IFM Investors

2025

Infrastructure Horizons

The forces shaping the future of infrastructure investing

Contents

Introduction

The forces shaping the future of infrastructure investing

Infrastructure is increasingly on investors' minds. This comes as governments pursue investment to fuel growth and enhance energy security, while the digitisation, decarbonisation and deglobalisation trends draw in private capital.

At the same time, geopolitical tensions and the rise of protectionist policies risk a resurgence of price pressures and market volatility. Against this backdrop, we believe infrastructure's role as an inflation hedge and its historically reliable returns have come into sharper focus.

Infrastructure is also maturing as an asset class. The development of equity and debt solutions across the risk spectrum is driving new commitments. Infrastructure investors are working with governments to help set the agenda and put capital to productive use. Meanwhile, we believe new opportunities such as data centres and facilities adjacent to air and sea ports are blurring the boundaries with other asset classes, including real estate.

This report focuses on six themes that we see reshaping the infrastructure market, including:

1 **Infrastructure's horizons expand**
Investors are moving beyond a monolithic view of infrastructure to focus on the distinct risk-return profiles of infrastructure equity and debt, of different sectors, sizes of deal, thematic exposures and of developing, mature and adjacent opportunities.

2 **Flying into the future**
How can we reduce airline emissions? Sustainable aviation fuel is the only medium-term pathway currently available to decarbonise aviation. Encouragingly, it requires little change to either existing aircraft or refuelling infrastructure.

3 **Turning trash into treasure**
New types of energy production are turning a problem into a solution – or agricultural and municipal waste into a sustainable source of fuel. We look at how emissions from landfill and farm waste are being transformed into renewable natural gas.

4 **AI's challenges and opportunities**
Data centres are powering the AI boom. Together with fibre networks, we believe they are creating enormous investment opportunities. AI can also revolutionise productivity across infrastructure assets – but we cannot ignore the challenges it brings.

5 **The next generation of energy**
To meet rising energy demand, the next generation of energy must integrate various renewable sources with innovative energy solutions, with co-location of energy and energy-intensive infrastructure on the rise.

6 **Deglobalisation and infrastructure**
In a fracturing world, governments are focusing on energy independence and boosting advanced manufacturing capabilities. Such shifts are reshaping the opportunities for investors in infrastructure debt.

IFM Investors

Luba Nikulina
Chief Strategy Officer

Expanding horizons

Infrastructure's maturing as an asset class demands fresh thinking

The maturing of infrastructure requires a greater willingness by investors to disentangle the risk and return drivers of the asset class, moving away from the view of infrastructure as a monolithic whole to a risk factor-based approach.

Key takeaways

1. Investors need to consider infrastructure opportunities in terms of risk exposure and return characteristics, rather than pursuing a single-minded focus on core assets.

2. Engaged, active asset managers can extract additional returns through targeted capital expenditure, expanding assets in what is often a proprietary deal.

3. A growing number of thematic opportunities, developing assets, or those adjacent to traditional infrastructure offer the potential for higher returns and the possibility to add value.

For decades, infrastructure was viewed as a reliable, homogenous asset class, with airports, toll roads and utilities the cornerstone of institutional investors' exposures. In Australia, where superannuation funds began investing in infrastructure 30 years ago, they have reaped the benefits of long-term ownership of many of the country's busiest air and sea ports. Their buy-and-hold approach is now sought after as the model to emulate by governments the world over.

But as infrastructure matures, and interest from institutional investors continues to grow, it is time to move away from the perception of infrastructure as a monolithic sector. We should instead consider opportunities in terms of the risk taken on, the sectors in which we invest, and the assets' distinctive return characteristics.

Infrastructure as ballast and buoyancy

The maturing of infrastructure will be an evolution rather than a revolution. The asset class will retain the same fundamental traits: cashflow generative, backed by hard assets, socially vital and difficult to replace, with significant barriers to entry and low competition. We can view infrastructure in nautical terms – as a ship's ballast, which also supplies buoyancy. It provides resilience and stability (the ballast), while also offering the potential for returns to support portfolio outcomes (the buoyancy). Its resilience stems from the fact that infrastructure assets often underpin a well-functioning society. Its users rely on the freight moved through sea ports or the water provided by utilities, regardless of economic circumstances. Both infrastructure equity and debt can provide the ballast and buoyancy that appeal to investors.

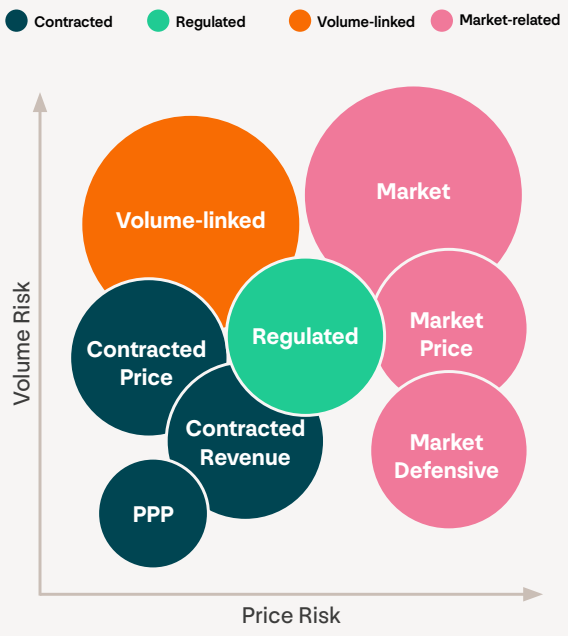
Yet as the sector matures, we can start to shift away from labels that no longer reflect its evolving dynamics. Toll roads and airports have traditionally been viewed as core infrastructure assets. Today it can be more useful to think of infrastructure in specific sectoral terms, such as where to consider an allocation to transportation, social and energy infrastructure or utilities.

What role is infrastructure performing?

Alternatively, we can consider the specific characteristics that infrastructure can offer investors. Should infrastructure equity be broken down into assets offering inflation protection and cashflow certainty, and those that present greater opportunities for growth? Where investors desire reliable income, underpinned by contracted revenue streams and robust covenants, should they consider the benefits of infrastructure debt over equity? Debt makes up the majority of infrastructure transactions and can offer interesting and complementary characteristics in portfolios. So rather than viewing all infrastructure as a homogenous asset class, investors could instead view it through the prism of the risks to which each asset exposes their portfolio, as well as the ways in which it can generate value and income over the longer term.

FIGURE 1

INFRASTRUCTURE RISK FACTORS



*Public-Private Partnership

Source: IFM Investors

> **While developing infrastructure assets do not offer the same level of resilience as mature ones, their return potential can be considerable.**

Mature versus developing opportunities

Another way to think about infrastructure is to divide it into mature and developing opportunities. Mature assets are existing toll roads, airports and bridges, where extracting additional return requires experienced asset managers exploring new ways to add value with management teams. One way to achieve this is through capital expenditure, as IFM Investors frequently does. These transactions are proprietary deals that only the experienced owner-manager with a long time horizon and well-established operational capabilities can access. Think of the opportunity for marine terminals to capitalise on demand for energy security and more sustainable fuel sources, as VTTI's recent acquisition of a majority stake in Italy's largest liquefied natural gas import facility attests. These transactions can benefit investors and also improve the value proposition to the wider community.

Some mature assets require an experienced manager to turn around their fortunes. These opportunities can arise upon privatisation, or where an asset suffers from high levels of debt and the threat of bankruptcy. Opportunities can also arise where the previous owner has failed to commit sufficient capital to the asset. This requires a new owner to invest significant sums, such as improvements to road quality and safety upon first acquiring a toll road.

Alongside mature infrastructure, significant capital must also be deployed in developing fields that require an appetite for construction risk, such as energy and digital sectors. The energy transition and the shift to a low-carbon economy are driving increasing capital requirements. The rollout of renewable energy requires a transmission network to connect new solar and wind farms to the homes and businesses consuming it. While developing infrastructure assets do not offer the same level of resilience as mature ones, their return potential can be considerable.

Other opportunities are arising in a 'goldilocks' zone. These are transactions that are neither too big nor too small, yet are often overlooked by infrastructure funds more interested in closing one or two large transactions. These mid-market opportunities are more frequent, and have more attractive competitive dynamics than larger transactions. They present opportunities for experienced managers to implement operational improvements and, potentially, sell selectively.

Some infrastructure opportunities are emerging at the intersection of traditional asset classes. Should a business park adjacent to a major airport be commissioned, built and managed by an airport operator with relationships with airlines flying in the freight? Or should it be an initiative of a real estate developer with relationships in industrial property and connections to large retailer customers? Investors would do better to weigh up their exposure to infrastructure, real assets, or even to risk-based factors, disregarding more conventional asset labels.

Alternatively, many investors are seeking to explore the opportunity set of infrastructure thematically. Three megatrends are reshaping both the asset class and the broader global economy. The energy transition is driving investments in renewables; digitisation of the economy and the advent of AI is driving opportunities in data centres and the expansion of fibre networks. Meanwhile, the reshoring of industries, and a focus on national self-sufficiency, presents opportunities to build and expand energy production, factories and logistics infrastructure.

Building out your neighbourhood

We are also seeing the emergence of opportunities within the 'neighbourhood' of infrastructure. These infrastructure-adjacent opportunities often benefit from the same economic protections as the core assets they supply – albeit without the regulatory framework directly underpinning their day-to-day operations – with the potential for higher returns and the opportunity to add value. This underlines how the categorisation of the asset can be less important than how it generates income and weathers economic cycles.

Infrastructure-adjacent opportunities can include water treatment plants that service growing catchments of metropolitan areas and offer drought protection in regions where water stress is common. They can include facilities adjacent to sea ports that shift freight to trains rather than trucks, helping reduce the carbon emissions associated with goods transport.

