards mainstream adoption by governments, end-users and the capital market transforming from a niche to a key renewable energy sector. Recognized for its multiple positive attributes, RNG has now become an important solution to global climate and energy security issues, alongside its key role as a catalyst for circular economies across multiple sectors. RNG attributes are now recognized worldwide to the point that **demand exceeds supply**.

On the policy side, the three main drivers of the adoption of RNG – decarbonization, methane emissions reductions and security of supply – are driving enabling policies and investments, leading to massive growth in the sector. Regulatory and government support, such as the Inflation Reduction Act (IRA), the federal Renewable Fuel Standard (RFS) and the California’s Low Carbon Fuel Standard (LCFS) in the US, the European Green Deal and the RePowerEU plan in Europe, the Metano Zero program and the Fuel of the Future Bill in Brazil, the SATAT and GOBARdhan schemes and the bio-CNG blending obligation in India, the rural revitalization strategy and the dual carbon targets in China, offers **strong structural policy drivers for the sector**. These policies have changed **the statute of biomethane from a niche market to a mainstream renewable energy source**, ready to be deployed now, as RNG is a mature technology and a drop-in substitute for natural gas.

On the market side, over years, RNG has been used by a widening group of consumers across sectors and all over the world. Cities, major corporations, industrial users in hard-to-abate sectors, fleet owners and gas/energy utilities have adopted RNG to move towards a circular economy, respond to the need of their customers for low-carbon products/supplies, rapidly decarbonize hard-to-abate sectors, and meet their environmental, social, and governance (ESG) commitments and reporting requirements. **The first long-term large-scale deals for unsubsidized RNG were signed in 2023, opening a huge market opportunity for RNG going forward**. For instance, **AstraZeneca** signed several long-term RNG deals, of which the US largest open market deal to date, and the UK’s first unsubsidized industrial-scale deal for RNG. In hard-to-abate sectors, **Saint-Gobain** entered into RNG agreements with TotalEnergies in France and with Gás Verde in Brazil, as part of its commitment to reduce its CO₂ emissions by 33% by 2030. These agreements are important for the RNG sector. **They initiate a merchant RNG market**, allowing the development of production without government support and provide a blueprint for wider commercial adoption of RNG. Large corporations and industrial users open a huge and rapidly expanding market for RNG. For these natural gas consumers that have near-term climate goals, **RNG is really the only option available today** to achieve emissions reduction goals with the necessary scale and urgency.

The use of RNG in the transportation sector has surged and accounted for 57% of the growth in global RNG demand in 2022, boosted by growing demand by large fleet owners and emerging demand in marine transportation. The transport sector accounted for 45% of global RNG demand. In this sector, RNG can make a real difference: its use to displace diesel can even **create carbon-negative emissions** as seen in California since 2020. The use of RNG in the European transportation sector is growing exponentially (+48% in 2022), boosted by the elevated prices of natural gas and diesel and regulation/support at EU and national levels. The trend is facilitated by the **numerous bio-LNG plants now operating and under construction** in the region. To continue this strong momentum, **policy makers have to take a neutral-technology approach** allowing a rapid decarbonization of the transportation sector. While regulators around the world have adopted a well-to-wheel methodology, **the European Commission (EC) is the only institution taking a tailpipe approach**, not allowing a level playing field for RNG.

2023 was again a compelling year for financial transactions in the sector. **In the challenging environment of 2023, where financial transaction activity in renewables (all technologies) declined in volume, RNG was a notable exception**. Although 2023 did not see headline-making acquisitions like the major deals announced by Shell and bp in 2022, there were transactions of comparable size, albeit with undisclosed valuations. **The \$1.2 billion acquisition of 7 US operating landfill gas-to-RNG (LFG-to-RNG) projects by Canada’s Enbridge was the largest disclosed deal**. Energy majors, except TotalEnergies which acquired two companies in the sector in 2023, focused on practical realization of their RNG portfolio, rather than acquisitions in the sector. In addition, a myriad of transactions (acquisitions, joint-ventures, fund raising) were made by financial investors and project developers. **The European RNG sector also saw the entry of new big players in 2023 (Cargill Inc. and SUEZ)**.

