GHD Future Energy at Energy LIVE 2024:

Pioneering Pathways to Net-Zero Energy Systems

→ The Power of Commitment

Executive Summary

GHD Future Energy solidified its position as a thought leader at Energy LIVE 2024 in Houston, Texas, contributing to pivotal discussions shaping the global energy transition. This premier event, attended by over 3,000 energy decision-makers, explored cutting-edge market analysis, strategies, and technology advancements across Energy Transition, Hydrogen, and Solar & Storage.

A cornerstone of GHD's participation was the keynote presentation, The Great Electrification Debate, featuring Dr Tej Gidda, GHD Global Leader – Future Energy, and Dr Peter Benyon, Australian Market Leader – Power. The debate tackled the feasibility of "electrify everything", sparking critical conversations about pathways to net zero.

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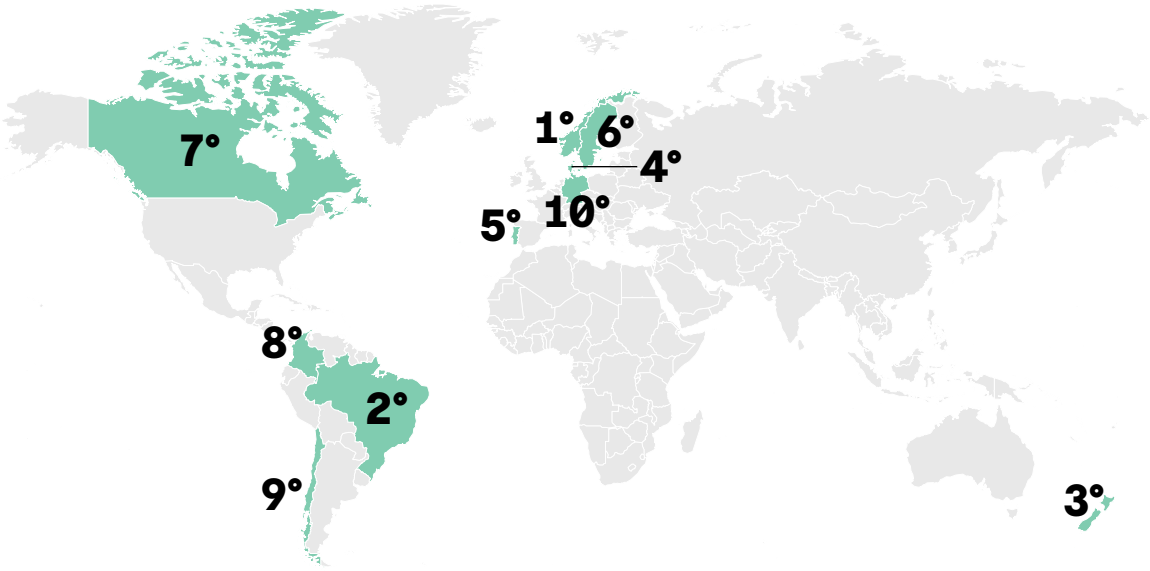
Key takeaways from Energy LIVE 2024

1 Electrification: aspirations vs. realities

GHD's keynote debate addressed the promise and challenges of electrifying global energy systems:

- ***Optimism:*** Dr Peter Benyon showcased the economic and environmental benefits of electrification, citing advancements in renewable energy adoption and energy storage. "With net-zero objectives in focus, green electricity - produced from abundant resources like wind and solar - stands out as the cleanest and most cost-effective energy source," he said.
- ***Pragmatism:*** Dr Tej Gidda emphasised barriers such as grid capacity, affordability, and resource constraints. "We must tailor solutions to regional realities. Electrification alone cannot meet global energy demands without complementary technologies like renewable fuels and hydrogen," he stated.

Top 10 Share or renewables in electricity production: Breakdown per country



1. Norway 98.3%
2. Brazil 89.3%
3. New Zealand 87.6%
4. Denmark 87.2%
5. Portugal 75.5%
6. Sweden 69.4%
7. Canada 67.2%
8. Colombia 66.4%
9. Chile 63.7%
10. Germany 53.5%

2 A balanced energy mix is essential

Energy LIVE 2024 underscored the critical importance of an integrated energy mix to achieve global net-zero goals. Discussions highlighted that no single energy source can meet the demands of a low-carbon future, emphasising the need for a multifaceted approach combining renewables, hydrogen, and advanced storage technologies.