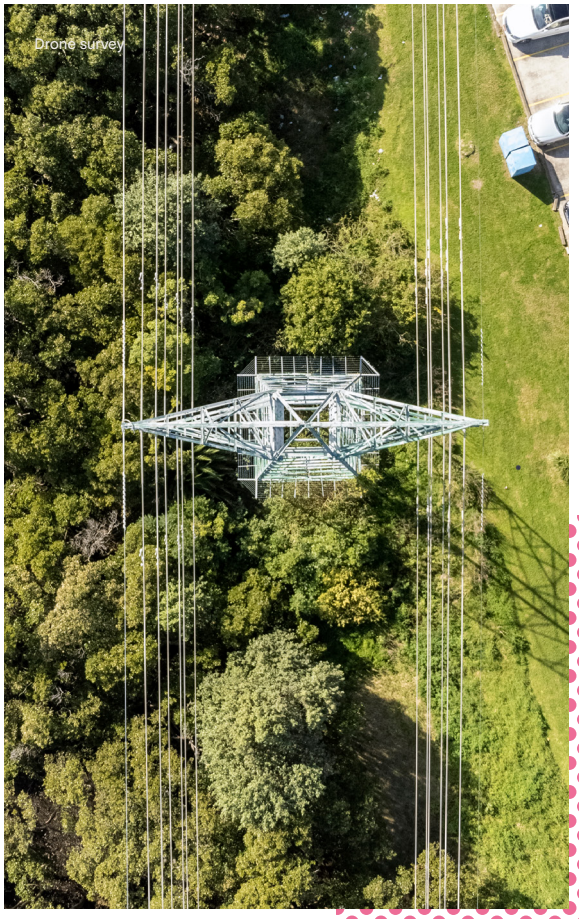
As a leading private markets manager with deep expertise, experience and networks in infrastructure equity and debt, and a growing capability in technology-focused growth private equity, we are particularly interested in the confluence of technology and critical infrastructure. Some infrastructure-adjacent opportunities resemble private equity in their risk and return potential. They can be compelling due to their increasingly important role in securing and enhancing a core asset's performance – by delivering cost efficiencies, power bill reductions, improving safety standards or other aspects of performance.

[1] Drone inspections - Ausgrid

Importantly, pursuing ventures that more closely resemble private equity allows us to build an understanding of a nascent and emerging opportunity set. Many of the niche opportunities capitalised by private equity have the potential to grow and become part of the mainstream infrastructure market.

For example, one of Australia's largest energy distributors, Ausgrid, has invested in drones to inspect its vast network, which supplies electricity to millions of people in New South Wales. The drones, typically weighing less than 2kg, can be used to survey hard-to-reach areas for bushfire prevention efforts, remove objects and untangle power lines[1]. Similarly, ageing water utilities could invest in artificial intelligence to better monitor water leakage and potential sewerage spillage – increasing the precision of maintenance programmes and minimising regulatory fines.

The opportunity set and investment universe of these infrastructure technology opportunities are only limited by the speed of technological developments emerging. Consider how far AI has come in ten years, or how drone technology has reduced in cost, making drones viable equipment for anything from surveillance to firework displays. These new opportunities span a range of important investment themes and megatrends, from capturing the energy transition to digitisation and automation.



Conclusion

As infrastructure matures and develops as an asset class, it demands fresh thinking from asset allocators. Infrastructure retains its distinct characteristics – and now it spans the full range of risk appetite, from secure debt investments to high-yielding opportunities equivalent in return to private equity. This evolution encourages not a uniform but a more nuanced and sophisticated approach from investors.

[1] Drone inspections - Ausgrid

IFM Investors

Sebastian Domenech
Executive Director,
Asset Management

AI at a crossroads

How AI is reshaping infrastructure investment

The AI revolution is expected to profoundly impact the infrastructure space, creating significant opportunities for investment and enhancing value of existing infrastructure. Like any revolution, it will also bring about relevant challenges.

Key takeaways

1. AI is expected to drive growth in demand for key infrastructure, which we believe will create significant opportunity for investment.
2. Implementation of AI is expected to power relevant improvements in financial and operational performance of infrastructure assets.
3. A holistic risk management framework needs to be in place to identify and address emerging risks and ensure sustainable positive outcomes for all stakeholders.

Artificial Intelligence (AI) is a near-overnight business success, about 80 years in the making. While AI has been present and integrated in businesses for decades in one form or another, the most recent breakthroughs in generative AI have opened up an entire new world of possibilities. AI, like electricity and the internet, is a general-purpose technology that can impact many aspects of human civilisation, and the infrastructure space is no exception.

The rapid adoption of generative AI is creating a surge in demand for key infrastructure to support deployment, thus creating an immense opportunity for investment in new projects. In addition, existing infrastructure assets are expected to derive relevant operational upside from AI adoption, thus increasing the value of these assets to society and their owners.

At the same time, AI poses a host of novel challenges that could have profound implications for human civilisation. This article focuses more specifically on challenges that we believe will directly affect the infrastructure space—including increased cybersecurity risks, algorithmic issues (errors, biases), data issues (privacy, intellectual property), and labour challenges. Infrastructure investors and asset operators alike must ensure that AI systems are deployed thoughtfully and in consideration of all stakeholders.

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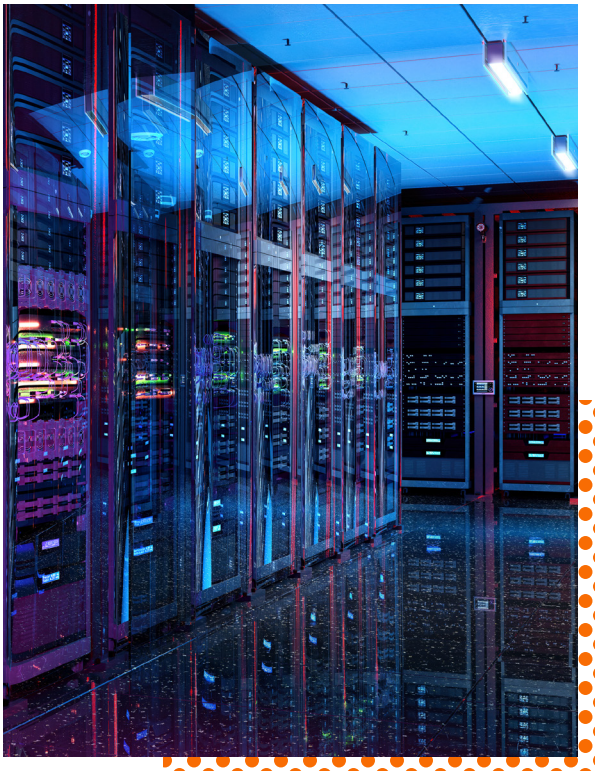
New investment opportunities in infrastructure

The recent breakthroughs in AI were made possible by substantial increases in computing power, algorithm development, and the massive accumulation of data humankind has built up over decades.

AI experts agree that the momentum for AI development is unstoppable. While there is an element of hype at some levels of the "AI value chain", the total potential business value AI can create is so significant, that the fundamentals for continued strong growth in demand for data storage and computer processing power are undeniable[1].

This calls for massive investment in the complex infrastructure network that is required to run AI. This network is composed primarily of 1) data centres, 2) the electricity that is required to power them, and 3) the fibre network to connect them to users.



Opportunities

Data centres – Global demand for storage and computing power in third party data centres has grown rapidly in the last decade, on the back of global corporate trends that include digitisation of processes and migration of data storage and computing power to the cloud. Global professional services company McKinsey estimates that global demand for data centres could reach 219 GW by 2030 (approximately quadrupling demand in 2023 and requiring investment of over $250 billion.[1])

Electricity – According to the US Department of Energy, electricity demand from US data centres has grown dramatically in the last decade, climbing from 58 TWh in 2014 to 176 TWh in 2023, and is expected to climb to levels between 325 to 580 TWh by 2028[2]. At the same time, many aspects of civilisation are being electrified, which we believe will create an enormous opportunity for investment in energy generation and grid enhancement.

Fibre networks – Fibre network investment has experienced headwinds in recent years due to a combination of rising interest rates, increasing development costs and the saturation of the most economically attractive urban markets. The development of large-scale data centres that need to be connected to users—especially those that are being developed in secondary and emerging data centre markets (further away from large urban centres)—is creating more attractive conditions for investment in new fibre network deployment.

[1] McKinsey - AI power: Expanding data center capacity to meet growing demand
[2] Berkeley Lab – Supported by the US Department of Energy - 2024 United States Data Center Energy Usage Report

CASE STUDY

Switch – data centre platform[3]

Funds managed or advised by IFM Investors made their first investment in a data centre platform in 2022. IFM partnered with DigitalBridge and acquired all outstanding shares of common stock in Switch, Inc. (NYSE: SWCH) in a take-private transaction with an enterprise value of ~$11 billion (as of 6 December 2022). At the time, Switch operated 16 top-tier data centre facilities located across five strategically located campuses in the US, and has since opened three new facilities and has expansion plans for nearly 20 more in the next decade.

We believe Switch is not only a strategic asset providing the proverbial 'picks and shovels' to large customers with significant demand for data centre services, but it also has advantages and distinct market positioning amongst data centre providers.

Switch was founded in 2000 and has built a tremendous business, team, and know-how that is valuable during a high-growth period that the business has now entered.

This is evidenced by Switch's profitability, renewable energy utilisation, large landbank within its operating campuses, and its dedicated construction and procurement teams, which can accelerate its ability to grow its platform. Further, we believe Switch's proprietary data centre designs and diversification in customers, regional markets, and physical data centre locations, effectively mitigate downside risk.

