SEAMLESS PROSUMER LIVING

ENERGY MONEY DATA

NET PRODUCING

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INDUSTRY 4.0

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HYDROGEN

OUR 2050 ENERGY VISION-CONSUMERS ARE NOW PROSUMERS, AND THEY'RE IN CHARGE

Within the first two installments of this short series, we explored the challenges facing all participants in the energy industry, as we strive to get back on target for Net Zero. Now it's time to focus all our collective energies on the future, on the opportunities before us and the enormity of the prize to be won.

It's our firm conviction at Capgemini that there are so many reasons for real optimism, that within this huge industry there already exist the skills, the experience and the ingenuity required, so that, when deployed in combination,

we can deliver the viable, long-term market mechanisms, systems and solutions that will enable us to achieve our global goal.

In this final Point of View, we share with you where our thinking, of a fully reimagined, connected and integrated 2050 energy system; where key stakeholders will contribute to a whole far greater than the sum of its parts – by uniting in a common cause, with confidence that we have the right destination in sight and that our roadmap is sound. Only then can we all move forward together with confidence.

CAPGEMINI'S 2050 ENERGY VISION

Seamless prosumer living
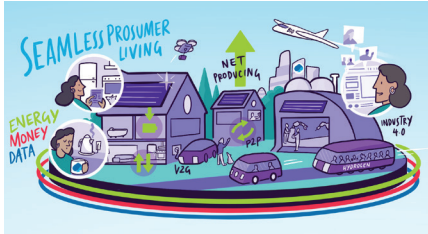
In 2050, consumers of energy are now prosumers – producing, storing, trading and consuming as our needs demand, in a flexible, smart, convenient and affordable energy system. I trade with my neighbour through micro grids and local community battery storage infrastructure, or shift excess generation back to the grid, when tariffs are attractive. I drive an EV, use a government grant to move from gas to electric, and there are solar panels on my roof. My smart meter is truly smart and works with any supplier, giving me choice between many providers of services across all my needs, enabling me to instantly switch to those that meet my unique selection criteria and specific service quality and price requirements. At any time, I can easily connect my appliance to my standards-based smart energy hub, available from my energy services provider or other leading brands, and enable it to make my home function in a more sustainable and seamless manner, interoperable with any other appliances I buy, using open standard service agreements and terms. When I travel I use low carbon services such as self-driving e-cabs, hydrogen buses, electric trains, biofuel powered planes. In summary, I am adapted, adopted, and expecting simplicity, interoperability, automation and increasingly autonomous operations, that are responsive to my needs and any necessary external factors.

