Flexible Service Connection for Distribution Assets and Expectations for Flexible Transmission Interconnections

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Flexible Service Connection for Distribution Assets

Leveraging DERMS to harness the value of flexibility

BENEFITS OF FLEXIBILITY

- ✓ Reliability & resiliency
- ✓ Renewables integration
- ✓ Capacity & peak load management
- ✓ Market participation (e.g., ancillary services, energy arbitrage)

OPERATIONAL RISKS

- ✗ Rapid switching between import / export
- ✗ Voltage / thermal overload potential
- ✗ Visibility / predictability for grid operators
- ✗ Misalignment between market participation & local grid needs

Several key capabilities are needed to successfully and safely integrate flexible resources into the grid

Monitoring & Visibility
Centralized DER data and performance info across system

Lookahead Forecasting
Uses forecasts to maintain safe operations within operating limits

Constraint-Aware Opt.
Optimizes assets while respecting grid constraints & as-operated network topology

Multi-objective Coordination
Deconflicts grid needs with market participation (local vs. system)

*Grid DERMS is the **central orchestration platform** that enables utilities to turn DERs into controllable grid assets*

PG&E Distribution Use Case

DERMS Programs

1. **1MW+ DER Telemetry for Operations (Infrastructure)**
   IEEE 2030.5 customer-owned telemetry for monitoring large DERs – this protocol is suited for schedules

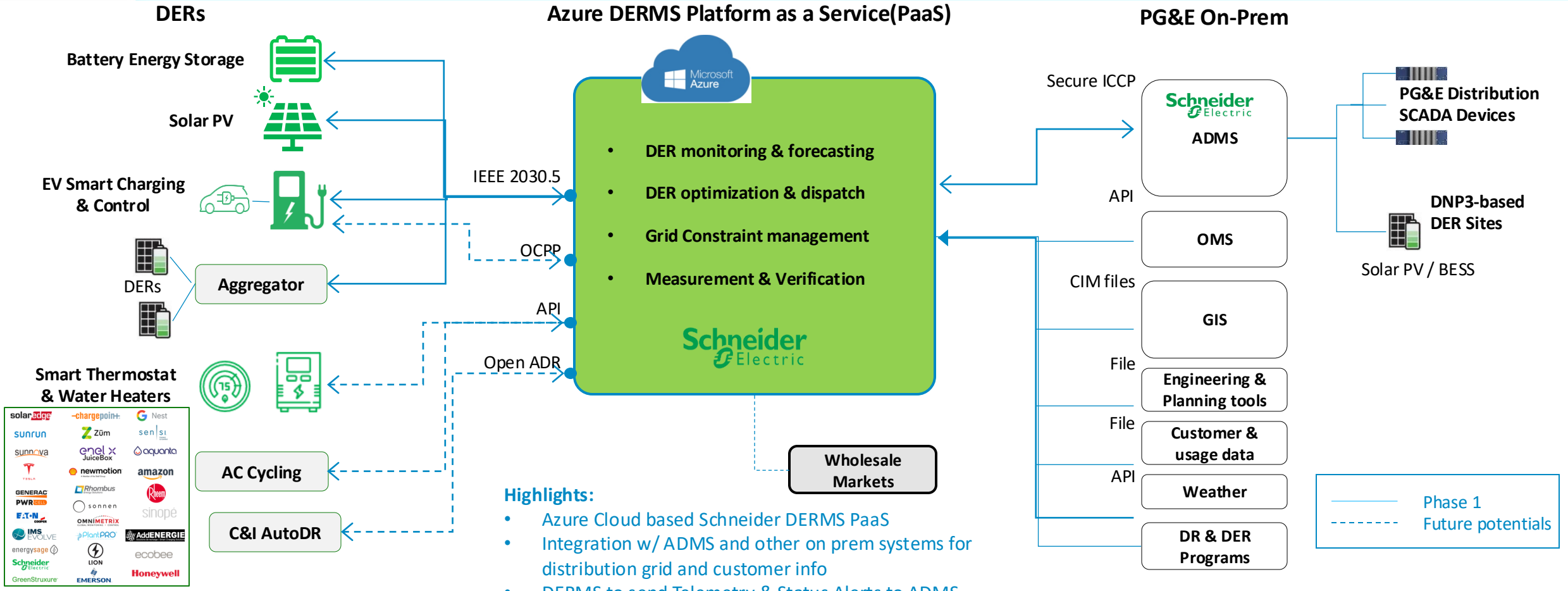
2. **Flexible Service Connections (Flex Connect)**
   Allows new load customers such as EV fast charging to connect sooner with more capacity as bridge solution until grid upgrades are completed – do not harm approach by setting limits

