

Knowledge is power

A DIGITAL TWIN-BASED ENERGY MODELING APPROACH FOR A CLIMATE-NEUTRAL FUTURE

AS THE WORLD RACES TO ACHIEVE A CLIMATE-NEUTRAL SOCIETY BY 2050, FLUVIUS, BELGIUM'S LEADING MULTI-UTILITY COMPANY, AND DELOITTE HAVE BROUGHT TO LIFE A GROUND-BREAKING RESULT: A SOPHISTICATED GRID DIGITAL TWIN SUITE CALLED 'NEXT GENERATION INFRASTRUCTURE' (NGIN), WHICH HAS INSPIRED A DELOITTE GLOBAL INITIATIVE: ELECTRIFIEDGRID.

NGIN not only assesses but also visualizes the impact of electrification at the distribution grid level. This helps Fluvius maximize value creation by optimizing asset management, identifying potential digital technologies, and future-proofing grid architecture.

Roy Gys, senior manager, Infrastructure and Energy Solutions, Deloitte Belgium, and Robert Saunders, senior manager, Strategy and Transformation, Deloitte Canada, share nine insights on how the Fluvius and Deloitte collaboration has ignited a broader journey towards a cleaner, greener and more sustainable future.

Before digging into these key insights about this innovative offering, Robert reflects on what working on this particular digital twin has meant to him.

"In working with clients mostly in North America, considering the unique forces impacting energy and policy, it became clear years ago that the digital capability to model the energy transition in high fidelity – all the way to the individual meter level – was going to be necessary and valuable. The question was just 'when' and 'where'. It was exciting to find geographies overseas where 'the future' was already being

experienced. In Belgium, with the government installing electrical fleet vehicles and progressive electrification policies, there is very high EV (electric vehicle) adoption.

Due to past incentive schemes, price instability and future uncertainty, solar photovoltaic (PV) adoption is also high. Also, the adoption of heat pumps and air-conditioning is on the rise. This combination creates risks, such as grid congestion and related problems, within the planning horizon and greatly changes the assumptions of the design of the electrical system. Planners and designers, therefore, need better, more granular forecasting and analysis.

"In North American terms – it's a 'California type' adoption market. Almost every geography is on this path, just at different speeds, as the electrical system is asked to do something it wasn't designed for – to handle much more of our daily energy needs. The planners and policy makers will also need more advanced means for analyzing the ability of the grid to meet demand through implementation of new equipment and tools. For instance, capabilities that will be enabled by a confluence of new hardware and software, including Distributed Energy Resources, Distributed Energy Resource Management Systems (DERMS), Advanced Distribution Management Systems (ADMS) and Advanced Metering Infrastructure (AMI).

"It's a credit to the whole team in Belgium (Fluvius and Deloitte) for being strategic in how they solved the problem, in an integrated fashion that unites the functional areas of their organization – customer, asset management, operations, sustainability, strategy,

finance, etc. and repeatable to help the world with these same challenges."

For his part, Roy agrees. "When we tap into the potential of data, we can build solutions that support our strategic and tactical decision-making about the future of infrastructure. Deloitte's unique collaboration with Fluvius has been a career highlight for me. Although we were relatively early in the market when it launched a few years ago, we can see how this type of digital twin-based modeling is picking up pace and really making a difference. Its data-driven analysis is informing the optimal way in which we can achieve the energy transition with its rapid electrification across Belgium. It has huge potential for the rest of the Europe, and the world, too."

Rob adds, "It's important to understand that this is not just about the distribution end of the system; going forward Deloitte is integrating modeling capabilities throughout the entire value chain – including the bulk (generation and transmission) system, with our macroeconomic modeling and indeed across energy systems and the shifting sources of demand (like transportation).

"The trillions of dollars per year being forecasted for the global energy transition, and the implied mega projects, aren't always modeled by contemplating the maximum potential of the distribution system to handle and shift peak demand. Instead, forecasts are made based on extrapolating the status quo of how demand has been predicted and managed in the past. But what happens when EVs charge back to the grid? It's a great question – and

society will expect politicians and grid planners to have that answer if we're going to invest billions in each region and cause rates to increase – we better have that answer! There's really only one way to know with confidence – thanks to big data and advances in processing speeds we can do that inexpensively." Deloitte is uniquely positioned to

Southern California Edison's 'Countdown to 2045' whitepaper outlines near-term priority actions to achieve net zero. It starts with: "Reimagine System Planning: California must reimagine how it plans the electric system to efficiently interconnect clean energy resources and enable operational flexibility. The state needs a planning process that is integrated across domains (including generation, transmission, distribution and local resources) and objectives (including affordability, reliability, load growth and climate adaptation) to ease the process of interconnecting resources and enable a more resilient, cost-effective system."