Renewables: vital yet variable

While renewables such as wind and solar are the cornerstone of the clean energy transition, their intermittency presents challenges to grid reliability. This has driven significant advancements in energy storage technologies. Beyond traditional lithium-ion batteries, innovations like vanadium redox flow and sodium-based batteries are emerging as transformative solutions. These technologies enable grids to store surplus energy during peak renewable generation periods and release it during high-demand hours, stabilising the energy supply.

Pumped hydro: the backbone of long-duration storage

Complementing these developments is pumped hydro power, a proven and scalable energy storage solution that plays a critical role in balancing renewable variability. Pumped hydro operates by using excess electricity to pump water from a lower reservoir to an upper reservoir during periods of surplus energy. When demand increases, the stored water is released to drive turbines, generating reliable, dispatchable power. This process essentially acts as a large-scale "water battery" that can support grid stability for extended durations.

Pumped hydro's long-duration storage capacity makes it especially valuable for addressing prolonged periods of low renewable generation, such as cloudy days or calm weather.

Hydrogen and renewable natural gas: decarbonising hard-to-electrify sectors

Hydrogen and renewable natural gas (RNG) emerged as pivotal solutions for sectors where direct electrification remains impractical, such as heavy industry, shipping, and aviation. Hydrogen, particularly green hydrogen produced through renewable-powered electrolysis, offers a scalable and versatile energy source. It can replace or complement fossil fuels in industrial processes and serve as a zero-emission fuel for heavy-duty transport. Similarly, RNG, derived from biogas, provides an immediate pathway to decarbonise existing gas infrastructure without requiring significant retrofitting.

Building synergy between technologies

Speakers emphasised the importance of fostering synergy among these technologies. Hydrogen, for instance, can complement renewable energy by storing surplus power generated during periods of high wind or solar output. This stored hydrogen can then be converted back to electricity when renewable generation dips. Similarly, RNG can integrate seamlessly with existing pipelines, providing a transitional solution while hydrogen infrastructure matures.

Flexibility and Resilience

The energy transition hinges on flexibility and resilience, achieved through an optimised mix of sources. A balanced energy system not only supports decarbonisation but also ensures energy security by diversifying supply streams. This multifaceted approach minimises the risk of over-reliance on any single energy source, enhancing system stability and reliability.

Energy LIVE 2024 made it clear that achieving net-zero goals will require the energy sector to embrace innovation and collaboration. By leveraging a diversified energy mix and developing synergies among technologies, the industry can address challenges like intermittency, decarbonise hard-to-electrify sectors, and deliver a resilient energy future.

By 2030, the International Energy Agency (IEA) projects that **renewable energy will account for over**

50%

of global electricity generation, necessitating robust storage solutions.

3 Policy certainty is key

One of the recurring themes at Energy LIVE 2024 was the urgent need for stable, long-term energy policies that transcend political cycles. Our GHD delegates emphasised that without clear, consistent frameworks, the energy transition risks being undermined by uncertainty and delayed investments.

The transformative impact of the US Inflation Reduction Act (IRA)

The IRA was universally hailed as a landmark piece of legislation, setting a new standard for incentivising decarbonisation. As the most significant climate law in US history, it provides an unparalleled suite of funding, programs, and incentives designed to accelerate the clean energy transition. Notably, the 45V hydrogen tax credit was spotlighted as a game-changer, making clean hydrogen production financially viable and spurring investment in hydrogen infrastructure. These mechanisms not only provide immediate benefits but also offer the long-term predictability investors and developers need to commit to large-scale clean energy projects.