IFM views Switch as a data centre builder and operator finely-tuned by decades of experience that is well positioned to capitalise on the many tailwinds for storage and computing.

Switch LAS VEGAS 12 Data Center

[3] Case studies are provided for illustrative purposes only and should not be relied on to make an investment decision.

Operational upside for infrastructure assets

Generative AI is expected to create sizeable economic benefits, given its potential to transform work and to accelerate technological development across industries. Global professional services company Accenture estimates that Generative AI can create up to $19.9 trillion in economic value by 2038, with a people-centric approach that maximises productivity growth.[4]

Infrastructure assets are expected to benefit from this positive trend in multiple ways. First, IFM anticipates that the ensuing economic growth will bring increased demand for all types of infrastructure assets, including transportation, utilities and energy-related infrastructure, positively impacting the top line.

Second, a broad deployment of AI is enabling material improvements in efficiency through increases in productivity and optimisation of operations across the value chain of infrastructure assets. Together with increased demand, these efficiency gains will have the potential to translate into enhanced returns for infrastructure investors.

Finally, infrastructure assets are positioned to achieve tangible improvement in the quality of services they provide, including safety and customer service, significantly enhancing the value of these assets to end users and society at large.

[4] Accenture - Work, workforce, workers - Reinvented in the age of generative AI
[5] World Health Organization – December 2023
[6] International Labour Organization – November 2023

AI in practice

Safety first – Despite being well into the 21st century, humanity still faces an unacceptable toll from accidents, with nearly 1.2 million transit-related fatalities[5] and almost three million work-related deaths annually[6] worldwide. The wide adoption of new technologies powered by AI, including autonomous vehicles, robotics, and human enhancement technologies, will enable infrastructure companies to dramatically reduce, and, hopefully, eventually eliminate such tragic events.

Customer experience – Users of infrastructure assets can anticipate enhanced services driven by a broad range of AI-powered applications. For example, road users will enjoy lower rates of congestion due to improved traffic prediction and incident management technologies. Airport users will enjoy better experiences through improved safety and security technologies, such as biometric screening, while utility users are expected to enjoy increasingly agile and effective customer support interactions due to enhanced customer service technologies.

Efficiency – Like most industries, infrastructure stands to benefit from AI solutions that boost labour productivity (see discussion below on AI's impact on labour) and enhance the efficiency of both administrative and operational processes. In particular, infrastructure assets will benefit from improved asset maintenance processes and energy efficiency. All of these efficiency enhancements are expected to contribute to the bottom line and to the sustainability of infrastructure operations, thereby increasing risk adjusted returns for investors.

Revenue optimisation – Infrastructure assets will benefit from improved capabilities to predict usage volumes and reduce congestion. AI powered models will increasingly benefit from growth in the deployment of sensors, and the increasing ability of AI to make sense of new and massive amounts of data. In turn, these developments will improve assets' ability to stimulate volume, increase utilisation, and assist in better timing capex expansion programmes.

CASE STUDY

Manchester Airports Group[7]

At Manchester Airports Group (MAG), which encompasses Manchester, East Midlands and Stansted airports, IFM is driving transformation by harnessing the power of AI. MAG partners with service providers that help enhance the company's digital and AI capability across all areas of the organisation, allowing for operational optimisations and enhanced customer experience.

MAG's AI models can predict how many passengers will be present at security during different times of the day. The forecasting module, which is benefiting from technological breakthroughs in AI algorithms, has now become accurate enough to drive meaningful operational benefits. With such accurate predictions, the manual effort required to produce end-to-end operational plans is significantly reduced, allowing enhanced planning, supply and resourcing, and ultimately better service.

The results of these AI deployments speak for themselves. Indeed, during a six-month span across MAG's airports tracked from March to August 2024, 98% of passengers passed through security in less than 15 minutes, while at Manchester Airport seven million more passengers pass through security in less than five minutes than before the technology was used.

Further, MAG co-developed an innovative, industry-first solution, which combines flight data, weather conditions, and historical trends to more accurately calculate flight arrival and departure times. During its first months in operation, the model was 5-10% more accurate at predicting actual airfield movements versus the scheduled timing. If accuracy can be maintained and increased, the opportunity lies in maximising aircraft movements during peak times.

We believe that MAG demonstrates the potential improvements AI can bring to existing operations, and IFM aims to apply similar strategies across our portfolio of airports.

[7] Case studies are provided for illustrative purposes only and should not be relied on to make an investment decision.

AI challenges

While AI will have a broad and profound impact in the long run, we are focusing on its more immediate impact on infrastructure assets.

Similar to other industries, the infrastructure sector faces an intensification of existing challenges, such as cybersecurity threats and the impact of automation on the workforce. It must also contend with new risks, including algorithmic issues stemming from generative AI solutions. These challenges can have potentially harmful effects on the numerous stakeholders connected to infrastructure assets.

Compounding the challenge, the fast-moving evolution of the technology leads to a growing gap in the development of regulation that will be necessary to manage and mitigate these risks in a consistent and system-wide fashion.

This situation calls for a proactive approach by companies in developing robust frameworks that allow owners and managers to identify, understand, and address the emerging risks brought about by the technology. Below is a non-comprehensive list of challenges posed by AI, which are relevant to infrastructure assets.

Key AI challenges

Cybersecurity – AI is arming bad actors with increasingly powerful tools that allow them to produce more sophisticated attacks, at a significantly lower cost. Generative AI generated code, deep fakes and automated phishing agents are only some of the resources that are being used to increase the volume and effectiveness of well-known threats. In this context, infrastructure assets—most of which provide essential services to society—need to increase their efforts to ensure that the protections they have in place are adequate for the increased levels of risk.

Algorithmic issues – Unlike traditional code that produces deterministic outputs based on the inputs it receives, generative AI models produce outputs that are based on probabilistic parameters. These parameters are set internally through exposing the model to vast amounts of data that allow "training" of the model. The implication is that these models, despite showing increasingly impressive human-like abilities, are not free of errors, biases and even hallucinations. They also potentially expose companies to data privacy and intellectual property issues. This means that any application of these algorithms needs to consider a broad set of risks in order to ensure that potential risk events are within the tolerance thresholds, and that appropriate mitigations are in place.

Labour impact – Generative AI marks a major breakthrough by displaying abilities previously limited to humans, including the proficient use of natural language and creativity. This is enabling the technology to take on complex tasks such as coding, designing, painting, and even composing music. This has enormous implications for human labour, as the technology can perform a relevant portion of tasks that only humans could do until now. Accenture estimates that over 40% of human working hours are in scope for automation or augmentation in the US[8].

[8] Accenture - Work, workforce, workers - Reinvented in the age of generative AI

Conclusion

Generative AI is arguably one of the greatest advancements in human history, with the potential to reshape industries, improve lives, and solve complex challenges. Its ability to enhance decision-making and drive innovation makes it a powerful tool across sectors, not only for infrastructure.

To fully harness its benefits, it must be developed and implemented in ways that maximise its positive impact while proactively addressing potential risks, such as cybersecurity and misinformation. With thoughtful integration and responsible adoption, generative AI can unlock new efficiencies, fuel economic growth, and create investment opportunities that drive progress and improve quality of life across society.

IFM Investors

Jacob Otto
Director, Head of Product Specialists - EMEA

Deglobalisation's impact on infrastructure

Deglobalisation is emerging as a major driver of infrastructure debt opportunities, as the US and Europe look to onshore vital industries.

Key takeaways

1. We believe a renewed focus on the reshoring of industries and building economic self-sufficiency will present investment opportunities.

2. Energy policies and the power generation and transportation landscape are evolving differently in the US and Europe.

3. Protecting growth drivers such as the digital economy and advanced manufacturing will require increased infrastructure investment, from fibre networks, data centres, factories and logistics to transportation.

In many ways, the global economy is more deeply interconnected today than at any point in human history. However, deglobalisation has become a popular political talking point, spilling into investor discussions. While we believe the global economy will remain fundamentally interconnected for years to come, we also believe there will be a renewed focus on reshoring of industries and building national economic self-sufficiency, ultimately impacting the patterns of global trade. These trends are driven by, among other things:

- Heightened geopolitical tensions
- Economic nationalism spurred by global competition, the heightened cost of living, immigration concerns, and offshoring
- Supply chain vulnerabilities
- Changes in the resource mix needed to power economic growth and resilience

These movements will shape the next wave of infrastructure investment. Politics and infrastructure have always been heavily intertwined. Support for infrastructure can take many forms and is particularly important for greenfield infrastructure development and growth. A wave of deglobalisation will particularly impact infrastructure investment through:

1) The promotion of energy independence, and
2) Protecting future drivers of growth domestically

These policies will help shape our outlook for debt investing in infrastructure sectors over the coming quarters. In this paper we will consider the landscape in both Europe and the US.

> **In many ways, the global economy is more deeply interconnected today than at any point in human history.**

Promotion of energy independence

Each nation's pursuit of energy independence will look different based on its available natural resources and attitudes towards reducing emissions.

European perspective

In Europe, globalisation led to a reliance on cheap, imported Russian gas, the risks of which became obvious with the outbreak of the Russia-Ukraine war. Immediate actions included increasing imports of hydrocarbons like Liquefied Natural Gas (LNG) from friendlier countries, with the US becoming the leading LNG exporter in 2023. Given Europe's political support for decarbonisation, domestic energy production increases will focus primarily on renewables, where solar, wind, and hydroelectric power have all played a role. Europe has consistently installed around 15 GW of wind capacity over the past 10 years[1], of which around 80% has been onshore. We expect to see further growth in the offshore sector, although supply chain and performance issues could slow deployment. Solar power continues to be very cost-competitive; however, reliable sunshine and land-use trade-offs challenge widespread deployment.

