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PNU202

PGE's Customer and Operational Improvement Journey with AWS

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3Ds + Changing value chain = Customer centricity



Decarbonization
Meeting sustainability goals, less fossil more RE…



Decentralization
Lower barrier to entry, more DERs, VPPs, more complexity



Digitization
High customer expectations, retention, cost pressures

Plus, **Deregulation**; the known, but unspoken **D**

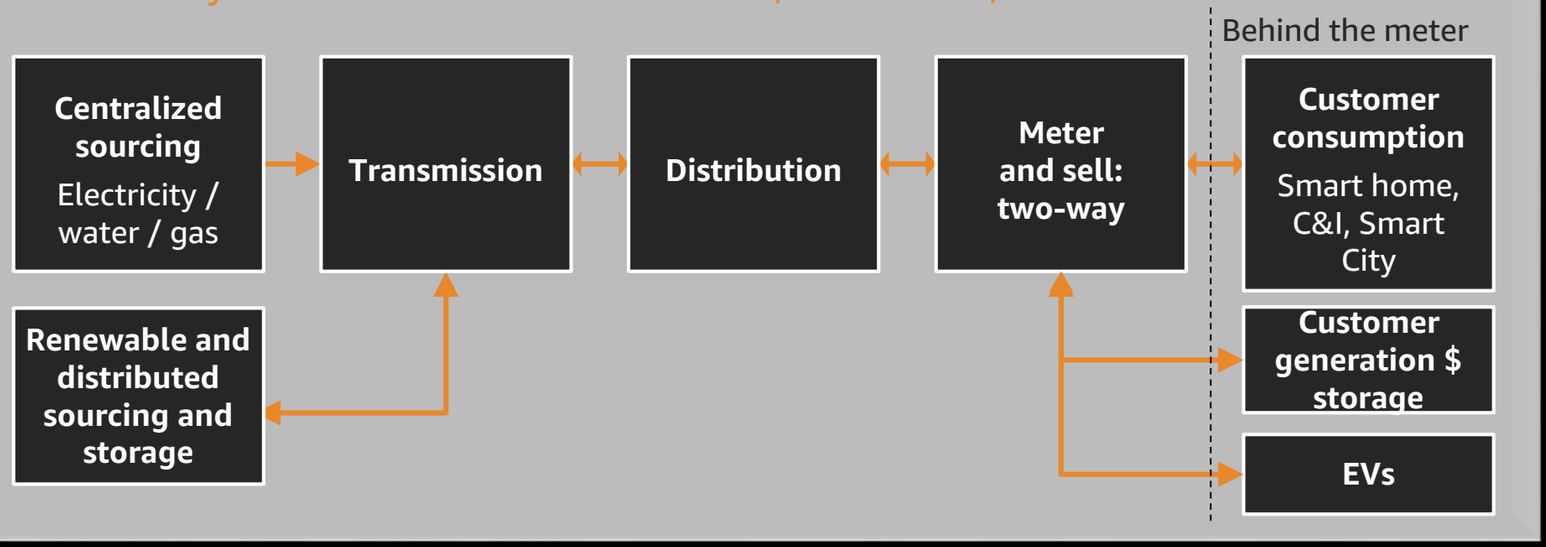
Utility value chain

Traditional – centralized



Utility value chain

Today and tomorrow – decentralized, distributed, and customer-centric



Digital transformation enables flexibility



Flexible generation



Flexible delivery



Flexible demand

And greater focus on core Utility objectives



Reliability



Safety and security



Agility and time to market



Customer satisfaction



Revenue and costs

AWS is powering the digital Utility

CUSTOMERS ARE ASKING FOR BUSINESS OUTCOME-DRIVEN SOLUTIONS ACROSS 5 CATEGORIES; ALL ENABLED BY DATA INSIGHTS

Industry solution categories	**AWS-enabled customer and partner solutions**	**Business transformation**				
		IT Transformation	OT Transformation	Asset and Work Optimization	Energy Supply Transition	Customer Engagement
		Data insights				
AWS cloud services	**Core services**	Database	Compute	Analytics	AI/ML	VOICE and CHAT ALEXA, Lex, Connect
	Foundation technology	Storage	Elastic compute	Data Lakes	Security	
	Data capture, ingest, and integration	Streaming, queuing, and messaging	IoT edge, core, and analytics	Data cataloging and ETL	Edge compute and storage	