The risk of fragmented policies

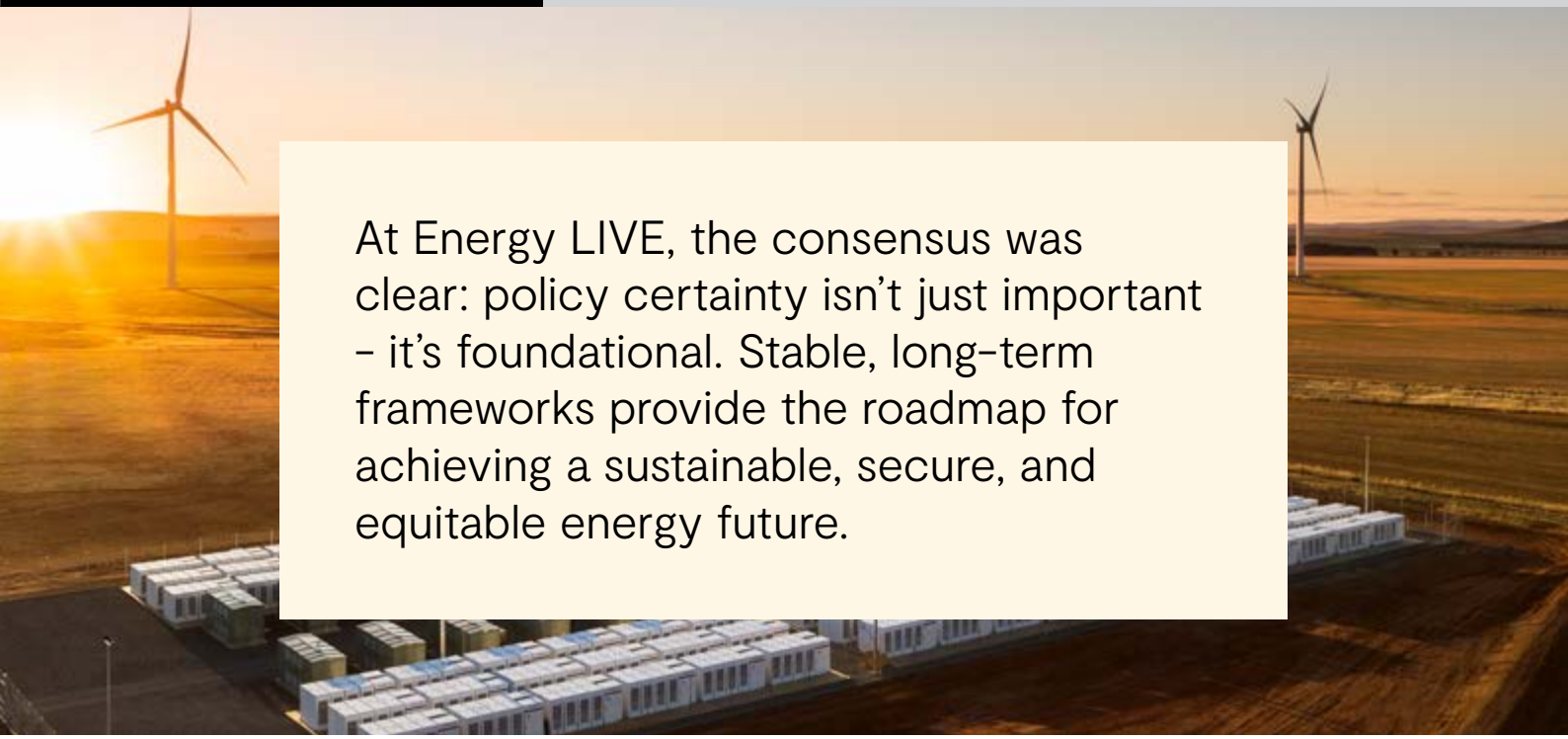
By contrast, nations with fragmented or inconsistent policies face a slower energy transition. Uncertainty around incentives, regulatory frameworks, and long-term goals creates hesitation among investors, delaying the deployment of critical renewable infrastructure. Several speakers pointed out that while some countries demonstrate pockets of progress, such as targeted subsidies or pilot projects, the absence of cohesive, overarching strategies limits their ability to scale solutions effectively.

Transcending political cycles

Energy infrastructure projects, by their nature, span decades. Developing renewable resources, building transmission lines, and deploying energy storage require timelines far beyond electoral terms. Delegates stressed the importance of designing policies that are insulated from political shifts, ensuring continuity and fostering trust among stakeholders.

Lessons for global policymakers

The IRA serves as a blueprint for other nations aiming to expedite their energy transitions. Clear, transparent, and ambitious policies not only attract investment but also signal a commitment to decarbonisation. By adopting similar models, countries can align short-term actions with long-term climate goals, creating a fertile environment for innovation, collaboration, and growth.



At Energy LIVE, the consensus was clear: policy certainty isn't just important - it's foundational. Stable, long-term frameworks provide the roadmap for achieving a sustainable, secure, and equitable energy future.