Countries will also need to find ways to generate and transport low-carbon power from places where it is efficient to create, to where it needs to be consumed. Not every country can feasibly deploy commercially viable renewables capacity to power their own grids.

Policy initiatives such as the European Green Deal and the REPowerEU plan have supported the renewables rollout. Norway and Sweden are now two of the largest power exporters to continental Europe via their surplus hydroelectric power. However, in our view, relying on trading energy with regional allies will not be sufficient to meet increasing electricity demand and energy security goals. More capacity is needed, and here Europe will need a multi-faceted approach.

This presents key opportunities for infrastructure debt investors, such as:

- **Increased wind and solar development:** We anticipate continued wind and solar growth, with solar expansion mainly in southern Europe, alongside the UK potentially sourcing renewables via undersea cables from Morocco[2].

- **Grid upgrades:** Europe will need to modernise and interconnect power grids across countries to truly benefit from more renewable energy generation. Investment opportunities lie in domestic grid infrastructure, interconnectors, other transmission infrastructure, and direct feedlines from energy generation sources for energy-intensive projects in the nascent hydrogen economy or for high-powered data centres.

- **Other renewable sources:** Biomass and biogas are 24/7 sources of renewable power that can help balance electricity grids. The key is to ensure sustainable and reliable feedstock sources. Geothermal and potentially increased hydroelectric power in places like the Pyrenees and Alps may also have a role to play.

- **Power generation with carbon capture, utilisation, and storage (CCUS):** Power assets across Europe are responding to evolving climate policy by accelerating efforts to deploy CCUS at commercial scale, with energy from waste and biomass plants driving deployment.

- **The role of nuclear:** The politics of nuclear generation in Europe is complicated. Germany, which produced as much as 170 TWh/year of nuclear power in the 1990s, shut down its last nuclear plant in 2023[3]. Many other reactors in Europe are nearing the end of their useful lives. If these are shut down, even greater investment will be needed in renewables. However, shifting political tides may plant the seeds of a nuclear renaissance akin to what is being seen in the US, which may include small modular nuclear reactors.

[1] Wind energy in Europe: 2023 Statistics and the outlook for 2024-2030, WindEurope
[2] Xlinks Morocco-UK Power Project
[3] Q&A - Germany's nuclear exit: One year after, Clean Energy Wire

CASE STUDY

Waste to-energy plant[4]

Funds advised by IFM Investors provided debt financing for the second largest waste-to-energy operator in the Netherlands. The business is focused on the processing and incineration of municipal, commercial and hazardous waste to generate energy, leading to a reduction in waste volumes going to landfill. It earns revenues through the collection of waste (gate fees) and the sale of energy.

The company has two facilities with a combined permitted capacity of 1,700 kt/year. The first is strategically located next to the Port of Rotterdam, and the second is on the outskirts of the City of Arnhem, near Germany.

We believe both locations are well positioned to receive and process waste and supply energy to continental Europe. The business has plans to build and operate a large CCUS facility in the medium term. Currently, this business is the only waste-to-energy operator with a commercial CCUS facility, and its port location will enable it to leverage existing infrastructure to deploy undersea carbon storage. IFM believes the growth plans combined with its strategic locations mean the business is competitively well positioned to gain market share.

[4] Case studies are provided for illustrative purposes only and should not be relied on to make an investment decision.

US perspective

In the US, political tides have shifted to prioritise energy independence and export, with climate goals taking a back seat. The US possesses an abundance of energy resources, and the Trump administration seems focused on leveraging these resources to maintain energy independence.

After years of relatively flat power demand, two key trends are pushing demand forecasts upward. Electrification of heating and transportation will strain power grids, moving peak demand from summer cooling into winter heating and increasing daily swings tied to electric vehicle (EV) charging. Increased domestic industrial output through an emphasis on onshoring and digitisation of the economy are now being supercharged through billions of dollars of investment in generative AI technologies – representing an opportunity to invest in data centres and the infrastructure to power them.

CASE STUDY

Natural gas power plant[5]

Funds advised by IFM provided debt financing to an 805 MW natural gas power generating plant in the Mid-Atlantic region of the US. The business benefits from higher capacity pricing driven by increasing demand for US power and the need for reliable dispatchable resourcing by the grid operator. Domestic capacity has historically priced at a premium due to imported power limits, transmission constraints, and difficulty constructing new plants. This is expected to continue as load growth and asset retirements tighten reserve margins on the grid.

We believe the business is well positioned to benefit from the forecasted energy demand growth driven by factors including increased EV adoption rates, higher data centre growth, and some building electrification assumed in New Jersey. To date, the business has benefited from conservative leverage, a track record of operations, a robust hedging strategy and experienced equity ownership.

Within the power market, other key investable themes include:

- **Natural gas as a transition fuel:** Natural gas remains a highly efficient source of reliable baseload power and will continue to push out older, inefficient technology and coal fired power. Gas power plants can also step in quickly to maintain grid reliability against fluctuating renewable power output.
- **Solar and wind projects continue:** Even with potential political headwinds, solar and wind capacity can expand in the US, to the extent that projects remain economically competitive. Many projects remain supported at the state level. Broadly speaking, institutional investors may replace funding from the Inflation Reduction Act for economically viable projects. Offshore wind development is more threatened, as President Trump has issued an executive order to halt new offshore wind leases and permits in federal waters.
- **Other renewables:** Geothermal, biogas, and hydroelectric power are less politically sensitive. "Advanced" geothermal projects leverage advances in subsurface modelling and horizontal drilling learned from the natural gas fracking boom to generate clean baseload power. Future water management projects could involve hydroelectric opportunities.
- **Upgrading grid infrastructure:** Like Europe, US grid infrastructure needs significant upgrades in many parts of the country, with transmission lines and transformers operating well beyond their intended lifespan.
- **Nuclear revitalisation:** Driven by demand for clean firm power, operators of three shuttered US nuclear reactors have announced plans to restart their facilities, including a multi-billion dollar commitment from Microsoft to reactivate Three Mile Island in Pennsylvania.

[5] Case studies are provided for illustrative purposes only and should not be relied on to make an investment decision.

Protecting drivers of growth: The digital economy and advanced manufacturing

As debt investors, we are keenly focused on protecting against downside risks. Understanding how growth plans can go wrong is important to our decisions to lend to infrastructure projects (such as rail, fibre, and data centres) supporting manufacturing growth. Even advanced manufacturing companies with significant government support have faced challenges, including Northvolt, the Swedish battery manufacturer that filed for bankruptcy last year. When investing in infrastructure to support growing industries, it is important to understand the competitive forces in an industry, and the strength of the contracts and offtake agreements manufacturing companies are able to secure.

We see opportunities to invest in the following infrastructure assets to support domestic technology and manufacturing development.

Data centre development: This is at the top of the agenda for countries striving to compete in the AI technology boom. The economics for data centres vary regionally, depending on factors like grid connectivity, land availability, local climate, and proximity to major tenants in technology hubs. Data centres are power-hungry and less sensitive to power prices than other users, which can lead to compelling opportunities to invest in the power plants tied to them. They also tend to benefit from highly rated counterparties with strong lease agreements.

Improved infrastructure in rural areas: Reshoring of manufacturing will likely mean factories and logistics infrastructure will need investment in more rural areas where there is sufficient land to build facilities. Digitisation has also created opportunities to invest in the fibre rollout in rural areas to replace less efficient copper wires.

Transportation infrastructure: If supply chains are being rerouted towards allies and trading partners, they will require better local and regional transportation infrastructure. Investment is also needed to electrify transportation to meet emissions reduction targets. We see opportunities to lend to businesses upgrading rail, bus, and ferry infrastructure to make it more efficient, sustainable, and able to handle increased capacity.

CASE STUDY

Fibre-to-the-home[6]

Funds advised by IFM provided debt financing for the largest independent fibre-to-the-home operator in France. The business designs, owns and operates fibre network infrastructure across the country with a focus on low- and medium-density areas where current connectivity is more limited. Currently in France, one in five households lack access to reliable, high-speed internet.

The French government and regulator are very supportive of the provision of fibre networks and the decommissioning of the copper network throughout France to promote digital inclusion via a less carbon intensive source. Unlike many other European economies, the provision of fibre services in France is regulated. Each operator in France has access to the network at determined pricing guidelines and benefits from a permanent right of use of 5% of the network capacity in a given area for a 20-year period. Ultimately this limits the risk of overbuild or over-competition for the provision of fibre services in a given area, especially in low density areas where businesses benefit from subsidies to improve the provision of services.

Conclusion

As the world becomes increasingly digital, we are witnessing economic change happening at a rapid pace. Global trade and mobility will remain important, but as governments seek to protect their domestic economies and improve global competitiveness, we expect to see more protectionist policies. Infrastructure will need to evolve to meet these changing economic needs.

[6] Case studies are provided for illustrative purposes only and should not be relied on to make an investment decision.

IFM Investors

Neil Doherty
Executive Director,
Infrastructure

Marigold Look
Executive Director,
Infrastructure

Integrating renewable energy and digital infrastructure

Pioneering the next generation

To meet rising energy demand, the next generation of energy must integrate various renewable sources with innovative energy solutions.

Key takeaways

1. An increase in energy demand will characterise the infrastructure landscape over the coming decades, creating unique challenges and significant opportunities.

2. Data centres are critical to the digital economy and require large amounts of electricity. Some are approaching renewable energy generators to build new centres on existing renewable sites.

3. Energy operators are increasingly able to enhance energy efficiency and power reliability for data centres by integrating multiple renewable energy sources at the same grid connection point.

The outlook for energy demand, particularly electricity, is increasing at a rate not seen in decades.

