dcbel

Energy & Utilities

The Need for Technical Aggregation & Multi-sided Edge DER Management

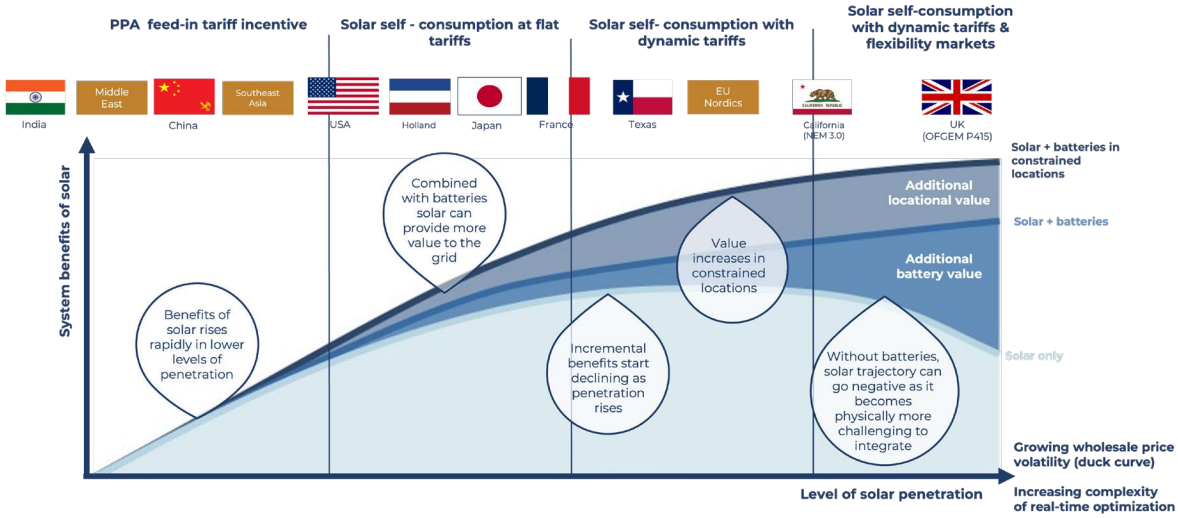
WHITEPAPER

dcbel.energy

The Energy World is Shifting **Even Faster than Anticipated**

The impact of renewables, distributed energy resources and electricity demand growth due to increased sector electrification has major implications for future grid capacity and operations. Moving towards further sectorial integration – whether for green hydrogen production, deployment of decarbonized heating technologies such as heat pumps in residential environments, as well as new Electric Vehicles (EVs) integrating Vehicle-to-Everything (V2X) functionality (now the de facto standard in all EVs by 2030) is a critical part of ensuring future energy system design, planning and operations are managed at an optimal cost to consumers.

It is widely accepted that storage self-consumptions and V2X are significantly disrupting the status quo with new technologies coming to market across various B2B and B2C sectors of the energy value chain. In that context, flexible interconnection and smart DER integration through innovative FERC Order No. 2222 rules, as well as the new European Demand side flexibility code are new rule books representing a regulatory reset for ISOs and utilities required to expand their approach to grid planning and capacity forecasting while preparing for a shift towards dynamic price incentives that integrate new dynamic price stimuli for all energy and ancillary service and grid congestion constraints. Associated regulatory changes have started in several countries across Europe and US.



Prosumers – whether residential, community, city, or industrial scale – are progressively evolving to be the cross sectorial integration focal point for which DER data orchestration is becoming key for planning, operational and transactional data. New multi-sided orchestration platforms are essential to bridge grid operator investment and needs with prosumer technology adoption scenarios, refined prosumer persona segments, investment options for PV self-consumption, fleet electrification, heating electrification, as well as new VPP Flexibility programs opening for transactive energy.

It is inevitable that all sectors will develop new system-based metrics and KPIs to analyze the energy efficiency and carbon footprint of the energy being distributed to them.

A New Paradigm

These cumulative market forces have created a new paradigm that requires a novel approach and strategy to integrate and orchestrate distributed energy systems.

Mass market deployment of interconnected distributed solar + storage due to DERs reaching Grid parity, funding incentives and new regulatory deployments phasing out solar PPAs such as NEM3, the IRA and European Flexibility code and the ability for rapid deployment that requires little Grid expansion.

Acceleration of storage bundled with solar and bidirectional EVs unlock an unprecedent amount of controllable power.

The variability of weather dependent renewable energy calls for a new approach to energy planning as top-down feeder level forecasts and historical statistical baselines no longer suffice.