The IRA will yield cumulative **global economic benefits from reduced greenhouse gas pollution** of over

USD 5 trillion

from the present to 2050. (US Treasury)

4 Harnessing technology for the transition

The role of technology in the energy transition cannot be overstated, and the discussions at Energy LIVE 2024 highlighted the transformative potential of Artificial Intelligence (AI) in reshaping the energy sector.

AI as a catalyst for renewable growth

AI's applications in optimising renewable energy deployment are rapidly evolving. By leveraging AI-powered predictive analytics, developers can pinpoint the best locations for wind and solar farms, ensuring maximum energy generation. These algorithms consider a variety of factors – solar irradiance, wind patterns, and land use constraints – allowing stakeholders to make data-driven decisions that reduce project risks and enhance efficiency.

Tackling interconnection bottlenecks

One of the most pressing challenges in scaling renewable energy is managing grid interconnection bottlenecks. AI-driven platforms are providing real-time insights into grid constraints, enabling utilities and operators to prioritise upgrades and allocate resources more effectively. These systems also facilitate faster approvals by modelling the grid's capacity to handle additional renewable inputs.

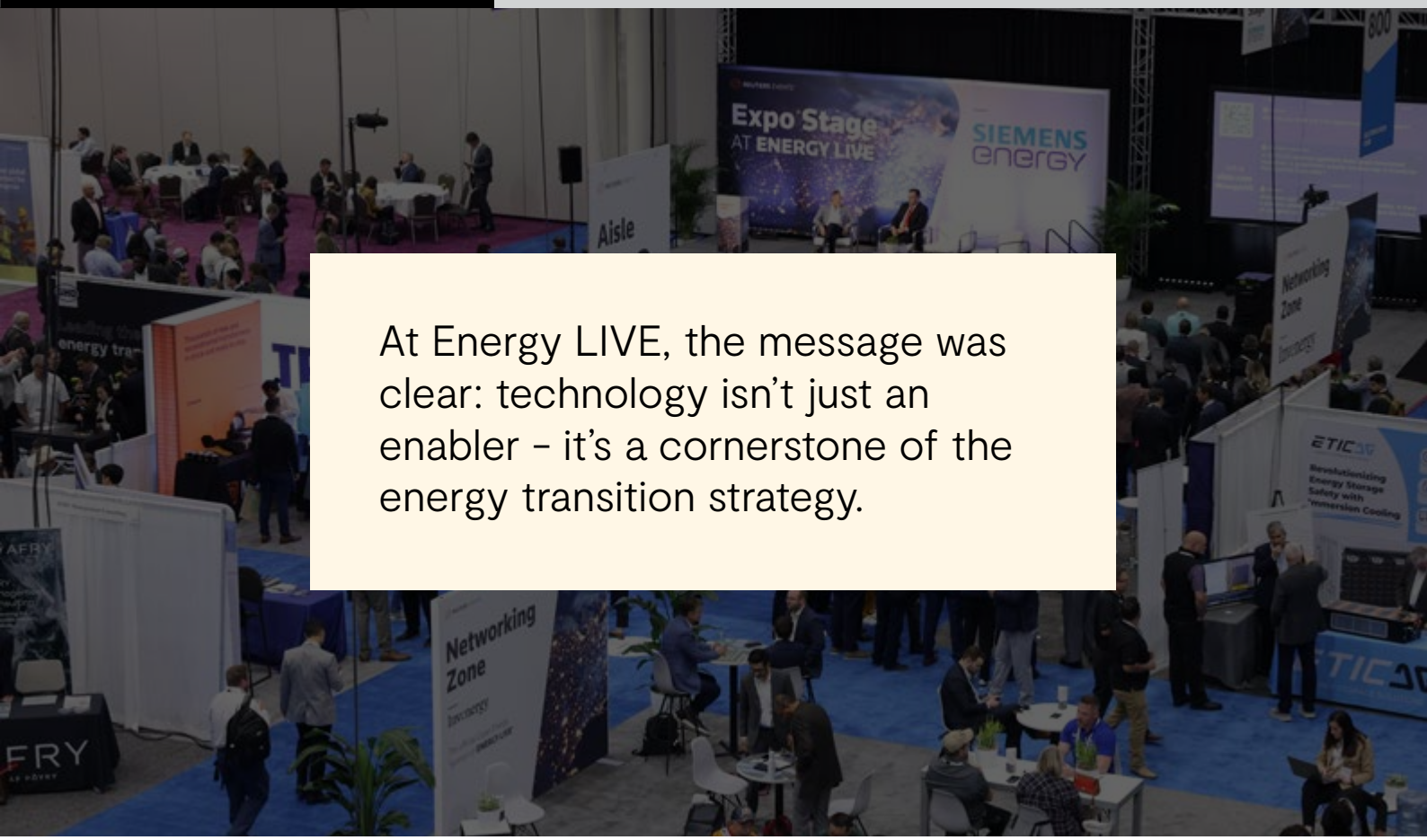
Revolutionising grid stability with Virtual Power Plants (VPPs)