This increase in demand will characterise the energy infrastructure landscape over the coming decades, creating unique challenges and significant opportunities. We believe key drivers of this growth include the digital economy—particularly the rise of high-performance computing for AI training and inference, the electrification of heating and transportation, industrial decarbonisation, and the resurgence of manufacturing through nearshoring and reshoring. The primary driver of rising electricity demand is the convergence of energy and digital infrastructure in the private sector, rather than government policy, which has become more uncertain globally.

To satisfy this growing demand, we believe lower-emitting conventional energy, such as nuclear and natural gas, will continue to play prominent roles. However, the next generation of energy—cleaner, abundant renewable energy such as wind, solar, battery storage and bio-fuels—is leading the way into the future.

The convergence of energy & digital infrastructure

The digital economy, powered by data centres and fibre networks, is set to be a key driver of energy demand in the coming years. The digital economy fosters innovation, boosts productivity, and enhances global connectivity, enabling businesses to access broader markets and manage resources efficiently, thus promoting economic growth and creating new opportunities.

Data centres, which require large and stable amounts of electricity, are critical to enabling growth and innovation in the digital economy. Perpetual growth in new digital content and services, including areas such as AI, requires significant investment in both data centres and electricity infrastructure to support their large power needs.

Driven by this symbiotic relationship, we expect a rapid convergence of renewable power generation, energy storage and digital infrastructure to meet surging power demand, while simultaneously

addressing the growing net zero objectives of data centre operators. Rapid technological development in both energy and digital infrastructure will assist in driving the dependency between sectors. For example, advancements in AI and machine learning capabilities are enabling data centre operators to optimise their energy usage, and thus enhance the overall efficiency of operations.

Another key driver that cannot be ignored is the strategic importance being placed on national AI capabilities by governments. This will require strong energy infrastructure to further support the development of local AI capabilities. In January 2025, the US announced the Stargate Project, which involves a $500 billion investment in AI infrastructure across 20 data centres in the near-term in partnership with leading technology companies including OpenAI, Oracle, Microsoft and NVIDIA. On the back of the growing domestic AI focus, the US Department of Energy recently forecast that power demand from data centres would double or triple by 2028 compared to 2023 levels[1].

In tandem with public sector initiatives, US hyperscalers are increasingly looking for innovative solutions to meet the large and increasing power demand from their growing data centre operations. Interestingly, these US hyperscalers have been prominent in the renewable energy market for years. Meta, Amazon, Microsoft and Google alone account for around 40% of US utility solar demand according to a study by UBS, and around 70% of the corporate power purchase agreement market in the last five years.[2]

Indeed, data centres are at the heart of cloud computing, digital media, and digital services, which have all revolutionised how we have used technology over the past two decades. The global expansion of data centres will broaden access to digital activities, with renewable electricity playing a key role in unlocking the digital sector's full potential. We expect that renewable and other forms of low carbon energy—including natural gas alongside nuclear, will be pivotal to meet this demand.

The global expansion of data centres will broaden access to digital activities, with renewable electricity playing a key role in unlocking the digital sector's full potential.

Follow-the-power and co-location

There is enormous demand globally for power from data centre operators, to the point where existing electricity networks in traditional data centre hubs cannot meet power demand. New data centres are therefore decentralising into secondary markets with access to power, and we are seeing an increased demand for green electricity as access to power is critical. Data centre operators are now “following the power” and approaching renewable energy generators to build new data centres on existing renewable energy sites. This can have a range of benefits for both parties, including having guaranteed power (with storage), a captive offtaker through behind the meter solutions, lowering transmission and distribution charges, and reduced curtailment risks.

We believe portfolio companies owned by IFM Investors' funds are well-placed to benefit from this trend and are strategically positioned at the nexus of power generation, electricity networks and data centres through our investments, experience and knowledge of these industries. Given our development capabilities, we understand and are able to speak the same language as data centre developers in order to deliver both generation and storage solutions to provide stable, round the clock power.

Energy operators are also increasingly able to enhance energy efficiency and power reliability for data centres by integrating multiple renewable energy sources – such as wind and solar – at the same grid connection point. This approach improves energy production by leveraging the complementary nature of different energy sources, making the system more reliable. In addition, the combination of different technologies using a shared grid connection improves the productivity of the existing power network, thereby reducing investment requirements for network owners and reducing long term network costs.

[1] US Department of Energy, 2024 Report on US Data Center Energy Usage
[2] Solar is growing faster than any electricity source as Big Tech seeks clean energy for data centers - CNBC.com

Here battery storage can be implemented to create a flexible, or dispatchable, renewable energy plant, combining solar and wind to optimise energy delivery. Beyond cost savings, co-locating storage with renewable energy sources improves energy flow management by storing excess energy during peak production and releasing it during high demand, thus stabilising supply. We believe the diversification offered by hybrid energy systems has the potential to reduce investment risk.

Accelerating renewable energy growth

Global renewable capacity is expected to grow by 2.7 times between 2024 and 2030, according to the International Energy Agency (IEA). This growth is essential to meeting rising global energy demand. As digital infrastructure and electric vehicles become more prevalent, the pressure on renewable energy sources intensifies.

"Considering existing policies and market conditions, our main case sees 5,500 gigawatts (GW) of new renewable capacity becoming operational by 2030," the IEA states. "This implies that global renewable capacity additions will continue to increase every year, reaching almost 940 GW annually by 2030—70% more than the record level achieved [in recent years].[3]"

Of this, solar and wind are projected to account for 95% of all renewable capacity growth through the end of the decade, driven by increasing economic competitiveness worldwide. However, not all wind energy is considered the same. Onshore wind is the more established technology, with a track record extending over decades, while in Europe, the advent of offshore wind continues to accelerate.

Despite the evolving need for more renewable energy capacity globally, permitting and interconnection issues continue to be significant constraints on the commercialisation of new projects, particularly in more nascent jurisdictions. These challenges principally stem from complex and lengthy approval processes with various permitting authorities. Furthermore, interconnection into the grid typically requires extensive feasibility studies and coordination with grid operators, which often prolong development timelines. The market requires continuous permitting and interconnection reform to streamline project approval processes and enable more renewable energy capacity to come online over time.

Conclusion

Renewable energy demand is growing due to the large power requirements of data for AI, and the electrification of several sectors. The decreasing levelised cost of electricity from renewables is expected to continue regardless of changes in the political landscape.

Corporates are developing tailored solutions such as co-locating renewable energy sources with data centres to ensure power security and to gain competitive advantages. Integrated managers who are invested across the value chain look well-placed to capitalise on this thematic, as they can leverage their expertise to provide innovative solutions to the market.

[3] Massive global growth of renewables to 2030 is set to match entire power capacity of major economies today, moving world closer to tripling goal - News - IEA

IFM Investors

Timothy May
Investment Director,
Infrastructure

Flying into the future

Shifting to sustainable fuel sources

Decarbonisation of aviation, a particularly hard-to-abate sector, will hinge on the successful global rollout of sustainable aviation fuel. But how close are we to a widespread use of this drop-in fuel?

Key takeaways

1. Decarbonisation of aviation remains a significant global challenge, with sustainable aviation fuels (SAF) offering the only currently available medium-term pathway to lowering the sector's emissions.

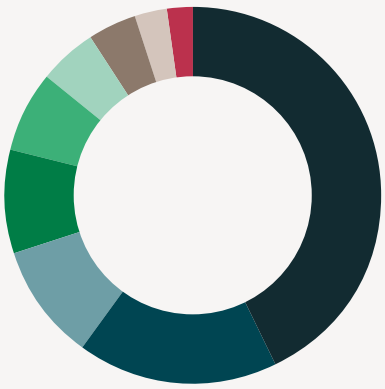
2. Government mandates and production fuel credits have proven effective in encouraging production of SAF globally. Airline-dependent Australia has only recently started its own process.

3. IFM Investors is working with the Australian government and industry to help leverage the country's advantages and get a domestic SAF industry off the ground.

Maintaining the freedom and connectivity that comes with frequent, affordable air travel while decarbonising is a significant global challenge. Over 20% of global carbon emissions come from the transport sector and while some of these emissions can be readily addressed, the 2% stemming from aviation are considered particularly hard-to-abate[1]. This is because the energy density requirements of commercial flight are difficult to meet using electrification or hydrogen. We believe that to decarbonise aviation, a fuel that is lighter than batteries and denser than hydrogen is needed. Sustainable aviation fuel (SAF) meets these criteria and is the only currently avaliable medium-term pathway to decarbonise aviation. Based on one modelling scenario[2], by 2050, replacing 80-90% of aviation fuel with SAF would reduce global aviation emissions by 62%[3].

FIGURE 1

GLOBAL EMISSIONS BY SECTOR IN 2023



Source: Air Transport Action Group (ATAG), 2024

[1] Aviation - IEA
[2] ICAO's long-term aspirational goal SAF avaliability scenarios (see scenario F2)
[3] IATA - Net Zero Roadmaps. Note this is dependent upon assumptions relating to the aircraft technology scenario by 2050.

SAF: An overview

The physical and chemical properties of SAF are almost identical to traditional aviation fuel. It was approved as safe for use in commercial aviation in 2011[4], following the first commercial flight blending traditional and biomass-based fuel in 2008[5]. Since then, approximately 800,000 commercial flights have been flown using SAF blended with traditional aviation fuel. Airlines covering approximately 34% of global passengers have made SAF usage commitments for 2030, although progress is being hindered by availability of fuel and airlines including Air New Zealand have scaled back commitments due to supply and price concerns[6]. One of the great advantages of SAF is that, being functionally identical to traditional aviation fuel, it is compatible with existing aviation fuel supply chains and airside fuel infrastructure, having already been supplied through 132 airports globally[7].