The sector is constantly innovating to adapt its technologies to new market needs (e.g. bio-CO₂, bio-LNG, biohydrogen), **commercialize innovative technologies** to treat a variety of feedstocks (e.g. gasification), **deploy**

modular designs for faster builds, and **achieve cost reductions** by scaling up RNG production to benefit from economies of scale and by industrializing the sector. **Synergies between low-carbon fuels** are exploited in advanced biorefineries to leverage infrastructure and support growth, while minimizing technology and execution risks and costs. These innovations are crucial to respond to current RNG challenges, among them, accelerate the buildout of capacity to meet 2030 decarbonization targets. As RNG and hydrogen are both crucial clean energy carriers to drive towards a decarbonized economy, **cohesive and non-discriminatory policies across hydrogen and RNG industries must be developed**.

Global RNG production expanded to 7.7 billion cubic metres (bcm) in 2022, a growth of 20% compared to 2021, driven by Europe and North America. **It is estimated at 9.5 bcm in 2023**, an increase of 23%. These increases will seem modest when the investments decided in 2022/2023 materialize. The time necessary to get permits (at least 2 years) and build new facilities (18 months) means that the new wave of RNG plants decided in the wake of the 2022 energy crisis in Europe and the passage of the IRA in the US will be seen starting in 2025/26. While current production is concentrated in Europe, North America, Brazil, China and India, **several countries in Asia and Central and South America initiated RNG production in 2023**. Driven by strong structural policy and market drivers, **the RNG market is poised for a huge expansion over this decade and beyond. The targets announced by regional and national governments around the world exceed 100 bcm/y by 2030**. Reaching this ambitious level requires the adoption of the right policy and regulatory framework, an acceleration of support, and faster permitting, which many governments have put in place in 2023.

Developments by major region

Europe is leading global RNG production. European production grew almost 20% to 4.2 bcm in 2022 (3.4 bcm in the EU), driven by growth in France, Denmark, Italy and the UK mainly. Production is estimated at 5 bcm in 2023 (+ 19% year-on-year). RNG represented only 1% of EU gas demand in 2022, but in some countries this share has already reached 30% to 40%. The number of production facilities exceeded 1,300 at the end of 2022. France is leading with 514 RNG facilities. European RNG demand is rising, driven by **strong growth in the transportation sector and decarbonization needs of industrial users**. Energy utilities are investing massively in RNG as a key component of their decarbonization policies and clean energy supplies. Energy majors and financial investors have continued their substantial support to the sector. RNG national markets across Europe remain quite heterogeneous, but nearly all countries have adopted (or are in the process of adopting) new regulation and financial incentives to support RNG development. Although cross-border trade is not yet harmonized, **trade of certificates increased significantly in 2022**. The trade was boosted by elevated natural gas and carbon prices, the EU ETS and national trading systems (as biomethane certificates can now be used within the EU ETS and in some national trading systems).

The European RNG sector is experiencing multiple tailwinds, including regulatory support for clean energy sources, industrial decarbonization goals, and a heightened focus on energy independence. Since the publication of the REPowerEU plan, **significant progress has been made towards achieving the 35-bcm target**. The Biomethane Industrial Partnership (BIP), launched in September 2022 to support the achievement of the 35-bcm target and further growth beyond, has identified the fundamental factors to de-risk investments and create a positive business case. **The BIP's recommendations are key** to enable policy makers, notably in nascent EU markets, but also in some mature markets, **to put in place robust frameworks to foster investments** in the sector. EU governments have submitted their draft National Energy and Climate Plans (NECPs). **The draft NECPs targets add up to a biomethane production of some 20 bcm by 2030**, with several countries – including Germany, the largest producer – not having reported any targets. While this clearly indicates an acceleration of EU biomethane production, it also shows that catalysing biomethane demand and setting more ambitious NECPs targets are critical to achieving the 2030 scale-up. Key regulations adopted in 2023/24 at EU level bring **a mix of positive and inconsistent signals to the sector**. Biomethane has received a boost with the adoption of the new Renewable Energy Directive (RED III) and the Net Zero Industry Act. The business case for biomethane producers has been improved in the final text of the Gas Package. However, the final text does not mention a binding EU biomethane target. There are also mounting access barriers to certain end-users (road transportation).