VPPs emerged as a point of discussion, showcasing how AI enables decentralised energy management. By aggregating distributed energy resources like rooftop solar panels, batteries, and electric vehicles, AI systems ensure grid stability by dispatching power where and when it's needed most. This flexibility is critical as the energy mix becomes increasingly variable with renewable inputs.

Broadening technological horizons

Beyond AI, innovations in machine learning, blockchain, and IoT are being harnessed to create smarter energy systems. These tools help improve forecasting, reduce transmission losses, and enhance energy storage integration. For example, smart meters equipped with IoT sensors are empowering consumers to actively manage their energy use, fostering a more collaborative and efficient energy ecosystem.

By embracing these technological advancements, the energy sector is well-positioned to overcome some of its most significant challenges, accelerate decarbonisation, and ensure a stable and resilient transition to a sustainable future.

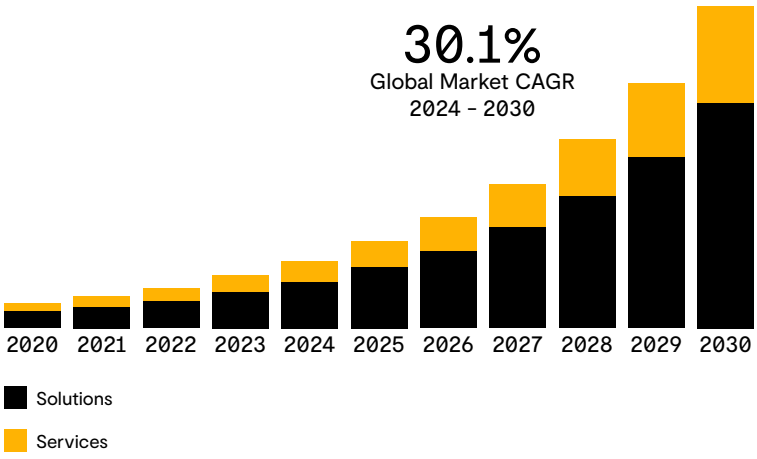


At Energy LIVE, the message was clear: technology isn't just an enabler - it's a cornerstone of the energy transition strategy.

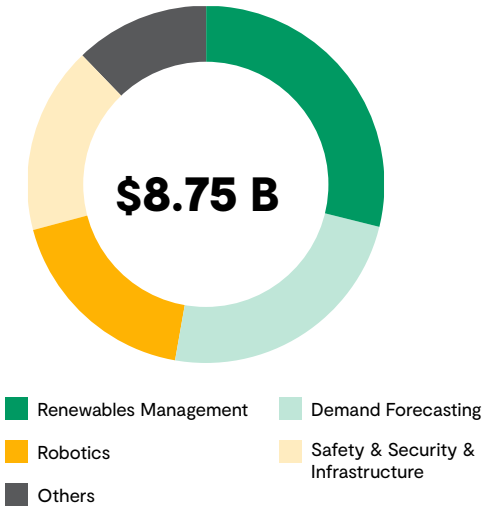
The **global AI in energy market size** was valued at **USD 8.75 billion in 2023** and is **expected to grow at a CAGR of**

30.1% from 2024 to 2030, emphasising its transformative potential. (Grand View Research)

AI in Energy Market Size



AI in Energy Market



5 Community engagement and equity

At Energy LIVE 2024, a recurring theme was the critical need for a just and equitable energy transition that leaves no one behind. The transition to cleaner energy sources offers immense opportunities but also comes with challenges that disproportionately affect disadvantaged communities. GHD delegates emphasised the importance of integrating equity and inclusion into every aspect of the energy transition.