3. **Flexible Generation Interconnections (Flex Connect)**
   Allows DER developers to avoid system upgrades via a more flexible and cost-effective interconnection process – do not harm approach by setting limits

4. **Operation of Capacity Deferral Solutions (Grid Service)**
   Dispatch DERs to defer distribution capacity projects – sending a dispatch, more active approach

5. **Integration with DR Programs (Grid Service)**
   Demand Response programs providing flexibility as a Distribution grid resource – visibility use case for Ops

Flex Connect Anatomy



Highlights:

- Azure Cloud based Schneider DERMS PaaS
- Integration w/ ADMS and other on prem systems for distribution grid and customer info
- DERMS to send Telemetry & Status Alerts to ADMS

Benefits

- Flexibility to quickly scale w/ new functionality, uses cases and geographies
- DERMS & ADMS can have independent release/update cycle
- Lower implementation and O&M burden for PG&E
- Improved security posture by abstracting 3rd party connections in the cloud

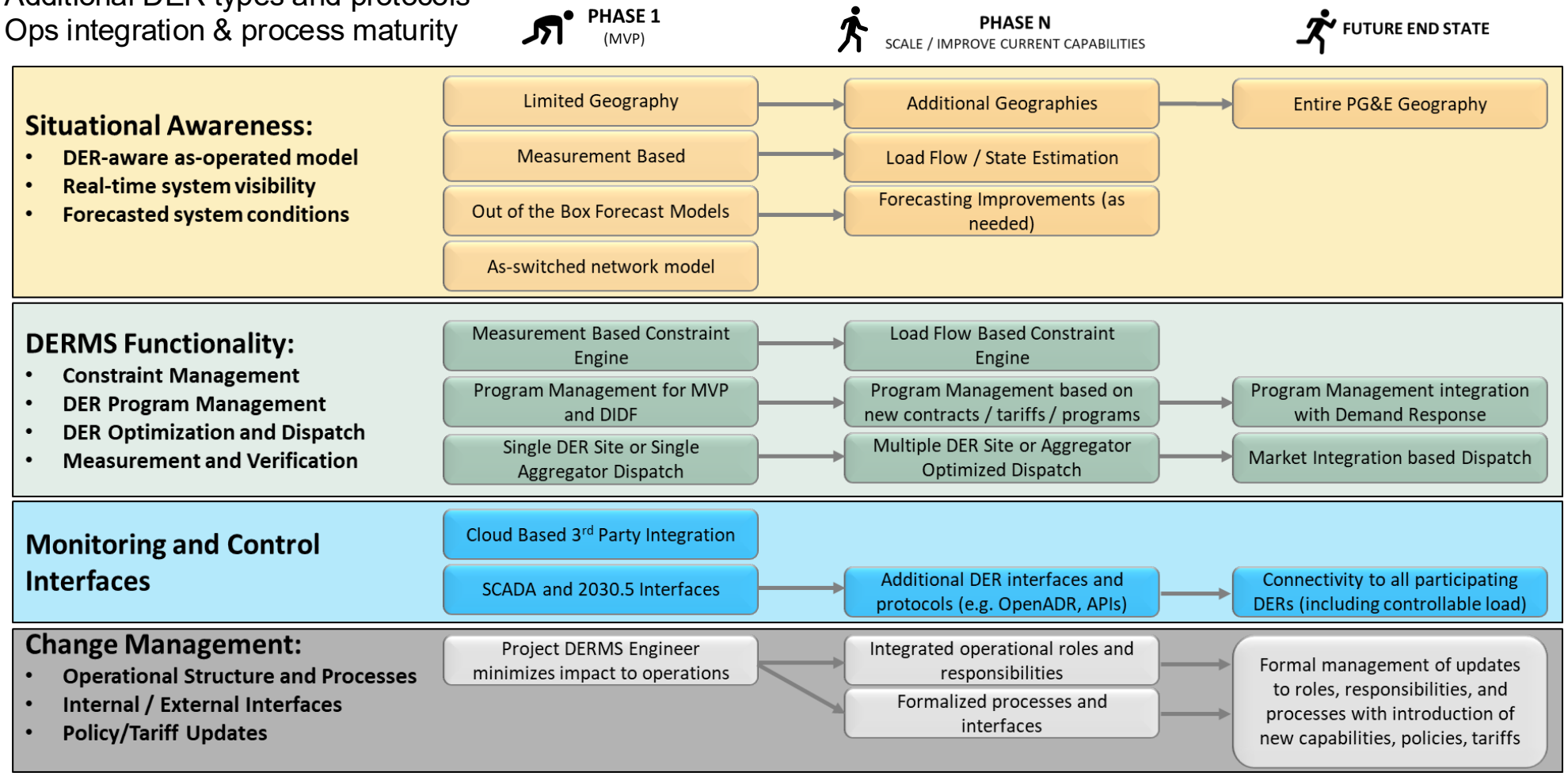
Risks

- Managing complex interfaces and integrations to external systems in the cloud
- Maintaining multiple network models

DERMS scaling progression: Crawl / Walk / Run

Future DERMS Phases: Scaling factors

- Geographical
- Functionality and level of complexity (e.g. power flow-based vs rules-based)
- Additional use case (e.g. expansion to cover DR and VGI use cases)
- Additional DER types and protocols
- Ops integration & process maturity



DERMS Current Status & Roadmap Overview

Initial DERMS use cases focused on maximizing capacity utilization on constrained distribution circuits. Over time, DERMS will scale to orchestrate DER aggregations into virtual power plants (VPPs) to unlock benefits to the grid, energy system, and customers.

To Date (2023-2025)	Current (2026)	Next GRC - (2027-2030)