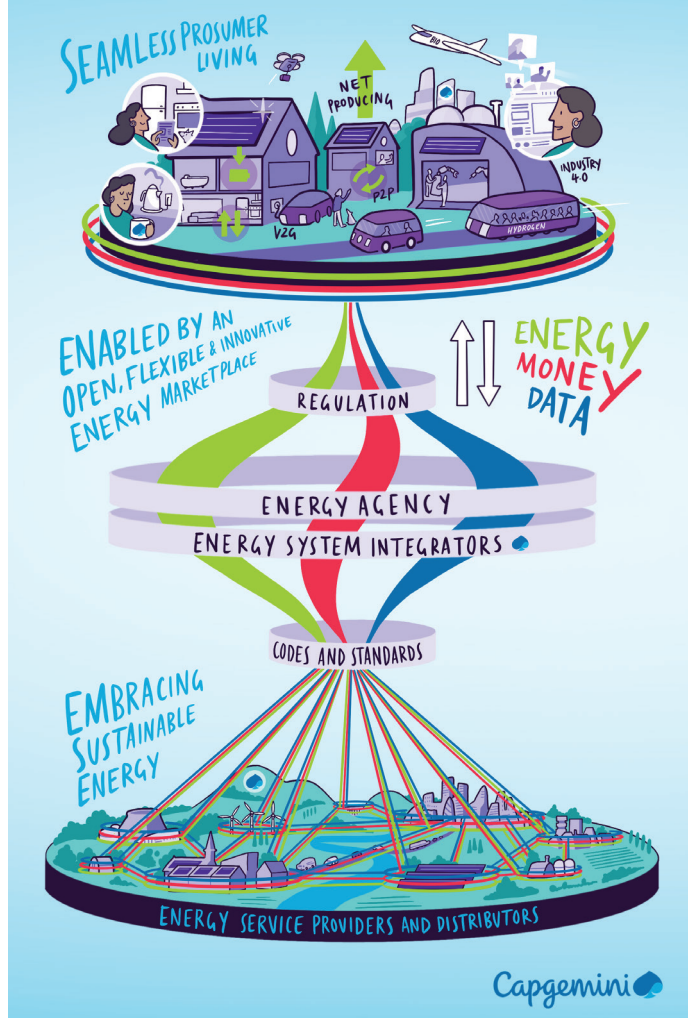### Embracing changed patterns of energy generation
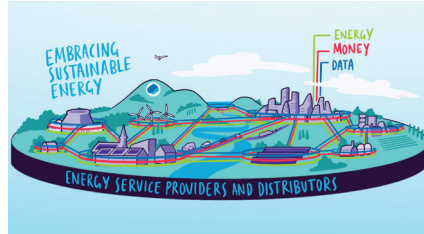
Net zero requires consistent, rapid growth in renewable generation and storage, with smart management and controls. The new energy system now features billions of assets, in a complex, hyper-connected and interoperable network. It has a common approach, with fully integrated databases, a decentralised, federated model based on trust, with service providers aware of the location, capabilities, operating thresholds, services and service agreements provided by every energy asset, such as smart home energy controllers, generation assets, storage and flexibility assets. Today automation and autonomous operations are the norm, with smart energy management systems automatically sharing control signals between them, to operate and balance the system, matching supply and demand, meeting standards of service, and responding to the needs and actions of consumers, as they elect to 'charge now' or 'charge when cheapest/most sustainable'.

Enabled by an integrated energy system
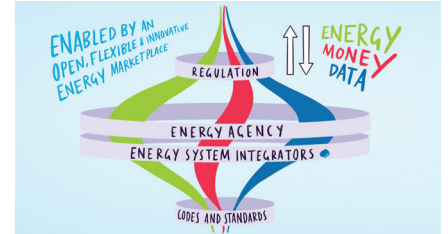
Our vision of the market requires an independent hub organisation, let's call it an Energy Agency, to fulfil this integration role in Energy X.0. In our new energy world, this Agency is ensuring an evolving blueprint that meets societal energy needs, driving standards and overseeing the operation of a flexible, responsive, net zero energy system, utilising common services and platforms. It knows what all the services, products and assets are, what they do, how and where to find them, how to communicate with them and what the standard service agreements are for their use, such as time, capacity, quality and cost. Our new system enables the use of energy contracting and clearing services as the norm, perhaps characterised by a central clearing platform. There is faster settlement in seconds and minutes, not weeks for the vast majority of energy, with automated processing of contractual terms and value from the service agreements. There are simplified processes, lower overheads and capital requirements, and reduced barriers to cash flow throughout the system. There is now a more flexible consumer experience, including financing, which has enabled an increase in choice about how I pay for my broader range of energy-as-a-service requirements and the differentiated service levels they now offer.

Capgemini's 2050 energy vision — power to the people
Get the future you want

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NET PRODUCING

INDUSTRY 4.0

P2P

V2G

HYDROGEN

ENABLED BY AN OPEN, FLEXIBLE & INNOVATIVE ENERGY MARKETPLACE

ENERGY MONEY DATA

REGULATION

ENERGY AGENCY

ENERGY SYSTEM INTEGRATORS

CODES AND STANDARDS

EMBRACING SUSTAINABLE ENERGY

ENERGY SERVICE PROVIDERS AND DISTRIBUTORS

Capgemini

How do we achieve our vision?