Our customers and partners

The Power & Utilities industry encompasses the production, transmission, distribution, retailing, and management of electricity, gas and water serving the earth population of 7.7B

Utilities incl. OEM's



ISVs and GSI / SIs



...and many more

PGE’s digital journey to reduce customer friction and improve operational efficiencies using AWS



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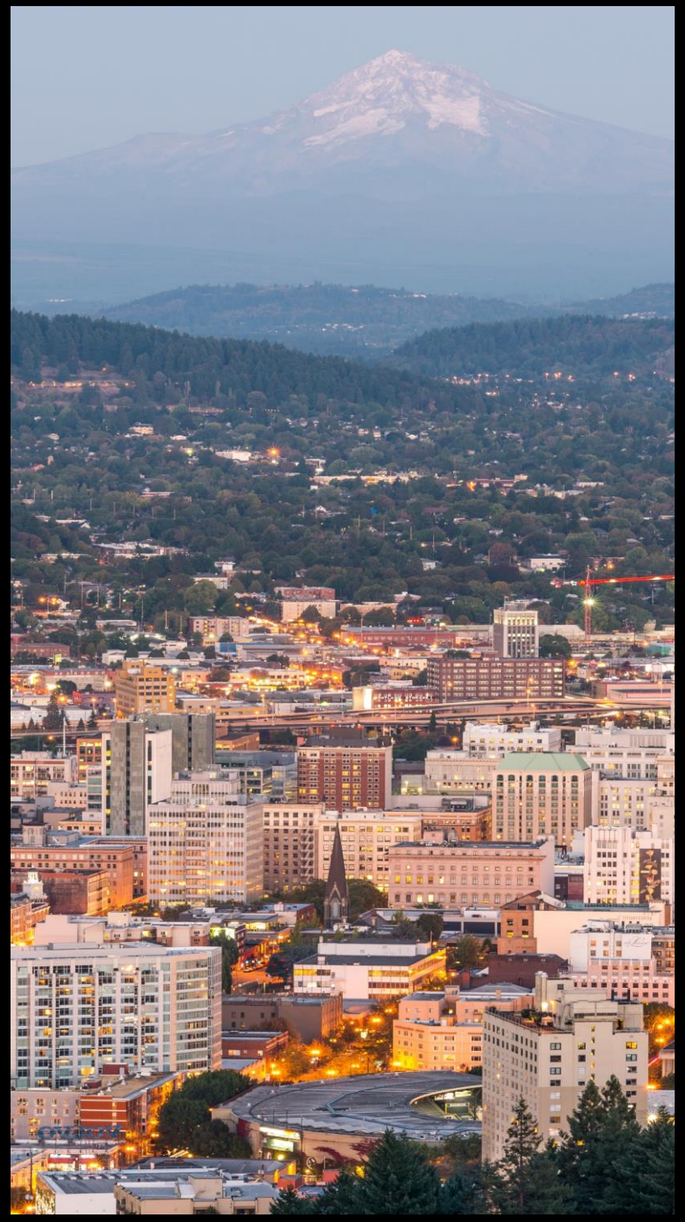
Agenda

- About Portland General Electric
- Challenges and opportunities PGE is facing as an electric utility
- AWS technologies help PGE’s digital transformation
- Learnings

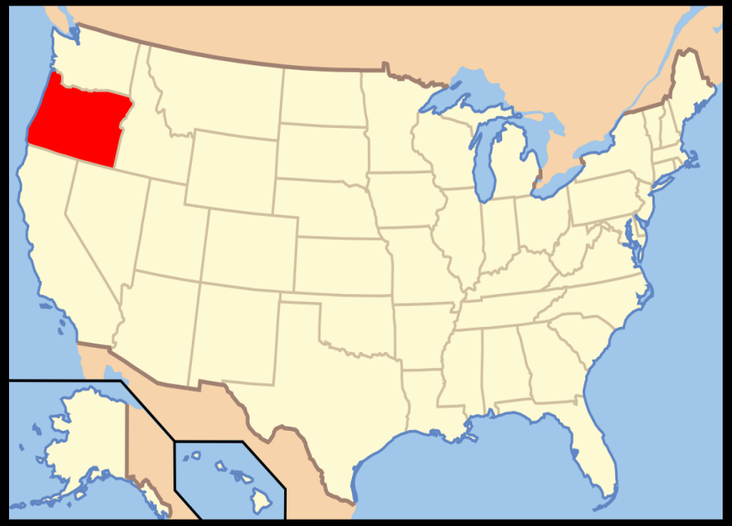


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About Portland General Electric (PGE)



