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A view of public housing blocks, with solar panels affixed to the roof of some blocks, in Singapore on Jun 27, 2019. (File photo: Reuters/Kevin Lam)

The announcement of Singapore's vision for a "low-carbon and climate resilient Singapore" on Friday (Feb 28) was a timely one.

Singapore's mitigation vision has two stated goals. First, an absolute peak emission level of 65 million tonnes of carbon dioxide equivalent by 2030 and second, an aspiration to halve the emissions peak emissions to 33 million tonnes by 2050, with a view to achieving net-zero emissions "as soon as viable" after that.

While delivering the announcement, Senior Minister Teo Chee Hean pithily and accurately noted "this (commitment) will be very challenging given our limited alternative energy options".

Indeed, the current geographical, economic and technological circumstances in Singapore will make it difficult – but not impossible – to first reduce current emissions before reaching the ideal net-zero level.

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GEOGRAPHICAL AND TECHNOLOGICAL CHALLENGES

Simply put, getting to net-zero requires carbon dioxide removal from the atmosphere through natural or artificial means and by being more efficient in using carbon in economic activities.

These approaches are not new. In 2018, the Intergovernmental Panel on Climate Change (IPCC) assessed several carbon dioxide removal pathways for governments to keep global temperatures from exceeding 1.5 degrees Celsius, requiring a global net-zero target by "around 2050".

The challenge of following these pathways, however, is very stark, and exacerbated for several reasons in Singapore's context.

While our small size and equatorial location have been beneficial for our trade and for reducing exposure to climate hazards like typhoons, the trade-off is that our geography severely handicaps effective carbon dioxide removal approaches in Singapore.

View of the central business district in Singapore. (File photo: AFP/Roslan Rahman)

We lack large forested areas where we can intensively and extensively replant fast-growing native vegetation that provide large green spaces, which store carbon at scale.

This also means that we do not have large renewable energy potential from bio-energy, rivers, wind and tidal options.

Our extensive cloud cover and small land area also prohibit efficient, large-scale deployment of domestic solar energy and its storage with current technology, although this can likely be overcome through a regional solar and renewable energy grid.

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Our geographical handicap can be offset by technology. One method involves capturing carbon dioxide directly from pre-treatment of fuels, or during post-combustion at power plants.

The captured carbon is either stored ("sequestered") underground where it does not contribute to climate change, or utilised as raw material for products such as plastics, fertilisers, and fuel in combination with hydrogen.

Some of these technologies have demonstrated small-scale engineering viability, but cost considerations are critical in determining operational viability at larger scales.

Generally, financial costs accumulate mainly from the immense capital investment of plants, the large energy costs of carbon capture, operation, and regeneration of carbon, as well as from plant maintenance.

Carbon dioxide storage tanks are seen at a cement plant and carbon capture facility in Anhui province, China on Sep 11, 2019. (Photo: REUTERS/David Stanway)

Two additional problems apply in Singapore. Carbon sequestration generally occurs in geological sites such as oils and gas fields, which are not located close to Singapore. The carbon captured locally will thus require additional transport costs to locations in which sequestration can occur.

Our utilisation of "clean" natural gas to generate power paradoxically means extracting carbon is more expensive compared to "dirtier" carbon-rich fossil fuels such as coal.

Lastly, one unmentioned but technologically feasible option in Singapore is nuclear power, which can reduce domestic emissions significantly. There remains, however, substantial socio-political and environmental issues impeding its deployment.

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RESTRUCTURING ECONOMIC GROWTH

Carbon dioxide removal can reduce emissions, but transforming Singapore's current economy is another important step in getting to net-zero.

There may be concerns that reducing emissions will damage the economy, as economic growth is strongly correlated to increased carbon emissions.

The move from emissions intensity – a metric looking at carbon emissions per unit of Gross Domestic Product (GDP) – to absolute emissions independent of GDP also bolsters the concern.

But such concerns can be allayed as development – with ample evidence from cities worldwide – can be "decoupled" from emissions successfully through increased use of renewable energy, and energy efficiency throughout all economic sectors, such as deploying AI-enabled smart technologies in domestic and commercial buildings.

Asia Square is one of the most eco-friendly buildings in Singapore. (Photo: designphase dba)

The low-carbon goals of "greener" buildings in construction and retrofitting, with higher energy labelling and performance standards, as well as the nationwide implementation of electric vehicles by 2040, are concrete steps that enable and enhance decoupling.

These efficiency measures are significant and will augment carbon dioxide removal technologies, especially in cities. Globally, the IPCC assessed that phasing out fossil fuel passenger vehicle sales by 2035 to 2050 is a benchmark that aligns with 1.5 degree Celsius-consistent pathways, as does reducing building emissions by 80 to 90 per cent by 2050.

The Government cannot do it alone; the private sector must be active partners in ensuring this sustainable transformation occurs through implementing new low-carbon technologies and practices throughout Singapore.

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For instance, Singapore Management University's new Connexion Building completed in January is the first on-site net zero energy building in Singapore's city centre. It was constructed mostly by using mass engineered timber from farmed mature trees that absorb and sequester carbon dioxide for the duration of the building's life cycle, and has a low energy signature via using power generated from an on-site photovoltaic system and high efficiency fixtures.

These sustainable design and construction elements can be emulated by other private sector actors in the building and construction industry, and widely implemented to decouple emissions from development.

Besides the private sector and the Government, decoupling carbon emissions also requires awareness and action from the public. SM Teo noted a nationwide collective effort is needed, especially when transforming the economy with "green" development is not a zero-sum game in which there are only winners and losers.

A decoupled, low-carbon economy requires "green" skills training and re-training for workers as industries prepare for a low-carbon future, such as the operation and maintenance of electric vehicles and charging points, or by installing renewable energy technologies.

Collective and coordinated action by all stakeholders – public, private, and people sectors – is needed to shift the needle in ensuring a sustainable economy, where everyone can win.

HOW SINGAPORE BENEFITS FROM SHIFT TOWARDS SUSTAINABILITY

The Singapore skyline as seen from the Marina Barrage Green Roof. (File photo: Corey Sta Maria)

The costs and challenges towards a net-zero path are considerable and daunting, both in terms of time, resources and capital.

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However, Singapore must chart this path sooner rather than later. There will also be immense benefits for climate adaptation in Singapore with the transition towards a greener economy.

The goal of constructing and retrofitting “greener” buildings with super-low-energy use will also cool Singapore locally by reducing the island's urban heat effect.

Similarly, the reduction of waste heat emissions from the transport sector through electric vehicles will also significantly aid in cooling Singapore, as well as reducing air pollution to pedestrians originating from vehicular burning of petrol and diesel.

The local implementation and development of new, low-carbon technologies by the private sector could be commercialised and exported to regional cities, who will be looking for successful urban climate mitigation examples or in the building and transport sector.

A successful transition to a decoupled, low-carbon economy will enable the next generation of Singaporeans with sustainable employment and shift away from sunset industries, such as those focusing on fossil fuel extraction.

Lastly, investments in mitigation and decarbonisation will be less expensive today than in a future where climate impacts and hazards become more pronounced, with higher human and economic costs arising from inaction.

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