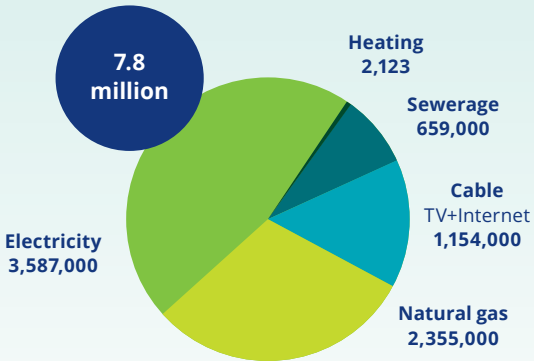
lead with our clients in this space because we have the modeling capabilities, proven assets, global teams and local specialists to ease the burden of implementation. Through our global work on the future of mobility projects, we're able to apply those insights into energy modeling. For instance, what happens to a regional energy demand profile if vehicles become autonomous by 2035?

Fluvius, close to you

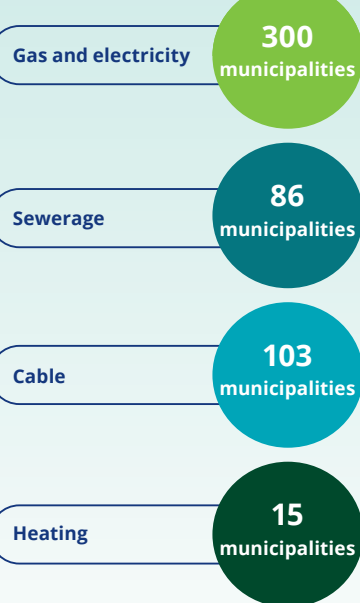
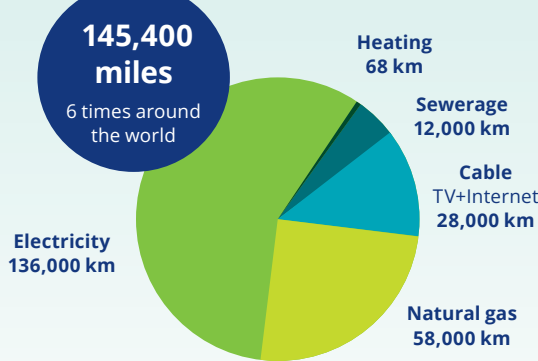
2022 KEY FIGURES



CONNECTION POINTS



LENGTH OF DISTRIBUTION GRIDS



Source: <https://jaarverslag.fluvius.be/2022/en/key-figures>



9 key facts...

1 GAINING CLARITY ON THE TERM 'DIGITAL TWIN'

"People get confused on the definition of 'digital twin'; it is really better to think of it as a concept, which is applied differently in many spaces. Generally speaking, 'digital twin' just means a digital representation of real-world physical elements. For the energy transition application, it is the representation of the equipment constituting 'the grid' for power flow analysis," says Robert. On top of the representation of the grid, we model factors impacting demand, from the rise of EVs to the growing adoption of heat pumps, and everything in between.

This is adjacent, although somewhat complementary, to other applications of digital twin technology used for 3D visualizations to do things like inspections (in which Deloitte also specializes). They are complementary because at the core both need to know where the assets are, what they are, etc., so there are elements of the data that could be shared which means big efficiency and cost savings for the utility, so long as they identify the opportunities.

2 VISIONARY LEADERS A FUTURE OF UTILITIES TRANSFORMATION

Fluvius' digital twin solution is entirely client-centric, following several years of foresight analysis with them regarding the future of energy. The effort has been centered on visionary leadership: the choices utilities must make, the ramifications for their existing capabilities, the disparities between the present and the envisioned future, the ability to address external influences, and the optimization of pathways to seize future opportunities in a world with high uncertainties. The utility has its sights set on the future of energy and aims to bridge the gap between today's capabilities and tomorrow's needs, ensuring they can adapt to external factors and optimize pathways to a sustainable future.

"We are currently developing and building the 'grids of tomorrow' in Flanders. That is our number one priority today," says **Raf Bellers**, Director Grid Management and Supply Chain at Fluvius. "To support an increasing number of heat pumps, solar installations, wind turbines and electric vehicles, our electricity grid needs to be progressively and proactively reinforced and digitized over the next 10 years. Our digital twin solution helps us analyze and simulate our grids to pinpoint and prioritize where specifically we need to invest. It's an important tool to work as efficiently as possible to help enable the energy transition."

3 BRINGING THE BEST FROM AROUND THE GLOBE TOGETHER WITH PURPOSE

Inspired by the Fluvius work on the distribution end of the system, the Deloitte ElectrifiedGrid initiative has cast its net globally, starting with a core in Canada and Belgium and concentrically building a collective of leaders in multiple areas of modeling and grid expertise from places such as Japan, France and the US. The guiding principle is to not duplicate efforts, and instead find ways to share benefits and integrate towards a future vision.