Addressing job displacement and economic equity

As fossil fuel industries decline, job displacement is an unavoidable consequence for many communities heavily reliant on these sectors. Delegates underscored the importance of proactive workforce transition programs, including retraining initiatives that equip workers with the skills needed for clean energy industries. By investing in job creation within renewables, hydrogen, and storage technologies, the transition can simultaneously advance climate goals and support regional economies.

Improving accessibility to clean energy technologies

While technologies like EVs and heat pumps are essential for decarbonisation, their high upfront costs often create barriers for lower-income households. Delegates called for mechanisms to lower these barriers, including targeted subsidies, financing options, and public awareness campaigns to highlight the long-term cost savings and environmental benefits. Making clean energy accessible to all will ensure broader adoption and greater societal impact.

Equitable funding mechanisms

Regions with limited resources or existing inequities face compounded challenges in the energy transition. GHD specialists highlighted the importance of creating equitable funding mechanisms that channel investments into disadvantaged communities. This includes funding models that prioritise underserved regions, Indigenous communities, and areas with high levels of energy poverty, ensuring they reap the benefits of clean energy projects.

Community engagement as a key driver

A successful transition requires more than funding and technology – it demands authentic community engagement. By involving communities early in the planning process, developers can address concerns, incorporate feedback, and ensure that solutions reflect local needs and priorities. As Dr Peter Benyon noted during his keynote, “The energy transition is not just about technology; it’s about people. By prioritising equity and engagement, we can build support for sustainable solutions.”

From building trust to addressing systemic inequalities, Energy LIVE reinforced that the energy transition must be inclusive, equitable, and community driven. Prioritising these principles will not only build broader public support but also ensure that the benefits of the energy transition are shared by all.

Keynote highlight:

The Great Electrification Debate

The Great Electrification Debate, featuring Dr Peter Benyon and Dr Tej Gidda, was one of the most anticipated sessions at Energy LIVE 2024. Drawing a packed audience, the session ignited lively discussions on the feasibility and practicality of electrifying everything as part of a net-zero future.

Electrification as a cornerstone

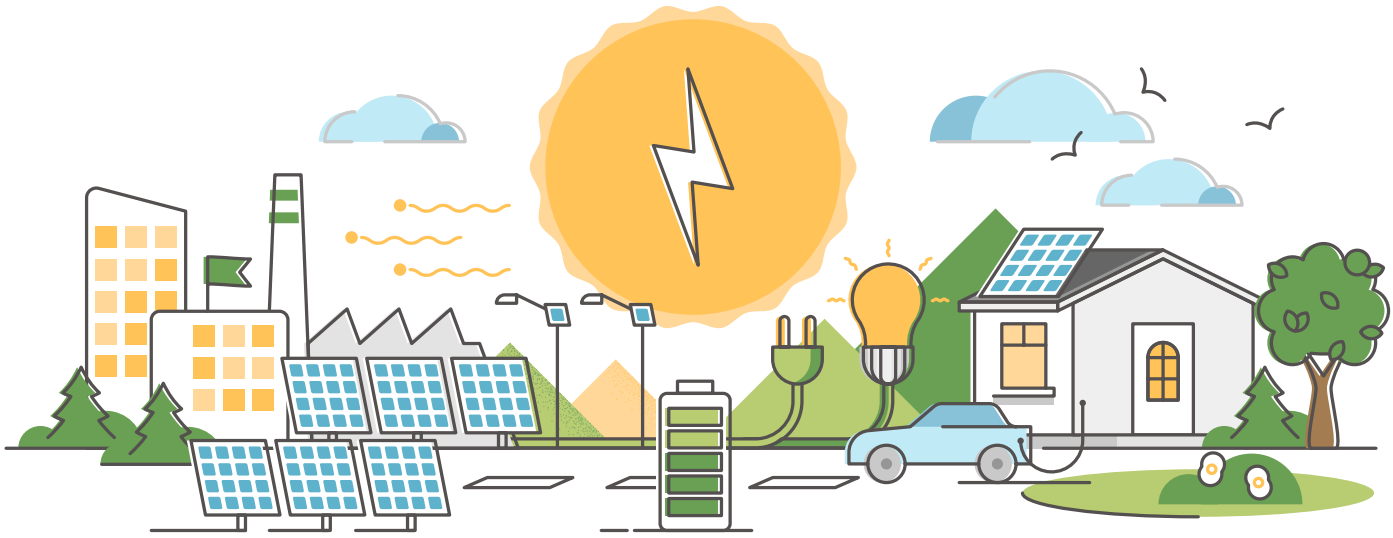
Dr Benyon championed the promise of electrification, citing its potential as a cost-effective and accessible pathway to reduce emissions while delivering significant public health benefits. He highlighted community-led initiatives like Electrify 2515 in Australia, which demonstrated how transitioning households to electric systems can yield both environmental and economic advantages. “Green electricity,” Dr Benyon asserted, “is not only a tool to combat climate change but a healthier and more affordable option for communities.” He emphasised that with advancements in energy storage, renewable energy, and grid technologies, widespread electrification could deliver cleaner air, lower energy costs, and a streamlined transition to net zero.