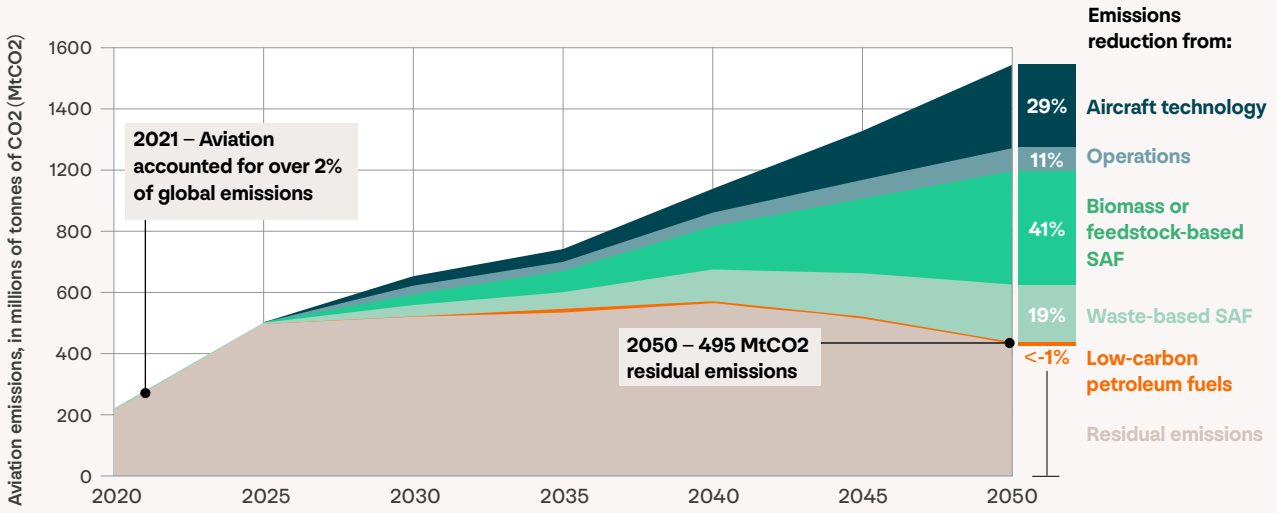
Where traditional aviation fuel is produced from crude oil, SAF can be produced from a range of feedstock readily available, including canola or rape seed oil. Other SAF feedstocks include sugar crops, waste oils, municipal rubbish and agricultural residues.

Unlike other decarbonisation pathways envisaged for aviation, such as engine and aircraft advancements, electrification, and hydrogen, SAF is a 'drop-in' ready fuel which can be blended with existing jet fuel, without significant alterations to airplane engines and refuelling infrastructure.

As a key decarbonisation lever in aviation, SAF is increasingly used across the aviation supply chain. The International Air Transport Association estimates SAF production will reach 2.7 billion litres in 2025. This would equate to 0.7% of all global jet fuel, more than doubling its share compared to the year prior. In the UK, Manchester Airports Group (MAG), a portfolio company of a fund managed by IFM, was instrumental in calling for the now-legislated UK mandate of 10% SAF usage by 2030. In the US, New York's LaGuardia Airport first distributed SAF to an airline tenant in 2022,

FIGURE 2

AVIATION INDUSTRY: GLOBAL EMISSION REDUCTION SCENARIO



Source: International Civil Aviation Organization (ICAO) report on the feasibility of a long-term industry goal for CO2 emission reductions. This is the 'medium' scenario out of a low, medium and high forecast of post-COVID aviation traffic.

[4] ICAO https://www.icao.int/environmental-protection/Documents/Sustainable%20Aviation%20Fuels%20Guide_100519.pdf
[5] News Releases
[6] ATAG 2024
[7] ICAO 2024

transporting the fuel from a Texas refinery nearly 1,500 miles away via two existing pipeline systems – those operated by Colonial Pipeline and Buckeye Partners, both owned by funds managed by IFM. As an owner of multiple Australian airports, including Sydney Airport, Melbourne Airport, Brisbane Airport and Adelaide Airport, rollout of SAF in Australia is a critical component in the continued decarbonisation strategy of IFM managed portfolios. Where many airports, including those owned by IFM managed funds, have successfully tackled Scope 1 and Scope 2 emissions, for instance by installing on-site solar arrays procuring renewable energy via power purchase agreements or electrifying fleet vehicles, most of an airport's Scope 3 emissions come from aircraft emissions.

Currently, however, global SAF supply is constrained, with 77 in-production SAF refining facilities which produced an estimated 1,900ML of SAF, or approximately 0.5% of total aviation fuel demand in 2024[8]. Of this, the overwhelming majority has been produced via the Hydrogenated Esters and Fatty Acids (HEFA) process, and S&P forecast 70% of all SAF will still be made via the HEFA process in 2030[9]. By 2050, global SAF demand is forecast to reach 330ML/d with the highest penetration in Europe (c. 50%) and North America (c. 35%)[10]. Commitment to increasing the global SAF supply is therefore necessary, with the Clean Skies for Tomorrow global target of 10% SAF across the aviation supply chain by 2030 backed by the wider industry, including Brisbane Airport[11].

Establishing a new industry

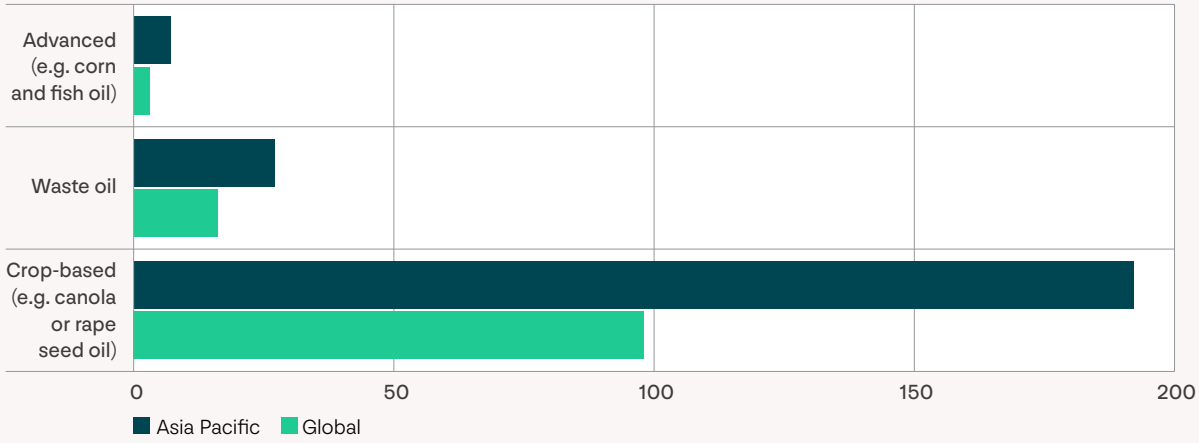
IFM Investors has a global exposure to the development of SAF markets and has seen some jurisdictions make rapid progress, while others move relatively slowly. The European Union's mandate of at least 20% SAF blended into existing fuel by 2035, increasing to 70% by 2050, is an example of a clear demand-side indicator of appetite for increasing SAF production. Similarly, the US Inflation Reduction Act Sustainable Aviation Fuel Credit is an example of a robust and effective supply-side incentive to drive investment into SAF supply chains.

In comparison, Australia has only recently begun to take its first meaningful steps towards establishing a domestic SAF industry. The government has started consulting with industry regarding supply and demand side support measures. We believe Australia has natural advantages which have the potential to create a generational opportunity to become a significant global producer of SAF - not least of

[8] ATAG, 2024
[9] S&P (2024)
[10] S&P (2024)
[11] Advancing Australia's sustainable aviation fuel industry | Brisbane Airport

FIGURE 3

FEEDSTOCK THAT CAN BE USED FOR SAF PRODUCTION, IN MILLION TONNES



Source: McKinsey Sustainable Fuels Practice (2024)

which being that the Asia-Pacific region produces an outsized share of SAF feedstock. Approximately 51% of global grains for SAF stem from the region, with significant shares in advanced feedstocks such as corn and fish oil (see Figure 3)[12]. Since 2022, IFM Investors has been engaged with government and industry to unlock this generational opportunity for Australia.

Working with industry and government

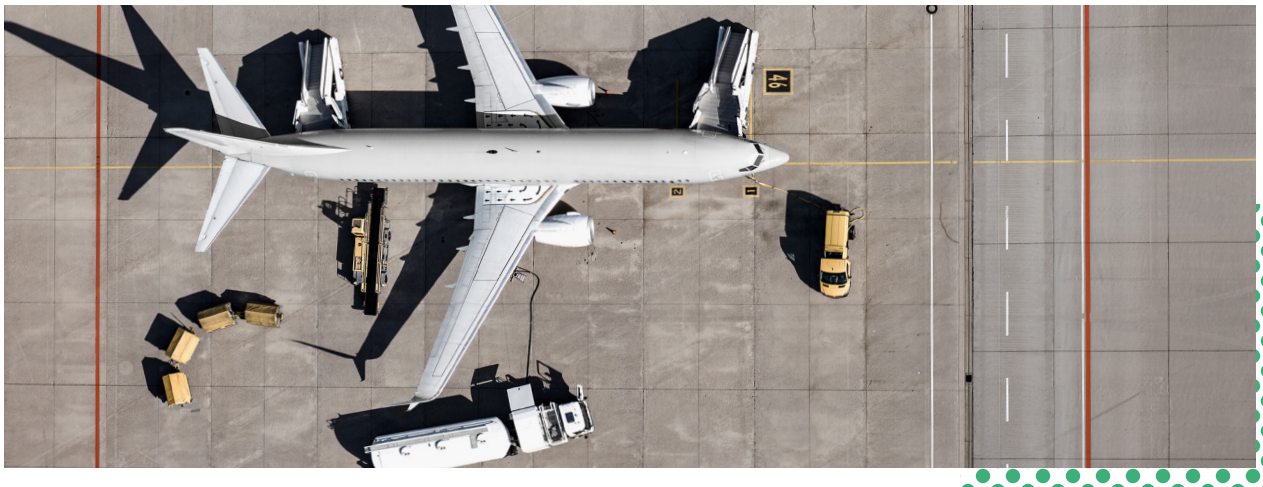
Given the significant opportunity for SAF production in Australia, IFM has been partnering with industry and government to advocate for a domestic industry. In July 2024, IFM announced that it was working with leading agribusiness and processing company GrainCorp and Australia's largest transport energy provider Ampol to explore the establishment of an integrated renewable fuels industry in Australia. At present, we are engaged with GrainCorp and Ampol in a preliminary feasibility process to assess the infrastructure and operational requirements of building an end-to-end SAF supply chain. This will include a greenfield GrainCorp canola crushing facility to supply a purpose-built renewable fuels refinery on the site of Ampol's existing refinery in Lytton, a suburb of Brisbane. This refinery is expected to be capable of producing over half a billion litres of SAF annually. Targeting a commencement date of 2030, the refinery would have a capacity of over 450 million litres of renewable fuels a year. Most recently, we were pleased to see the feasibility study supported by the Federal Government's Australian Renewable Energy Agency (ARENA), which has awarded a combined A$14 million to GrainCorp and Ampol to progress their respective components of the study.