Growing wholesale volatility due to renewable injection intermittency has led to an increase in costs and retail flat tariffs. Utilities are rethinking their rate strategies and are increasingly evaluating dynamic signals and transactive controls for flexible DER owners who are willing to participate in the market and considering new options to separate dynamic loads with submetering.

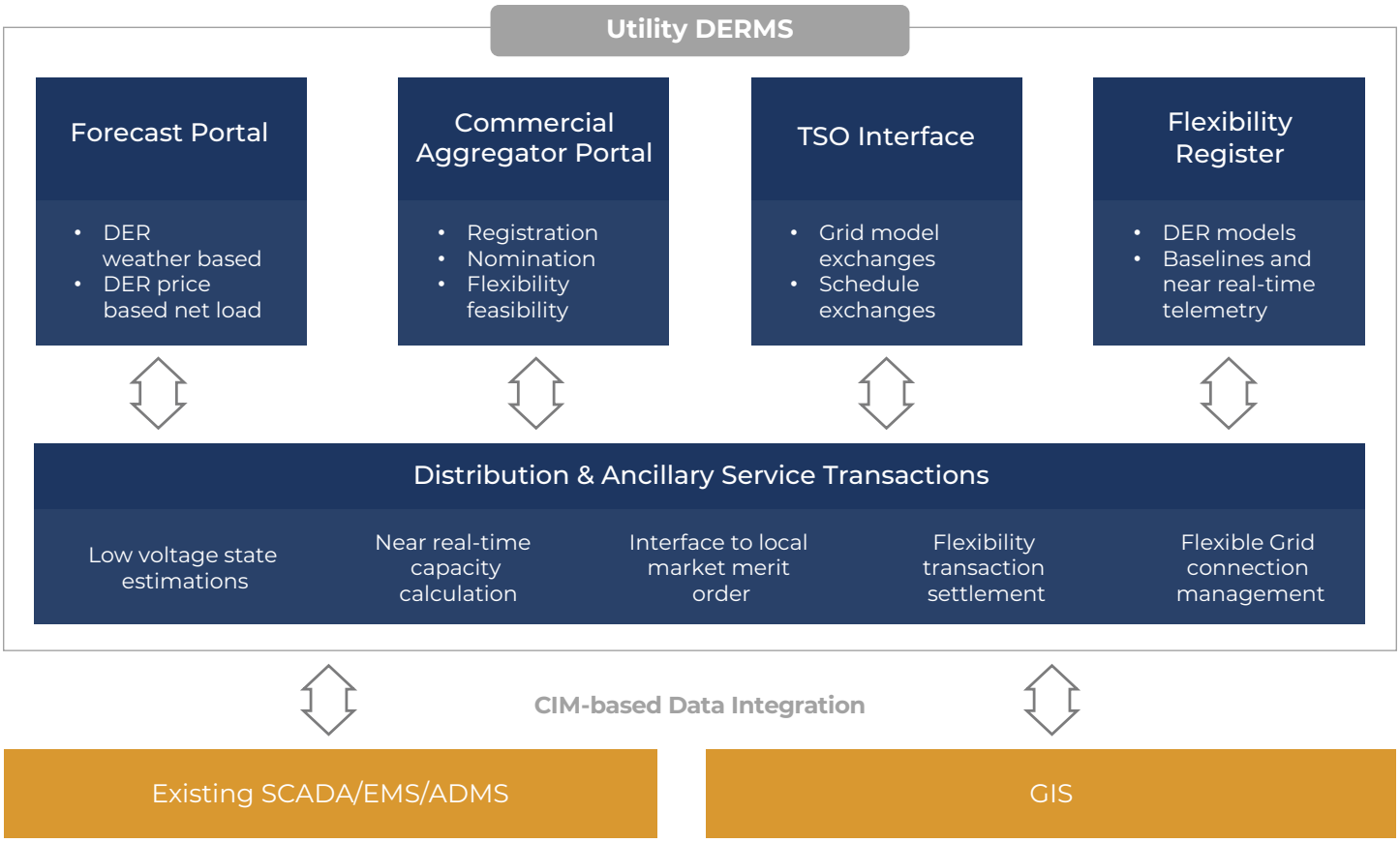
Increased electrification and decarbonization of the home means that consumers are using more electricity than ever while aiming for new 24-7 net-zero metrics incentivized through home renovation programs, phasing out natural gas and reducing carbon by integrating EVs, local PV and Smart Heat Pumps.