Deployed foundational cloud DERMS platform including IEEE 2030.5 DER headend	Scale Flex Connect program for operational flexibility geographically and across more customer types	Ubiquitous deployment of DERMS across service territory (where value add)
64 customer-owned telemetry sites 1MW+ DERs to comply w/ Rule 21 via 2030.5	Enable grid and program management capabilities for emergent DER programs including EV managed charging pilots (V1G)	Develop VPPs by orchestrating heterogenous DERs to solve one or multiple grid constraints
Operated **six** flexible service connections (Flex Connect) sites, adding **~5 GWh** of new load and **two** NWA/Deferral procurements	Extend forecasting and constraint management down to the service transformer	Scale VGI use cases including V1G and V2X
Provide Dx Ops w/ visibility of flexible capacity available from Demand Response programs at the feeder level	Pilot data sharing between Dx & Tx and ISO to ensure reliable and resilient grid operations	Integrate DERMS w/ grid edge computing platforms to optimize at the hyper local level

Ways of Measuring Value

01

Customer Value

- DERs, Larger Loads, Batteries (750kW+)
- Lower interconnection costs ($$)
- Speed-to-Power (days)

02

Rate-Payer Value

- Increased utility asset utilization (Incremental MWh)
- Reduced CO2 emissions in community (kg CO2 avoided)

03

Utility Value

- Maximizing asset utilization (Incremental MWh, customer speed-to-power)
- Greater operational flexibility (#Feeders, MWs, Forecasting, DR Program Integration)

Operationalizing Flexible Interconnection

Going from pilot to full-scale production

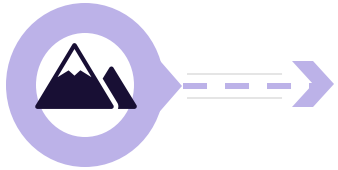
Mapping D-Flex into T-Flex

PEOPLE	PROCESS	TECHNOLOGY
Roles & Responsibilities	Business Processes for DERMS Operations	Use Cases, Requirements, & Success Criteria
Application & End User Training	Technical & Support Processes	Comprehensive Test Strategy & Cases
Operating Model & Resource Planning	Business Readiness & Go Live Criteria	Crawl, Walk, Run Approach

