A source of renewable 'super-infrastructure'

InstarAGF's **Gregory Smith** makes the case for bioenergy, explaining why its profile is 'compelling' both from an environmental as well as an economic perspective

IN 2016, MORE than 190 countries signed the United Nations' Paris Agreement, reflecting an urgent global consensus on the need to adopt a less energy intensive, more sustainable model of economic development. While it remains to be seen whether all signatories will ultimately pull their full weight towards the agreement's greenhouse gas (GHG) reduction targets, the Paris treaty could well serve as a strong catalyst for low-carbon innovation and investment.

Part of the Paris equation relies on reducing energy consumption where practicable – a priority for the private sector, which accounts for about half of the electricity consumed globally – with the balance resting on our ability to better harness renewable and low-emissions energy sources.

The impact of climate change on our environment and human civilisation has been part of the public consciousness for four decades, helping to spur the first modern commercial wind and solar power facilities in the early 1980s. Today, renewable energy production is surging with about two-thirds of net new generating capacity coming from clean sources. Renewable energy accounted for about 18 percent of electricity generation in the US in 2017, according to the Business Council for Sustainable Energy and Bloomberg New Energy Finance.

Looking ahead at the next 20 years, we are on the cusp of adopting clean energy and greening our essential infrastructure at an unprecedented scale as we seek to arrest the growing GHG footprint of the global economy.

CITIES ARE LEADING THE CHARGE

A 21st century energy paradigm is emerging by necessity, characterised by new renewable sources of power such as bioenergy, energy storage and efficiency, local microgrids, and the electrification of mobility. Combined, such community or regional initiatives help to reduce energy use, improve energy security and unlock new value in several other sectors.

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We have a unique opportunity to transform the energy landscape, and accordingly, our economic prospects and quality of life – starting with innovation at the local level. Infrastructure is the pivotal enabling force of any community, creating the capacity to meet existing and future challenges presented by population growth, urbanisation, and other emerging natural and technological factors.

While many nations have been slow to implement smart climate or GHG emissions policies, cities around the world are leading the way. According to the Carbon Disclosure Project, more than 40 cities globally, including several in the US, now get all their electricity from renewables, while at least 100 get about 70 percent of their power from clean sources.

Nearly 50 US cities have pledged to transition to 100 percent renewable energy for environmental, economic and public health reasons. Cities account for about 70 percent of carbon emissions in the US, with the largest 250 urban centres generating almost 85 percent of gross domestic product. The electricity sector alone accounts for nearly 30 percent of carbon emissions in the US. This makes urban energy innovation vital to the country's long-term environmental viability and synonymous with sustainable economic development. With global GHG emissions reaching a record high in 2017, the decisions we make over the next 15 years will have an enduring impact on both economic and climate outcomes.

A COMPLETE ENERGY AND ENVIRONMENTAL SOLUTION

As an energy source, a key challenge presented by most renewables is their intermittent nature. Bioenergy, with its ability to deliver baseload power and ancillary benefits, is emerging as a flexible, competitive source of renewable super-infrastructure with the ability to play a significantly larger role in decarbonising energy systems and reducing GHG emissions across the broader economy. This includes both waste-to-energy and anaerobic digestion facilities.

New technologies, pathways and policies are reducing the costs of bioenergy, increasing conversion efficiencies and expanding the base of feedstocks to include agricultural products such as manure and solid or liquid food processing by-products, fruit and vegetable spoils and processing wastes, post-consumer food waste, packaged food waste, cardboard, plastics and films.

Nutrient-dense organic wastes are particularly well suited to anaerobic digestion, which produces biogas that can be used to fuel renewable electricity and heat generation, or be upgraded to pipeline-quality or renewable natural gas, or compressed into vehicle fuel.

Unlike most other renewable energy sources, bioenergy can generate both heat and electricity in a combined heat and power plant, with a range of uses to heat or cool applications in a community or an industry, thereby helping to diversify and secure local energy supply. Bioenergy is also potentially more scalable than other forms of renewable energy, given its dispatchable nature and the variety of feedstocks available.

Key elements of bioenergy's value proposition include its compelling environmental profile and ability to stimulate regional economic diversification and employment. For the agricultural industry, such benefits include realising marketable by-products from its waste streams, such as nutrient solids and green carbon dioxide.