While the above partnership is a significant step towards the establishment of an Australia SAF industry, its success is dependent on a suitable renewable fuels regulatory framework being introduced by the Australian government, and by other supportive governments across the globe. Reflecting on the significant success of supply-side support measures implemented in the US, we believe that a time-limited production tax incentive is essential. This could bridge the cost differential between SAF and traditional aviation fuel, support early investment into an Australian industry and create a more cost-competitive landscape with overseas SAF refining markets. Similarly, drawing on policy mechanisms that have demonstrated success in Europe, we would also encourage the Australian government to consider how an appropriate and achievable domestic SAF mandate may be implemented. This could increase market certainty for early investors in Australian SAF whilst being conscious of the price impacts on travellers.

[12] McKinsey (2024)

Once production incentives are in place, Australian farmers may see greater economic incentive to increase farming of feedstocks which can be converted into SAF. IFM anticipates that alongside an increase in canola crops in Australia, the right incentives, such as long-term offtake agreements signed between supply chain participants, could see a growth in farming of novel crops that have an even greater carbon emissions reduction potential. With jet fuel demand in Australia forecast to reach around 10bn litres per annum in 2030, achievement of meaningful progress towards 10% SAF usage in 2030 will require use of a wide slate of Australian feedstocks including canola oil and waste oils. It will also be important to optimise agricultural SAF supply chains to appropriately manage land and water resources.

> **Alongside an increase in canola crops in Australia, the right incentives could see a growth in farming of novel crops that have an even greater carbon emissions reduction potential.**



Conclusion

A suite of supply and demand side incentives built in partnership with industry can form the basis of a globally competitive regulatory framework for the production of SAF and other renewable fuels in Australia. We believe this could spur significant private sector investment and enhance Australia's long term regional economic development and fuel security. It could also play a key role in supporting the decarbonisation of Australia's aviation industry.

IFM Investors

Ashish Thomas
Executive Director,
Infrastructure

Gas into gold

The waste-to-energy opportunity

The production of renewable energy from agricultural, industrial, municipal and consumer waste has potential: a way to turn trash into treasure, while also combatting climate change.

Key takeaways

1. By capturing and converting methane from decomposing organic matter, renewable natural gas (RNG) can help reduce emissions, improve waste management and create more circular economies.

2. RNG is compatible with existing natural gas infrastructure and industrial processes, and it is directly interchangeable with fossil natural gas, rendering it a 'drop-in fuel'.

3. Demand for RNG is being supported by a combination of regulation and rising demand from companies seeking to meet net zero commitments.

In transitioning the global economy towards a low-emissions future, a portfolio of tools is needed to overcome challenges posed by sectors that have traditionally been hard-to-abate. Renewable natural gas (RNG) is an alternative fuel that can help industries lower emissions, improve waste management and create more circular economies. While we believe RNG has long been recognised as an investment with burgeoning potential, increasing demand and awareness of methane's relative impact on global warming has led to an acceleration of interest and capital in the sector.

A 'drop-in fuel'

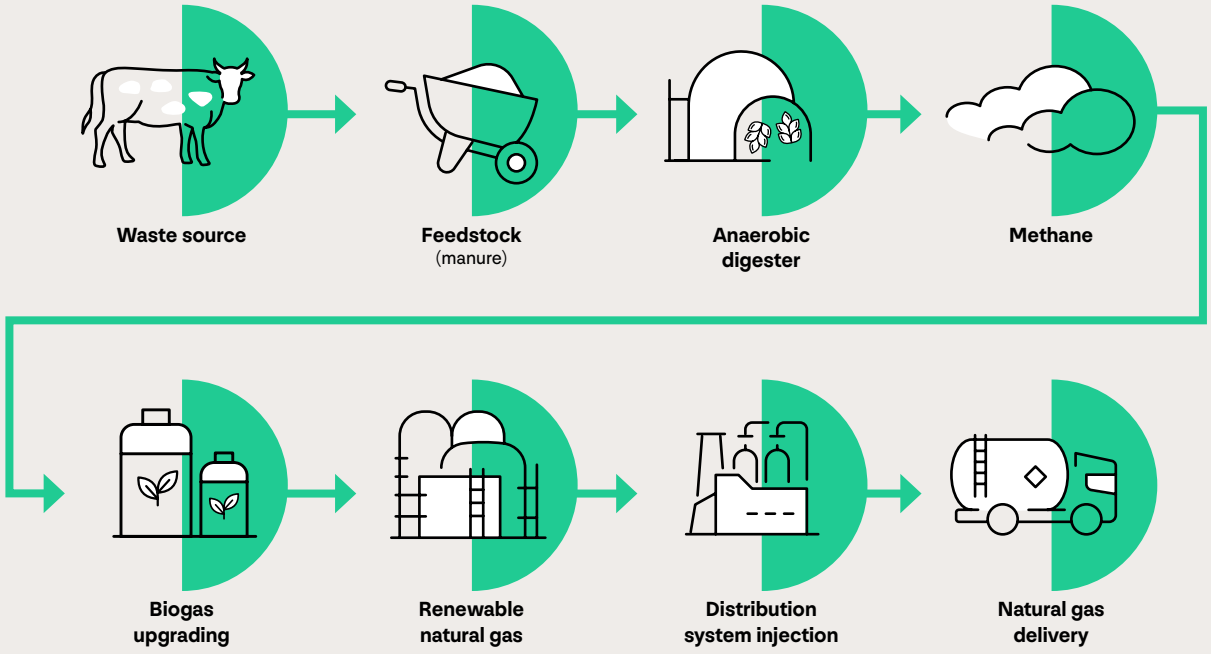
RNG shares many of the same attributes as fossil natural gas and the same basic chemistry – greater than 95% methane, or CH_4. RNG is compatible with existing natural gas infrastructure and industrial processes, and it is directly interchangeable with fossil natural gas, rendering it a 'drop-in fuel' (similar to renewable diesel and sustainable aviation fuel).

However, while fossil natural gas involves the extraction of carbon sequestered beneath the earth's surface, RNG is produced from the natural decomposition of organic matter, through a process commonly known as anaerobic digestion. The source of organic matter giving rise to methane emissions can vary, from landfills, to dairy farming (and the associated decomposition of manure), waste water processes and organic consumer waste. All are significant generators of methane emissions, with the source of these methane emissions often referred to in the RNG industry as the 'feedstock type.'

Methane emissions are widely known to have significant adverse environmental impacts. The United States Environmental Protection Agency (EPA) points to methane as being "more than 28 times as potent as carbon dioxide at trapping heat in the atmosphere[2]". Against this backdrop, RNG projects have the potential to deliver significant methane emissions reductions – not only by displacing fossil natural gas (and thereby avoiding the release of carbon sequestered in the earth) but also by capturing naturally occurring methane emissions that would otherwise be released into the atmosphere.

FIGURE 1

ANAEROBIC DIGESTION IS RESPONSIBLE FOR GENERATING METHANE, WHICH CAN THEN BE CAPTURED AND UPGRADED TO PRODUCE RNG[1]



[1] The Coalition for Renewable Natural Gas

Market growth spurred by regulatory support

In the United States, the RNG industry has long been supported by regulation, including the Renewable Fuels Standard (RFS). Introduced in 2005, the RFS requires a certain volume of renewable fuels be used to replace or reduce the quantity of fossil fuels used in transportation, and in the heating of homes. For each molecule of renewable fuel injected into the interstate pipeline system, the RFS provides for the generation of a regulatory credit, which is then purchased by obligated parties (such as refiners, importers and blenders) who produce fossil fuels (and specifically, gasoline) for consumption in the United States.

Further support for the development of RNG projects in the United States is provided by California's Low Carbon Fuel Standard (LCFS), which is designed to lower the carbon intensity of California's transportation fuel sources. This is done through the development of low carbon intensity (CI) feedstock types, including both dairy manure and organic consumer waste. A similar programme in Canada known as the Clean Fuel Regulations (CFR) aims to significantly reduce greenhouse gas emissions from transportation fuels, by requiring fuel suppliers to gradually decrease the CI of gasoline and diesel.