Aging grid infrastructures are complex to reinforce and expand and the increasing frequency and severity of extreme weather events adds further network stress. New bottom-up consumer lead resiliency options are required to manage outages through high exposure geographies.

Grid-edge rooftop solar with storage is a faster to deploy and more cost-balanced non wire option to increase grid connection capacity and reduce grid reinforcement queues .

Next Generation
Utility Control Rooms

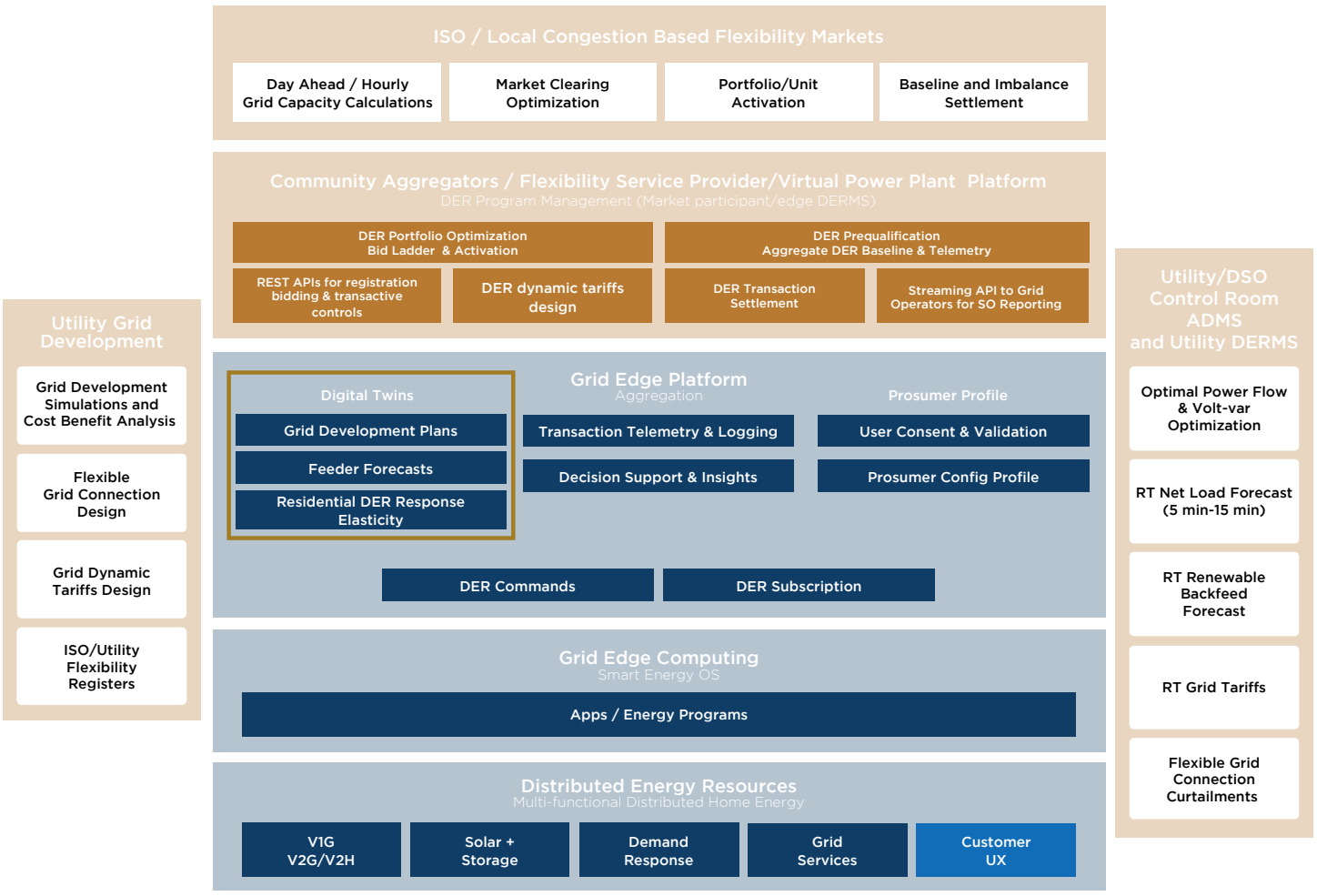
From Integrated T&D Grid Control Rooms to Renewable Desks , Demand Response and Distribution Automation, utility control rooms have undergone significant transformation in the last few decades. The mass proliferation of renewables calls into question the current methods and tools used for grid planning, near real-time load forecasts at the various spatial levels of distribution transformer, substation and upstream Transmission P nodes as well as new tools for VPP and aggregator flexibility program design to properly analyze prosumer DER elasticity to energy and grid ancillary service price signals.