In cities, bioenergy solutions can reduce urban waste management costs. Bioenergy also improves the quality and environmental footprint of other forms of infrastructure, most notably in the wastewater sector, where the anaerobic digestion of sludge could offer the potential for energy self-sufficiency while lowering emissions and costs. Just 8 percent of wastewater treatment plants in the US currently operate anaerobic digesters on site. Clean water agencies are increasingly evaluating how they can

Bioenergy: supporting greener, wealthier communities by reducing emissions, improving water quality and producing a local source of renewable electricity

become more resilient and improve environmental and financial performance, opening the door to new partnerships with the bioenergy industry.

Because of these attributes, bioenergy has significant potential to serve as a vehicle for job creation and economic opportunity. Studies show that continuing to develop bioenergy capacity could contribute nearly $260 billion and 1.1 million jobs to the US economy by 2030, ranging from scientific research to power plant operations, farming and manufacturing.

Simply, bioenergy achieves considerable additional value from products that already exist in the economy – repurposing, recycling and reusing to turn cost centres into new revenue streams. We are barely skimming the surface of what is possible.

THE BIOENERGY INVESTMENT OPPORTUNITY

Globally, government policies and regulation are strong drivers for the bioenergy market, which can include both subsidies for power systems, investments in new technologies, and increasingly stringent environmental laws aimed at curbing GHG emissions and promoting bioenergy across a variety of industries.

In the US, regulatory initiatives, such as renewable portfolio standards, which are established in about half of states, and organics recycling requirements are creating the conditions for greater adoption of bioenergy. In 2015, for example, the Environmental Protection Agency and the Department of Agriculture announced a 50 percent food waste reduction goal by 2030 in a country where 40 percent of food produced goes uneaten.

Public perception is likewise a powerful force for change. Globally, 5 billion metric tonnes of waste are generated every year from agriculture, which is the thermal equivalent of about 1.2 billion tonnes of oil, or 25 percent of current global production, according to the United Nations Environment Programme.

> "Bioenergy achieves additional value from products that already exist in the economy"

In North America, livestock farms are under increasing public scrutiny for their methane emissions and environmental management practices in an era where a growing number of people care about where their food comes from and how it is produced. Such farms in the US are typically large, which makes bioenergy both economically feasible and environmentally essential to remediating the industry's footprint.

There are also interesting opportunities to collaborate across infrastructure and economic sectors, such as in the co-digestion of wastewater sludge and food waste. Wastewater treatment plants can often be made more profitable by adding food waste, which generates methane that can be captured and used as an energy source, from nearby communities. This makes municipal food and organic waste collection more environmentally and economically viable, offering densely populated cities and regions an effective way to improve overall infrastructure sustainability.

North American communities are already innovating across the bioenergy field. At Pixley Biogas, in Pixley, California, cow manure and industrial and municipal waste creates biogas that is used as a substitute for natural gas to power a production facility for ethanol, which is used as low-carbon vehicle fuel. The digestate is returned to the dairy farm, where solid fraction is used as bedding for the cows, and liquid fraction is used as fertilizer for field crops.

This co-operation has reduced carbon dioxide emissions by 15,000 tonnes, and reclaimed 90 million gallons of water. In Gresham, Oregon, municipal sewage and food waste is used to generate electricity that covers most of the energy needs of the city's wastewater plant, with the hot water used to provide heating and thermal energy to on-site buildings, trimming the plant's annual energy costs. In both these examples, the blending of feedstocks demonstrates a growing trend in the industry that creates additional potential for bioenergy development in the coming years.

BUILDING RESILIENT COMMUNITIES

Bioenergy systems support greener, wealthier communities by reducing emissions, improving water quality, producing a local source of renewable electricity, heat and fuel, and lowering energy costs while generating new sources of revenue.

The distributed nature of such systems also increases the reliability of critical services such as food, waste management, energy, wastewater treatment and transportation, thereby enhancing urban resiliency. The right private sector partners, with deep experience managing complex energy solutions and the ability to properly mitigate risk, can bring considerable value to the table.

Bioenergy is a vital building block for sustainable development in that it creates entirely new economic frameworks, which reduce inequality and promote healthier communities. It also brings together seemingly disparate sectors in a common purpose: mitigating climate change and adapting to its effects. As momentum grows from Paris and beyond for stronger climate action, bioenergy represents a new wave of renewable energy opportunities in North America for investors, for communities and for future generations, where everything has its use and there is a use for everything. ■