We believe these regulatory programmes have been an effective tool in encouraging the development of RNG projects over the last 20 years, particularly for certain feedstock types. According to the Coalition for Renewable Natural Gas and Office of Energy Efficiency and Renewable Energy, 70% of RNG production in the United States is derived from landfills, with a further 20% derived from agricultural waste – primarily manure from dairy farms[3]. However, as demand for RNG continues to grow, the industry is bracing for the development of RNG feedstocks outside of landfill and dairy manure, with fugitive methane emissions from waste water and organic consumer waste generally seen as the next frontier for RNG feedstocks.

[2] United States Environmental Protection Agency
[3] Bloomberg New Energy Finance

CASE STUDY

The benefits of an on-site RNG project to global food producers[4]

Many global food producers believe that they have a dual responsibility: feeding a future world, while also helping the food system – which is a significant contributor to global emissions – mitigate its environmental impacts. We believe a critical strategy in addressing these responsibilities is to adopt circular economy technologies, repurposing waste streams and food byproducts into RNG through the application of on-site methane capture and upgrading systems.

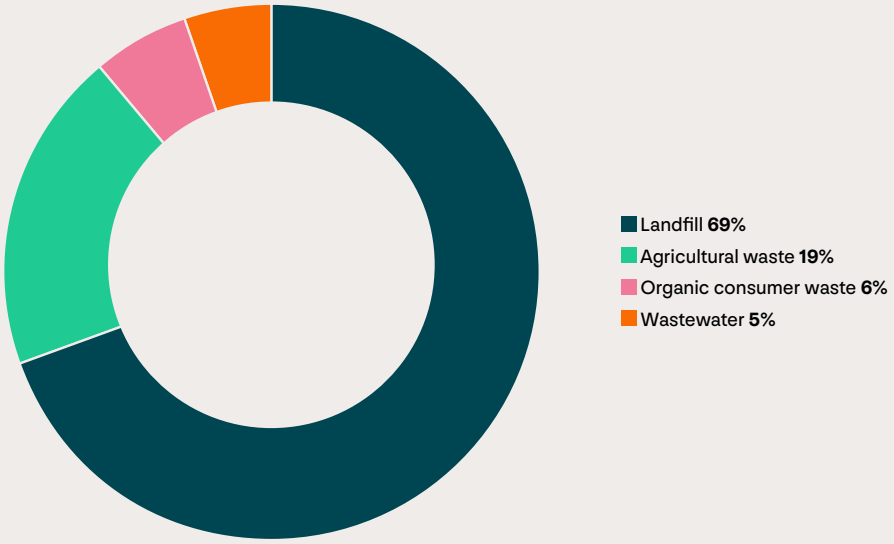
While the installation and operation of such systems is typically outside the core competency of food producers, partnering with an experienced RNG developer can facilitate methane capture, while also driving improvements to waste operations, and local air and water quality. In most cases, a royalty or fee can be earned from sale of the captured methane, thereby providing an incremental and reliable source of long-term income. And where an RNG project is effective in mitigating fugitive methane emissions, food producers can lay claim to the reduction in greenhouse gas emissions flowing from the project.

Critical to the success of these projects is a clear delineation of roles and responsibilities, and alignment around the mutual benefits to each party.

[4] Case studies are provided for illustrative purposes only and should not be relied on to make an investment decision.

FIGURE 2

NOT GOING TO WASTE:
SHARE OF RNG PRODUCTION CAPACITY BY FEEDSTOCK TYPE (2021)



Source: Bloomberg New Energy Finance

The introduction of the Inflation Reduction Act (IRA) in 2022 gave rise to significant tax credits in support of RNG projects, through the introduction of an Investment Tax Credit (ITC), and in providing for ITC bonus credits that facilitate the recovery of up to 50% of eligible expenditures.

While recent shifts in the political environment in both the United States and Canada have introduced some near-term uncertainty to the future of these regulatory programmes, it is important to note that biofuels have historically enjoyed bipartisan support in the United States. Regulation such as the RFS works to support the agricultural industry in Midwest Republican strongholds, while the environmental benefits of biofuels have long been recognised and touted by Democrats. Indeed, the Trump administration has specifically identified biofuels as a domestic energy resource in need of further attention and development[5].

However, favourable policy developments at both the regional and local level are beginning to drive the development of new RNG feedstocks that have historically been overlooked by RNG developers. California continues to lead the way in this regard, with SB1383, a law that requires a 75% reduction in organic waste being sent to landfill this year, from 2016 levels. This paves the way for RNG projects that focus on the aggregation of organic consumer waste as a feedstock. And in coupling SB1383 with SB1440 – a separate mandate that sets minimum RNG procurement targets for Californian natural gas utilities – the local market is poised for significant growth in the coming years. While the implementation of these programmes has not been without its challenges, with landfill diversion mandates beginning to spread to other parts of the country, sector tailwinds are growing for the RNG industry as it seeks to expand to relatively untapped sources of feedstock.

[5] Unleashing American Energy – The White House

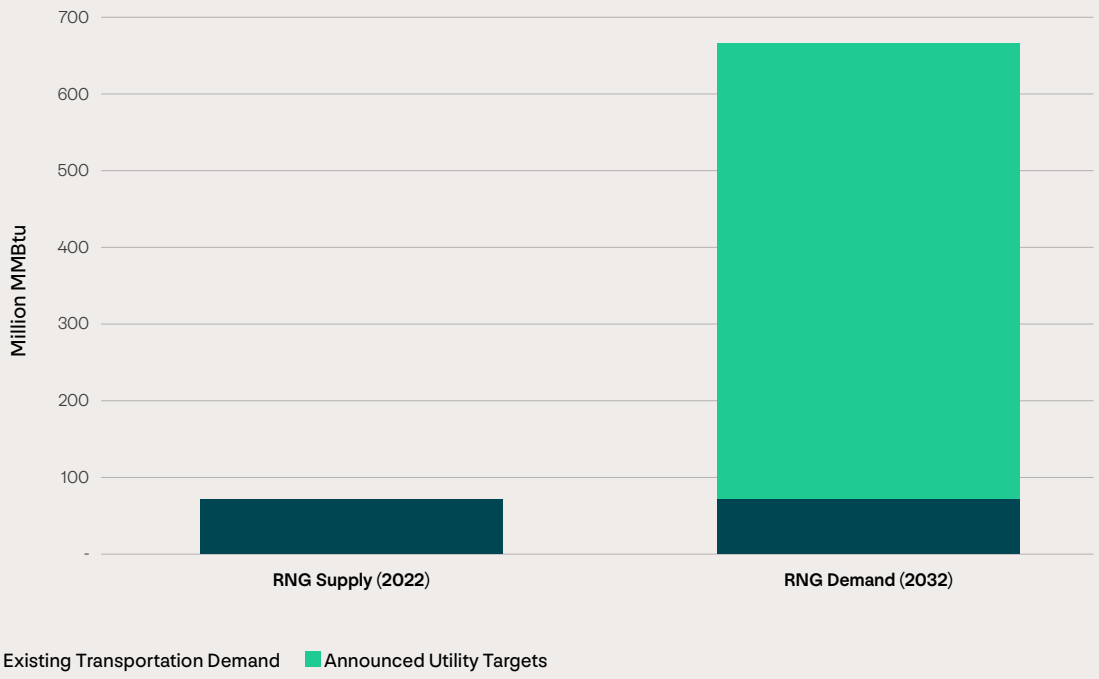
Demand-driven growth from voluntary buyers

Regulatory programmes have provided, and are expected to continue to provide, a robust baseline of demand for RNG. However, industry attention is rapidly shifting toward the recent and rapid growth in the voluntary market, where RNG is sold directly to end-users, such as natural gas utilities and commercial and industrial (C&I) customers. These end-users are seeking to displace fossil natural gas to help meet net zero commitments. Natural gas utilities are typically driven by mandated procurement targets, C&I customers by limited decarbonisation alternatives. For these types of buyers, which operate in hard to abate sectors, RNG is a simple and effective 'transition fuel', particularly where electrification and/or green hydrogen are either cost prohibitive, or dependent on significant technological advancements and infrastructure build-out.

FIGURE 3

DEMEAND TO SIGNIFICANTLY OUTSTRIP SUPPLY:

US RNG SUPPLY VS IDENTIFIED DEMAND BY MILLION MMBTU[6]



[6] Argonne National Laboratory RNG Database, ICF, publicly-disclosed RNG purchase agreements and procurement targets

CASE STUDY

IFM Investors and GreenGasUSA[7]

In March 2023, IFM Investors (through one of its managed funds) acquired a majority stake in GreenGasUSA (GreenGas), a vertically integrated US-based developer, owner and operator of RNG projects, headquartered in Charleston, South Carolina.

Unlike most RNG developers, GreenGas specialises in the capture, upgrade, transportation and injection of RNG from on-site sources of feedstock at large-scale wastewater treatment plants. These plants, which are often co-located with industrial protein processing facilities, accept biogenic material from various sources, including poultry, cows and pigs.

GreenGas has historically succeeded in marketing and selling RNG produced from these sources under long-term, fixed price offtake agreements, selling RNG to investment grade C&I customers, such as Mercedes Benz and Carolina Gas Transmission (a subsidiary of Berkshire Hathaway Energy). In capping these wastewater "lagoons" and capturing the associated methane, GreenGas has historically reduced environmental emissions from waste streams and helped several feedstock partner sites avoid being listed as top state-level emitters by the EPA.

[7] Case studies are provided for illustrative purposes only and should not be relied on to make an investment decision.

Conclusion

With nearly half of listed utilities having already set emissions reduction targets, announced utility mandates alone are expected to see RNG demand outstrip supply by more than 8.5 times, over a 10-year period[8]. This favourable supply-demand dynamic is expected to both drive RNG pricing higher and encourage the development of higher cost RNG sources. With this, the RNG industry is poised for significant growth in the years to come.

[8] Argonne National Laboratory RNG Database, ICF, publicly-disclosed RNG purchase agreements and procurement targets

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