Markets seldom work well on their own. Affordable, sustainable energy is critical, not just for businesses and consumers, but for all of national infrastructure, from schools and hospitals to transport and security. Effective policy, governance and management is necessary to ensure the market works for everybody and provides at least a universal standard of service, competition, and similarly, plays a key role in driving innovation, delivering for the consumer and driving down costs.

Telecoms and the internet provide informative examples of how this can work for energy. Central standards bodies define the blueprint – how the system as a whole works. They also

enable a flexible way in which to extend and create new standards that enable rapid definition and introduction of new products and services, and which incentivise interoperability. Energy needs its own equivalent, moving away from the monolithic legacy 'industry codes' to a flexible agile mechanism that drives agility and innovation, supported by standards and interoperability.

We talked before about having all the ingredients and a recipe for success and that the key will be leveraging the right technologies to enable a new market to function effectively. In common with other industries who have embraced a new market construct, most of the key technologies already exist. In a similar vein to an old Franklin saying of 'well done is better than well said' , Capgemini are not just energy analysts and commentators. For example, alongside some of our key clients (EDF, Engie, Schneider, Total, Volkswagen), Capgemini is a shareholder in InnoEnergy, which has invested in more than 300 clean energy start-ups to exploit technologies like:

• **Digital Twin technology**
• **Automation**
• **Augmented Reality**
• **Artificial Intelligence (AI)**
• **Internet of Things (IoT)**

To solve energy industry problems. Take AI, and smart energy grids, for instance. When exploited effectively, AI can play a vital role in the management of smart energy grids, to overcome the inherently variable and uncertain nature of generation from renewables. Equally, it can be applied to the ever-changing nature of demand and when combined with Automation could feasibly have a role in reducing demand at key times, as we move to uncertainty of supply surrounding renewable energy. It will allow physical assets to be interconnected and to communicate with each other through the vast flows of data in real time – with no need for manual intervention or human intelligence.

With the need to control and optimise flows and consumptions, and increased pressure on maintenance costs alongside the evolution from traditional to smart infrastructure and grid, it's our belief that exploiting such technologies can be the only way to approach the leapfrog required to get to the Energy X.0. state we described in our previous bulletin.

# Achieving our 2050 energy vision – four important steps

1. We introduced the concept of seamless prosumer living and the expectation of smart energy.

This already exists today with much consumer technology connected to the internet – smart home assistants for example – providing a proven and virtually seamless experience. Contrast this with today's electricity, gas and heating situation – with isolated appliances failing to deliver the value for consumers that is tantalisingly at their fingertips.

We must seize the opportunity to develop and implement standards and protocols that enable a seamless experience managing our most hungry energy consuming items – heat pumps, fridges, EV charging – that make sustainability simple. As a consumer I want to choose to charge when cheapest or charge now for my EV. I want to be able to manage the cost of my heating for my home, be smart about appliance usage by setting sensors to work when capacity is high.

This would consist of a simple registration process for all products and services. During registration, the common data needed to describe the solution is provided, enabling:

- **basic qualification processes (do you meet the required standards?)**
- **search (have you provided the necessary data?)**
- **trust (are you who you say you are?), and**
- **value (cost and sustainability metrics).**
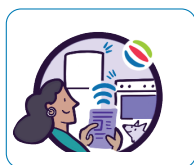
In this way we're essentially leveraging the premise of an eBay or an Amazon marketplace to enable consumers to find, compare, select, purchase, or subscribe to what they need, from a competitive landscape of providers, with easy fulfilment and great customer service. Building on the existing work done by projects like TraDER and Piclo, or products in the industry like KrakenFlex which allows digitally controlled and optimised Distributed Energy Resources (DERs) it would be possible to expand the scope, which allows generators to transact directly with flexible assets, to go further and expose that flexibility as 'levels of service' to be selected directly by the consumer.

Existing proven mechanisms to source and deliver technology-enabled platforms, delivering a common service to society in an economically efficient way, are all out there. The technologies and standards to enable this are proven in the internet world – TLS security, e-commerce platforms, HTTP, LDAP-style directories and registries and federated identity. All we need is ambition and galvanised, coordinated action to make it happen.