A diversified approach to decarbonisation

Dr Gidda offered a counterbalance, advocating for a pragmatic and diversified approach. While recognising the potential of electrification, he stressed its limitations in addressing affordability and infrastructure gaps, particularly in North America. Dr Gidda argued that sectors like heavy industry and transport require complementary solutions, including hydrogen and renewable fuels, to meet decarbonisation targets without overburdening power grids. “Electrification isn’t the sole answer; it’s part of a larger, multifaceted solution,” Dr Gidda remarked, underscoring the need to leverage existing infrastructure and embrace a mix of low-carbon technologies.

An engaged dialogue

The debate highlighted the urgency of advancing both electrification and broader decarbonisation efforts while fostering innovation in complementary technologies. Delegates left the session with a deeper understanding of the complexities of energy transition, acknowledging that the future requires both bold strategies and practical, region-specific solutions. **This keynote perfectly encapsulated GHD Future Energy's as an advocate for driving informed dialogue and inspiring action across the energy sector.**

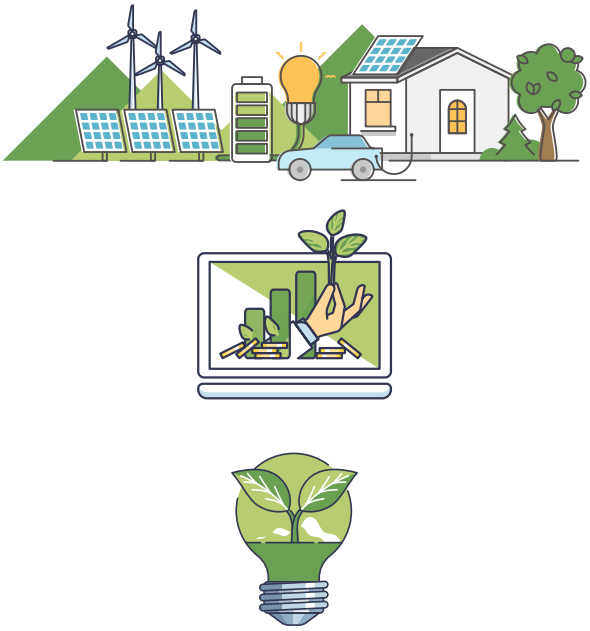


Global electricity demand is **expected to double by 2050**, requiring unprecedented investments in grid infrastructure and storage technologies. (DNV)

Looking ahead:

GHD's commitment to Future Energy

Energy LIVE 2024 reaffirmed the necessity of cross-sector collaboration to address the multifaceted challenges of the global energy transition. GHD Future Energy is leveraging these insights to deepen its commitment to building innovative, equitable, and sustainable energy systems.



GHD Future Energy remains committed to:

- → Driving innovation in renewable technologies, hydrogen, and energy storage.
- → Advocating for policies that enable long-term investments in sustainable infrastructure.
- → Partnering with communities to ensure equitable energy transitions.

Looking ahead, GHD Future Energy is poised to lead the way in delivering resilient energy systems aligned with global climate goals. The company's participation at Energy LIVE 2024 underscores its role as a trusted partner and industry leader in navigating the complexities of the energy future.