Considerations and Discussion Points

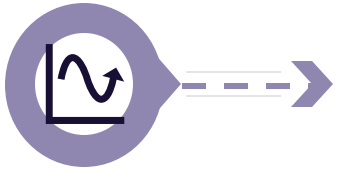
- **Inherent differences** between the distribution and transmission networks and considerations for planning and operations
- **Regulatory aspects** of flexible interconnection; distribution mainly state-regulated whereas transmission is jointly state and federal
- **More complex operation** in transmission system vs. distribution feeders, with a larger number of stakeholders with defined roles

Challenges and Risks



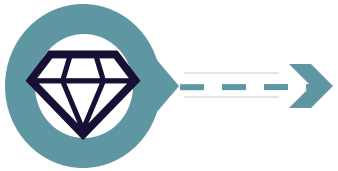
Operations Integration and Approval

- Getting executive level push across the business and having a dedicated Ops person on the team is critical. Put in the time to know their processes, their perspective, and their challenges



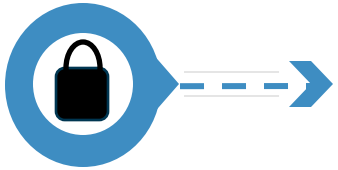
Customer Adoption

- Create a compelling enough case for customers to want to participate and find customers who want to be (or are forced to be) innovative.



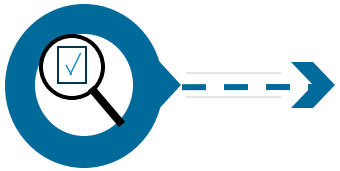
Vendor Team and Development

- Having vendor to put their best team to develop new functions is important. For MVP good enough is better than perfect, but good enough has to ensure no safety/grid issues.



Cybersecurity / Compliance

- New cyber processes can be time intensive, so leveraging existing and approved cyber processes would save a lot of effort



Well-Defined Narrow Scope for MVP

- The use case should be very well understood with Planning and Operations, scenarios documented and agreed on by stakeholders

Building Trust With Customers

Key Consideration

More conservative limits and forecast buffers applied in early stages of DERMS operations to evaluate platform & site performance

Lesson Learnt from Flex Connect

We will need to talk with multiple customers, maybe can work with customers to propose locations that are better fits, incentives (non-monetary), etc.

	Apr	May	Jun	Jul	Aug	Sep	Oct
0	1.26	1.46	1.53	0.87	0.73	1.21	0.78
1	1.03	1.31	1.54	0.91	0.75	1.22	0.90
2	1.04	1.51	1.50	0.92	0.76	1.23	0.89
3	1.23	1.65	1.77	1.86	1.32	1.53	1.10
4	1.73	2.09	2.10	2.34	1.96	2.11	1.60
5	2.03	2.40	2.83	2.69	2.97	3.41	2.31
6	2.46	3.24	3.34	3.27	2.87	3.10	2.97
7	2.86	3.19	3.51	2.73	2.36	2.69	2.74
8	2.75	3.32	3.67	2.67	2.26	2.89	2.49
9	2.30	3.36	3.47	2.75	2.36	3.08	2.34
10	2.71	3.74	3.48	2.79	2.05	3.33	2.11
11	2.60	3.92	3.50	2.79	2.36	3.33	2.01
12	2.99	3.86	3.44	2.78	2.23	3.33	2.23
13	2.93	4.09	3.69	2.83	2.44	3.34	2.02
14	3.10	4.12	3.55	2.85	2.43	3.09	2.38
15	3.19	4.09	3.75	2.87	2.45	3.32	2.28
16	2.77	3.87	3.61	2.99	2.49	2.98	2.61
17	2.51	3.36	3.12	2.74	2.55	2.65	2.88
18	2.45	2.88	2.66	2.46	2.21	2.73	2.10
19	2.03	2.75	2.42	2.32	2.41	2.87	2.15
20	2.07	2.57	2.33	1.93	2.28	2.60	2.00
21	1.93	2.20	2.25	1.85	2.42	3.45	2.01
22	1.52	1.76	1.46	0.75	0.55	1.09	0.74
23	1.29	1.80	1.48	0.89	0.65	1.14	0.76

Thank you!

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Grid Research Innovation & Development

Building the grid of the future, today.