2. Registering and connecting assets, harnessing data flow

Today's energy industry is characterised by multiple, disparate asset databases. For our vision to become reality we need a common approach, with complete integration between databases. Other industries have proven the criticality of accurate and up-to-date asset registers. Mobile phones wouldn't work without them; all vehicles on the road must be centrally registered; the core of the internet is the same. This is an essential principle that the energy ecosystem must embrace.

In Energy X.0., data and physical assets will grow exponentially, embracing smart home energy controllers, smart devices/consumer goods and appliances, generation, storage and flexibility assets. It is a key building block enabling whole system visibility. When aligned with efficient operations, it will provide the foundation data for the systemwide digital twin, now recognised as a must for the future, to enable a digitalised energy system across the planning and operational lifecycle.

Again, the technologies for this exist today – flexible engineering, product and asset management solutions, data interchange standards, visualisation technologies and integration and automation pipelines – to join it together. All that's required is an agile approach, governance and standards, a flexible target blueprint that we agree on and the associated programmes to deliver the vision, ambition and galvanised action.

3. Control room automation – energy flow

With billions of hyper connected and interoperable assets, compared to today's siloed system of transmission, distribution and other networks, mostly dominated by large generators, the new system will demand far higher levels of automation and autonomous operation.

This represents a step change in how we think, how we operate, how we leverage data, as well as cultural and behavioural change. In tackling this massively increased scale, we can learn from the industrialisation of IT, which itself has transitioned from server rooms to enterprise data centres to hyperscale cloud operations, with increased efficiency, reliability availability, all with cost efficiency. We may also need to learn to think differently – for example, IT has moved from designing for resilience to designing to be failure tolerant, becoming more simple and efficient at the same time.

At Capgemini we've been at the forefront of the change within IT and can bring this insight to the energy industry. Moreover, we are involved in creating the infrastructure and control rooms of the future. At Telenor Connexion for example, the IoT division of the Telenor Group, one of the world's largest mobile network operators, we built an advanced, cloud based, real-time troubleshooting toolset which provides unique, live insights into all their global mobiles and networks and all connected devices.

4. Settlement in real-time – money flow

Finally, if Energy X.0 is real-time, seamless, flexible and sustainable, then the associated financial flows also need fundamental change. Today's energy finance, with monthly and year-plus settlement processes, can learn from the financial markets – real time trades, rapid settlement, transparent pricing signals for all players, clarity on the true costs, transaction charges, taxes and duties.

At Capgemini, our capital markets and financial services capability has been grown over decades of working with companies like Euroclear and most of the leading banks and securities houses. With a global team of 6,500 capital markets professionals and 60,000 financial services professionals, we have provided innovative ideas for technology transformation and operational efficiency improvement to drive new business and operating models, and innovative payments roadmaps.

We can bring this skill to the energy market to enable the vision, to drive the ambition and stimulate the coordinated action required to deliver transparent pricing signals. In turn this will drive behavioural change for individual and business consumers alike, enabling them to reduce consumption at times of higher prices, and swift and easy switching between suppliers to access energy from the most sustainable sources.

The UK energy industry has all the tools at its disposal. Together we can learn from the successes of other industries. We'd love to play our part to help you to apply the vision, ambition and coordinated action that will transform this powerhouse industry, and meet our shared global goals.

If you'd like to discuss our vision for the energy industry of the future or share your point of view, we'd love to talk to you, to see how we can collaborate for the greater good, for Net Zero in 2050.

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About Capgemini

Capgemini is a global leader in partnering with companies to transform and manage their business by harnessing the power of technology. The Group is guided everyday by its purpose of unleashing human energy through technology for an inclusive and sustainable future. It is a responsible and diverse organization of 290,000 team members in nearly 50 countries. With its strong 50 year heritage and deep industry expertise, Capgemini is trusted by its clients to address the entire breadth of their business needs, from strategy and design to operations, fueled by the fast evolving and innovative world of cloud, data, AI, connectivity, software, digital engineering and platforms. The Group reported in 2020 global revenues of €16 billion.

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