The US has reinforced its leading position, accounting for almost a third of global RNG production. Production increased to 2.5 bcm in 2022 from 275 RNG facilities and is expected to exceed 3 bcm in 2023. The sector is propelled to new heights by the IRA. **The IRA is a game changer for RNG**: it creates substantial fiscal support to biogas for all end-uses and extends credits for alternative fuels in transportation. Moreover, the US Environmental Protection Agency (EPA) has **increased the RFS's RNG production volumes significantly** – a doubling in three years – and set targets for three years for the first time, giving more visibility to investors. The

long-term future of RNG as a transportation fuel (after 2040) under the LCFS is more uncertain as the scheme is undergoing substantial regulatory changes. While most RNG developed to date has been in response to federal and state policies encouraging the vehicle fuels market, **additional demand from non-transportation sectors is poised to drive massive growth in RNG demand. Voluntary customers have become a key growing market for RNG**, driven by ESG-related goals and reporting requirements. **A growing number of natural gas/energy utilities are participating in the RNG market** by adopting voluntary initiatives, setting RNG/green gas blending targets, and even developing non-regulated subsidiaries to produce RNG. California has adopted the first RNG standard in the country: 12% of demand by core customers (residential and small commercial customers), will have to be supplied by RNG by 2030. RNG use is also spreading to the production of electricity and hydrogen. **In Canada, the RNG sector has entered an exponential growth era.** Production is surging, although from a small base (0.24 bcm in 2022). The growth is driven by provincial green mandates and voluntary programs, the federal Clean Fuel Regulation (CFR), launched in July 2023, the spreading of RNG production to more provinces and the entry of new players in the sector. Given the substantial financial support and flowing investment in the sector, **North American production could register a five-to-seven-fold increase by 2030 from 2022 levels to 15 bcm-20 bcm.**

The significance of RNG for China has been strengthened since 2022. New policy guidance has been issued to accelerate RNG production and guide the industrialization of the sector. **There is a strategic shift to comprehensively promote the rural revitalization with the construction of large-scale biomethane clusters at county level** to help the establishment of a circular economy and expand the use of clean gas. Since the global energy crisis, the development of RNG is also seen as an important measure to ensure domestic energy supplies and **improve security of gas supply.** The establishment of the **domestic carbon market** also provides a platform for RNG to realize market value. The still undeveloped sector (an estimated production of 0.3 bcm in 2022) is expected to register **an accelerated development during the 14th Five-Year-Plan** period (2021-2025), driven by the expansion of its end-use market, notably to hard-to-abate industrial users, improvement in policy support, better grid access, the adoption of a promising cluster model at county level, and the participation of large national companies and key foreign companies in the sector. The government production target of 20 bcm/y by 2030, established in 2019, remains unchanged in recent policy documents.

In India, emissions reduction targets, the need to improve air quality and economic development in rural areas, and the urgent need to reduce dependence on high-priced imported fossil fuels, are spurring growth in bio-CNG production. **The government has launched two new initiatives** to address the various impediments that pulled back achieving the SATAT goal of 5,000 bio-CNG plants by 2023-24 – representing 21 bcm/y of RNG production. **A new support scheme to biogas/bio-CNG (GOBARDhan) was launched in January 2023.** Combined with an **investment of \$1.2 billion**, the scheme will enable the building of 200 RNG plants. In addition, to further facilitate the growth of the sector, the government has introduced **a mandatory blending of bio-CNG** in the city gas distribution sector, starting at 1% in 2025-26, gradually raised to 5% from 2028-29. These policy initiatives have driven a new momentum for RNG in India. There are now more than 500 bio-CNG facilities in operation, under construction and in advanced stage across the country with a production capacity of 2.6 bcm/y, a huge leap from the 0.07 bcm produced in 2022 from 62 plants. **The bio-CNG sector in India is poised to exponential growth** driven by these new policy initiatives, growing gas needs and a surging natural gas vehicle (NGV) market, the entry of large domestic and foreign corporations into the sector, and a huge biomethane potential.

In Brazil, the commitment to reduce carbon and methane emissions, the energy crisis, growing dependency on fuel imports and shortage of fertilizers, have **raised the importance of biogas/biomethane in the country.** RNG production is surging and reached 0.35 bcm in 2022. The acceleration of RNG production is driven by policy support (e.g. the Metano Zero program), certification of RNG, large investments from waste management, energy and biofuel companies, and the huge feedstock potential for producing RNG. Rising demand by large corporations, industrial customers and gas distribution companies, together with a massive growth in bio-CNG to displace high-priced diesel imports, are also propelling the sector to new heights. Moreover, **Brazil could adopt a mandate for biomethane (Fuel of the Future Bill)**, starting with 1% of all gas consumed in the country in 2026, and reaching 10% by 2034. The biomethane mandate would give the security needed by investors to develop the full biomethane potential of the country and **make Brazil, already a global leader in the production of biofuels, a global giant in the sector.** According to the Brazilian Biogas Association, **Brazil could produce 11 bcm/y of biomethane by 2030.**