A good example is the way that Deloitte is integrating already built (or being deployed in regions) macroeconomic and bulk energy system models in specific geographies (e.g., Deloitte's DARE – Deloitte Applied Research on Energy modeling capability) with the deep 'bottom up' modeling capability of a deployed instance of 'ElectrifiedGrid' in a region. The common rallying cry is the noble cause at hand – accelerating the energy transition so that we can meet the commitments of the UN Paris Agreement (COP21) while not sacrificing reliability or cost.

4 LEAVING NO ONE BEHIND

Deloitte supports Fluvius, and many other utilities globally, to provide safe, reliable, affordable and clean energy to everyone. Increasingly in focus, too, is ensuring that no one is left behind in the transition to a sustainable future, that we enable a 'just transition' for society. ElectrifiedGrid is an enabler of achieving this goal, as it equips the utilities with the capabilities needed to help identify affordability challenges at a neighborhood level, or even street level, and test digitally customer programs which can help alleviate these issues.



5 NAVIGATING UNCERTAINTY WITH CONFIDENCE TO MOVE WITH URGENCY

Using ElectrifiedGrid to assess the transition costs required to meet government-set climate targets, under a variety of scenarios, will help accelerate progress where the urgency of change has been most pressing. By simulating scenarios of electrification and assessing the infrastructure needed, the grid digital twin proves invaluable for supporting the selection of 'low' or 'no' regret investment choices and lighting a policy path forward. Key to the confidence is understanding not just costs but also risk in a more statistical manner.

The recent tide of news stories (e.g., failed rate increase requests) show the sometimes growing divide between government and utilities, and underscore technology and data-driven insights are increasingly indispensable in shaping the energy landscape of the future.

6 A COMPLEX LANDSCAPE

There's no one-size-fits-all solution to the global energy transition challenges; the transition is highly dynamic. It's no secret that each region has unique challenges, and the future of energy isn't evenly distributed. The ElectrifiedGrid team has looked at global scenarios and found that regions with the most pressing issues tend to be furthest along in adopting digital twins to help them better understand and tackle those issues. Another visible example is the area of grid resiliency analysis – because of the increase in severity and frequency of natural disasters, namely and most recently wildfires and floods; grid digital twins have been used to enhance disaster preparedness through the simulation of extreme weather events.

7 THE IMPORTANCE OF DATA

Effective modeling requires high-quality data. Fluvius and Deloitte recognized early that data quality is an ongoing journey, and they use their digital twin program to incentivize data improvements within the organization. Robert explains how ElectrifiedGrid will continue forward with this concept at its core: "Data is the lifeblood of the digital twin. It plays a vital role in achieving accurate diagnoses, modeling and simulations. The commitment to data-quality improvement sets a precedent for ongoing data-driven excellence. However, organizations can't wait for perfect data – so we are helping them by using AI to help set assumptions, fill data gaps and validate and improve those over time in a structured manner. The result is an acceleration to value being generated."

8 A CROSS-SECTOR TOOLBOX OF USE CASES

ElectrifiedGrid is not a single-use case solution; it's a dynamic tool that can be applied to a wide range of challenges. The value of the tool/platform will snowball, which is an important aspect of its overall investment thesis for utilities and others in the regional ecosystem. The adaptability of the digital twin technology makes it a valuable resource for informed decision-making and improved operations in adjacent sectors as well. It's cross-sector impact could extend – from answering questions and planning the electrical grid, to gas delivery systems, to transportation planning, water planning and waste management and more. The ability to leverage Application Program Interfaces (APIs) will lead to cross-sector cross organizational efficiencies – and is ultimately aligned with the vision for 'Smart Cities'.

9 PLANNING WITH THE REGULATOR AND OTHER ENERGY STAKEHOLDER GROUPS

The digital twin is a powerful tool for evolving relationships between utilities, regulators, government entities, and special interest groups (such as indigenous first nations), catalyzed by working together to plan the energy transition. ElectrifiedGrid will help align utility investments with the needs of regulators and the public – and highlights the significance of building a shared 'living vision' at the core of collaborative planning sessions. As a tangible example, Roy notes that "Fluvius secured an additional EUR 4 billion to invest in the energy transition because they could quantify the benefits and addressed risks better using the digital twin."

The journey that ElectrifiedGrid is pioneering is a sustainable energy future that serves the needs of today and tomorrow. The Fluvius

digital twin program supported by Deloitte is not just another piece of technology; it's a shining light guiding the way to a climate-neutral society and an inspirational example of how data and digital underpin leaders' ability to make decisions that benefit everyone.

Roy concludes that while the capability had its beginning and foundation in Belgium, Deloitte is continuing the development globally, transcending borders: "Electrification is a worldwide problem, so we're looking at making a global portfolio of assets to support the energy transition – and that's ElectrifiedGrid."



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