The Need for an Innovative **Multi-sided Edge Platform**

There is a need for a multi-sided edge DER Technical Aggregation platform to enable the real-time transaction management and control of flexible residential DERs such as V2X, home batteries and smart heating, while augmenting real-time system awareness, market participation opportunities and providing an engaging user experience for prosumers.

An integral part being the availability of residential energy digital analytics that allow for real-time behind the meter visibility and the ability to simulate the grid impact of thousands of DER interactions against real world conditions without the need for costly and time-consuming hardware deployments. This innovative approach provides critical net load data to ADMS and near-real world insights into the future impact of DER integration, flexibility programs and energy asset control.

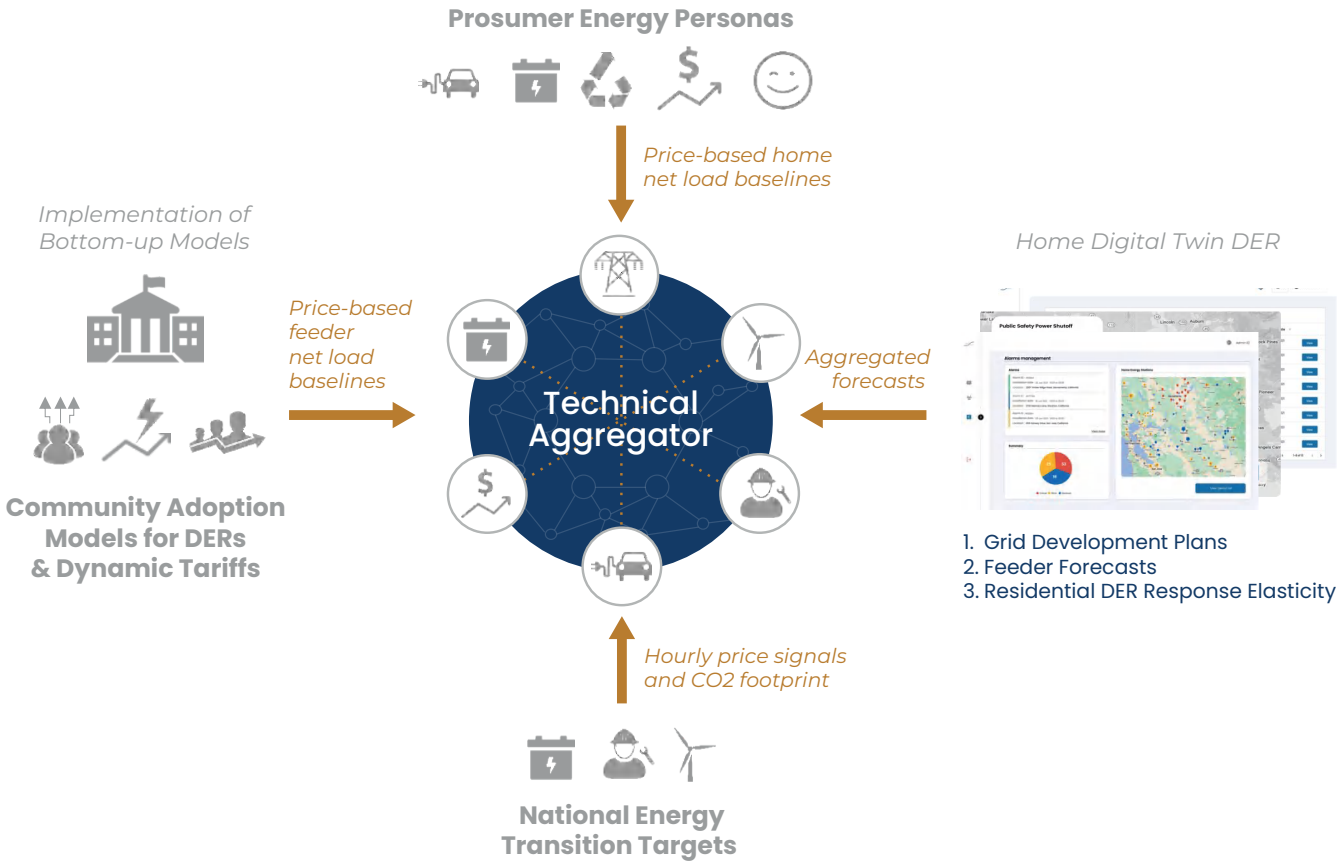


Digital Twin Granular DER
Net Load Forecasting

To ensure the optimal use of grid capacity we must proactively assess the impact that the inevitable deployment of millions of intelligent grid-edge devices will have on the energy market, asset management and feeder management, and closely consider the effects of future dynamic price incentives on device operating profiles.