Let's keep the conversation going

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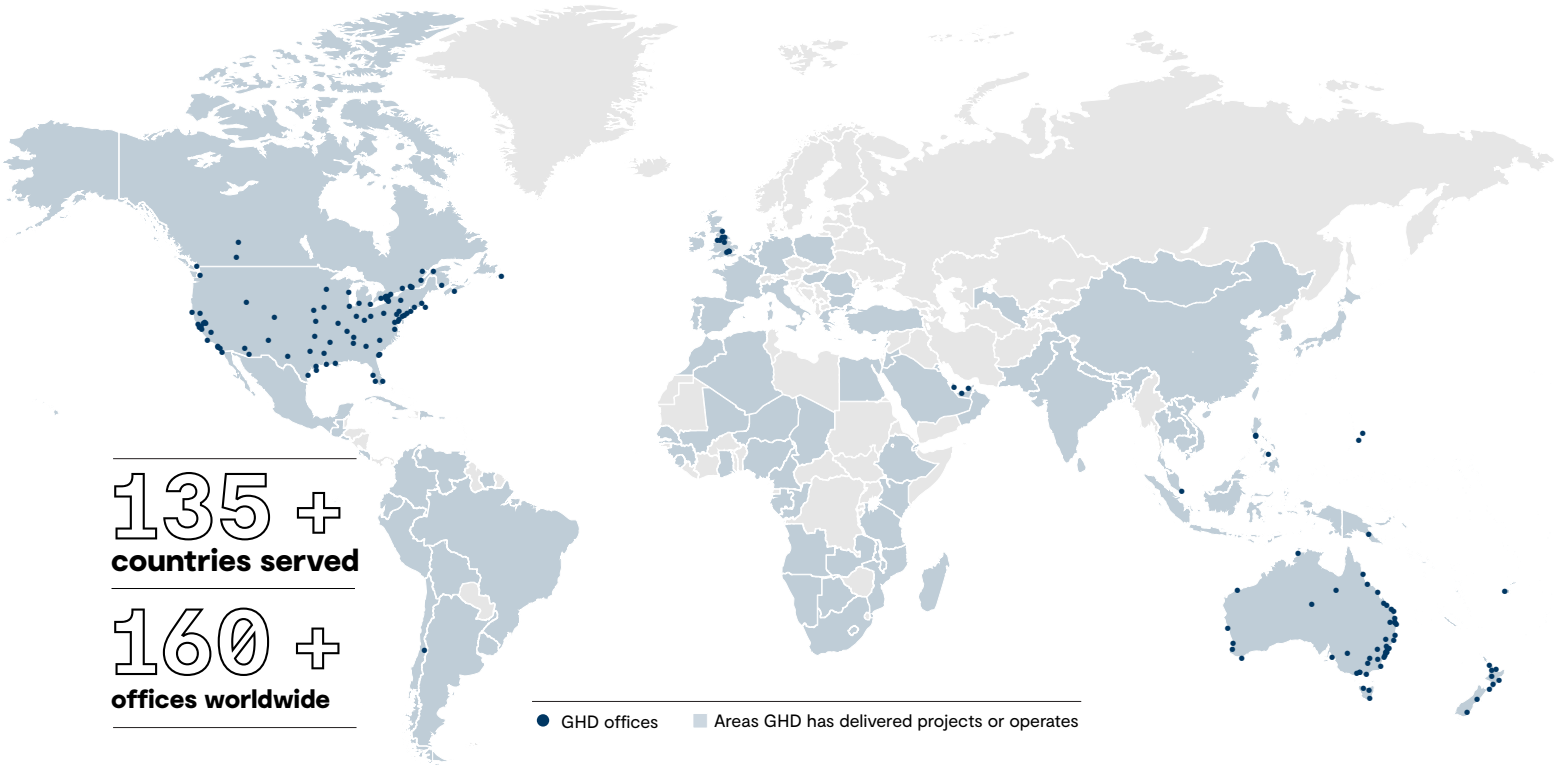
For a deeper dive into our vision and solutions, visit GHD Future Energy**.**



About GHD

GHD recognises and understands the world is constantly changing. We are committed to solving the world's biggest challenges in the areas of water, energy and communities.

We are a global professional services company that leads through engineering, construction and architectural expertise. Our forward-looking, innovative approaches connect and sustain communities around the world. Delivering extraordinary social and economic outcomes, we are focused on building lasting relationships with our partners and clients.

Established in 1928, we remain wholly owned by our people. We are 12,000+ diverse and skilled individuals connected by over 160 offices, across five continents – Asia, Australia, Europe, North and South America, and the Pacific region.

Discover more at ghd.com

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