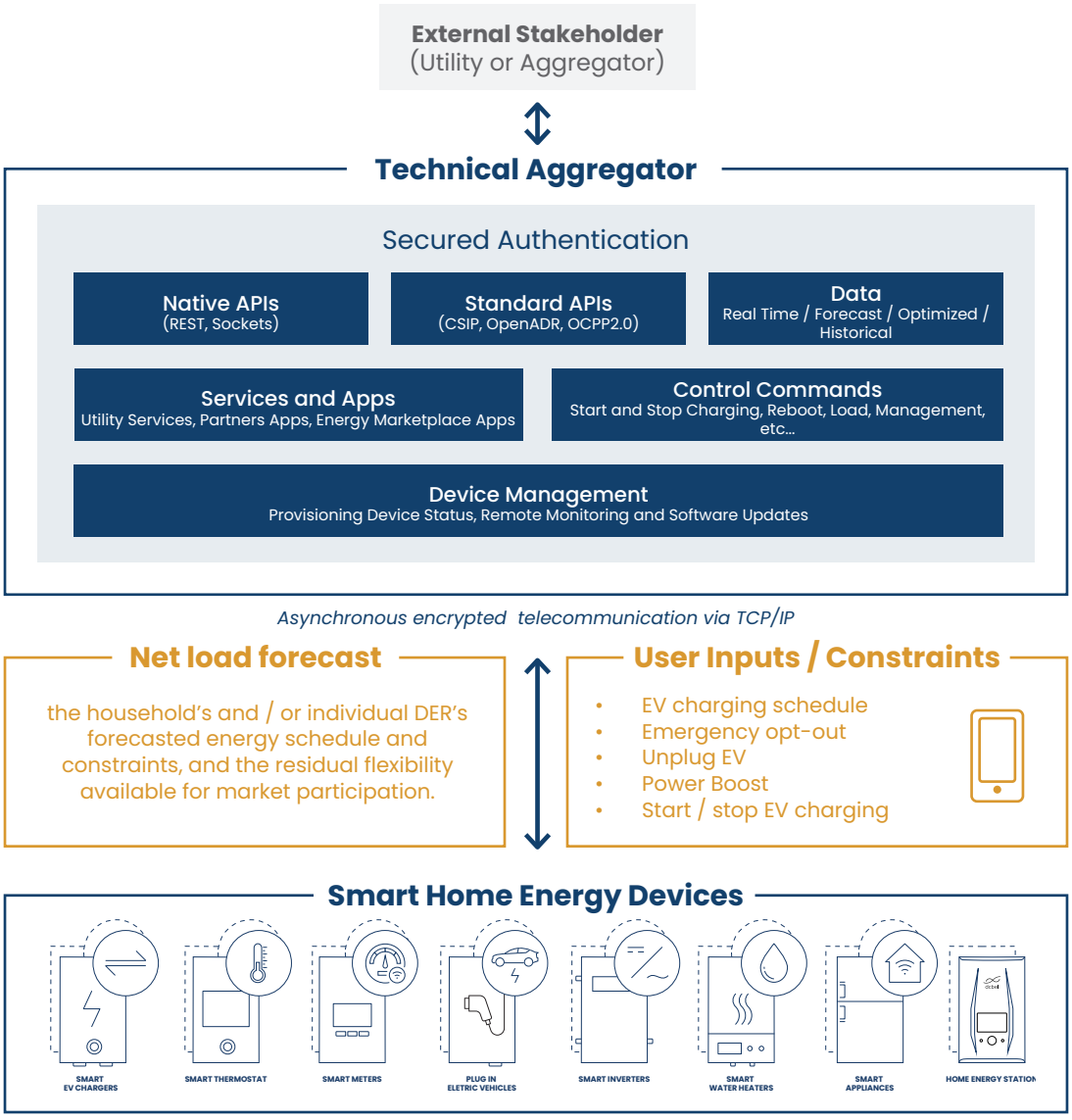
Particularly, the mass amount of DERs installed in a distribution network means that traditional feeder and secondary distribution load forecasting models now yield less accurate results as they do not account for the significant generation and supply occurring at the residential node level. The increasing adoption of solar with integrated storage, EVs and bidirectional chargers will further exacerbate this problem.

The use of digital twin analytics provides the opportunity for utilities exposed to exponential DER deployments to leverage a hyper-accurate, bottom-up approach to energy forecasting using both actual metered data and /or synthetic load profiles based on energy personas. The result is a real-time or long-term granular DER net load forecasts that can connect via API to existing DERMS for grid planning and feeder or asset management.



Multi-stakeholder **Communication Architecture**

The energy grid, initially designed for centralized generation and the unidirectional flow of power, must continue to change to support increasingly powerful DERs and the bidirectional flow of power. Like all multi-stakeholder ecosystems, secure and dynamic data exchange is critical to ensure a balanced cost-effective energy transition for the whole electricity system.
In the context of the energy grid, communication means a live "conversation" among grid operators, prosumer-owned DER devices, prosumer constraints, Regional Operators, and many other actors. A multi-sided edge DER platform ensures a scalable approach to communication with the ecosystem.



Utility, Home Energy & **Grid-edge Computing**

Information exchange is fundamental for utility companies that must always have enough energy to respond to the customer demand in their jurisdiction. However, because they don't have access to granular "behind the meter" consumption data, they often generate and store much more energy than their customers actually need and end up having to sell it at a loss on the wholesale market. Utilities want to be able to forecast and manage their customers' energy consumption patterns as precisely as possible to minimize over-generation while maintaining their stature as a reliable and resilient energy provider.

As traditional SCADA systems are not designed to manage millions of DERs, grid-edge computing and smart energy analytics are core to solving future home energy visibility issues.

Grid-edge computing and analytics allow for incredible flexibility and everyday cost reduction on IT deployments while enhancing reliability over current hardware-only platforms. Further, running data transactions locally (as opposed to in the cloud) can reduce costs by more than 60% over traditional cloud or blockchain platforms.

By delegating the responsibility for the system's energy management, power dispatch and DER control functionalities, with companies can reduce cloud operation costs operating costs by more than $300 / user annually, and finally create a sustainable business model for DER aggregation.

Technical Aggregator & DER **Cyber-security**

DER data integration with Grid operations technology also poses complex security, privacy, and compliance challenges. Unlike traditional cyber technology where issues revolve around software implementation, DER involves both the cyber and the physical worlds and can pose a significant security threat to Grid Operators. IoT in the realm of residential energy is also extremely critical for real-time data as it is poses privacy risks and must comply with international data protection acts.

Grid-edge computing must address cyber-security as a top priority ensuring end to end security combining root utility certificates with edge encryption integrating TLS.

Direct access to a grid-edge platform or DER hardware should be strictly limited and the use of an embedded Trusted Platform Module (TPM) hardware security encryption should be made mandatory. All communication should be managed through the Technical Aggregation platform, which oversees all needed data encryption and exchange from the connected DERs. Ultimately, this approach will provide easier integration through virtualized and standardized APIs updated with latest protocol, while ensuring physical assets already deployed remain compatible with protocol evolution.

As more and more grid-edge devices come online, utilities will need to establish new integration validation and certify compliance with stringent NERC CIP cybersecurity requirements.

dcbel sits at the nexus of **prosumers, aggregators and utilities**

dcbel was founded in 2015 on the principle that everyone deserves clean, reliable and sustainable energy to live a life without compromise, and the belief that the best path forward requires the creation of new, mutually beneficial relationships between prosumers, utilities and energy service providers.

The company offers a portfolio of software and hardware products that allow prosumers to take a more active role in their energy lives and partner with utilities and commercial aggregators in the flexible integration of DERs and the shift towards dynamic price incentives.

Homeowners can supply their home and EVs with solar power, use vehicle-to-home charging to offset peak energy prices and earn money by discharging energy from a home battery or EV to the grid to support grid stability and minimize congestion. dcbel puts prosumers at the center of their home energy strategy by ensuring that they are compensated for offering grid support and providing unique technology that provides control, situational awareness and delightful user experiences.

Utilities and Commercial Aggregators can proactively assess the impact of edge devices on grid capacity and energy market dynamics while designing and implementing flexible energy programs in regions where capacity expansion is not possible. Our purpose-built platforms provide secure, robust and scalable edge computing integrating millions of field-deployed residential distributed energy resources and offers cloud-based residential energy system digital twins decision support tools which can be configured to emulate different home locations, configurations and lifestyles.

dcbel.energy

dcbel

To learn more, contact us at
askusanything@dcbel.energy