- Established in 1889
- ~901,000 customers
- ~4,000 square miles
- 51 cities
- Vertically integrated:
    - 16 generation facilities
    - 30,000 miles of transmission and distribution lines
    - 180 substations
- Serving half of all Oregonians; three quarters of commercial / industrial activity
- 4,000+ employees and contractors

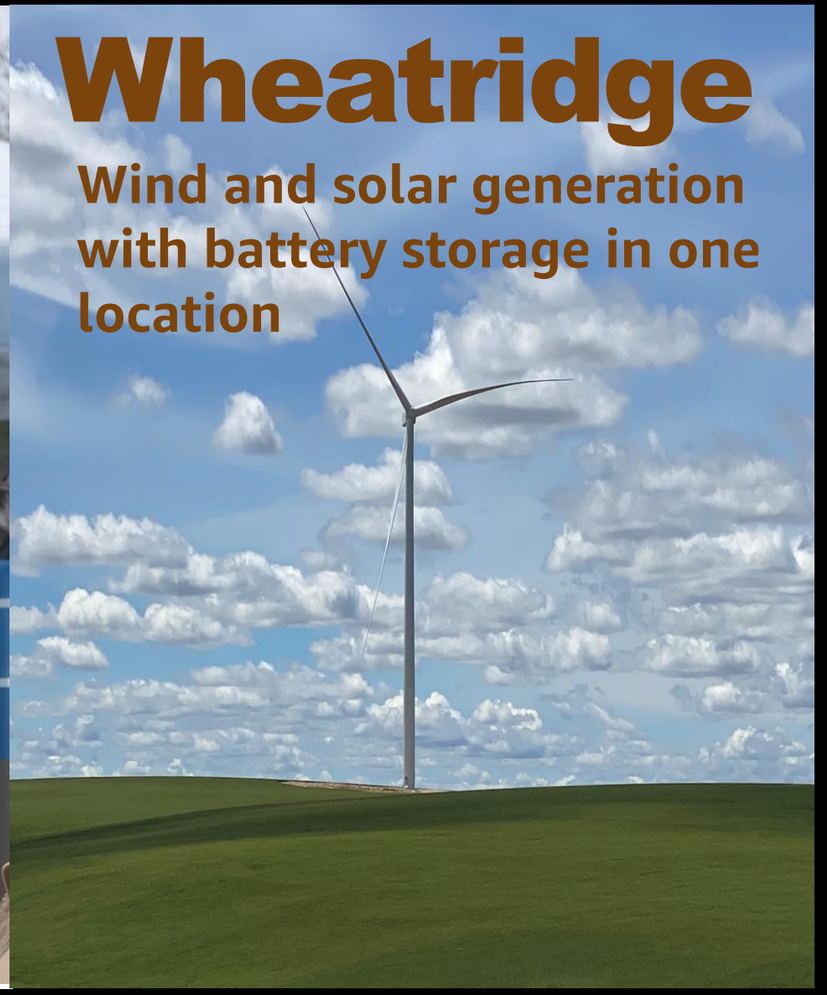


Changing customer expectations









The future is now



Decarbonize

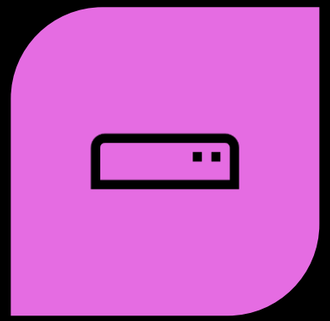


Electrify

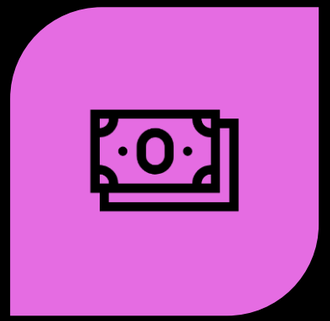


Perform

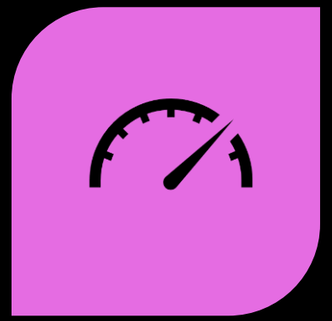
Measuring success



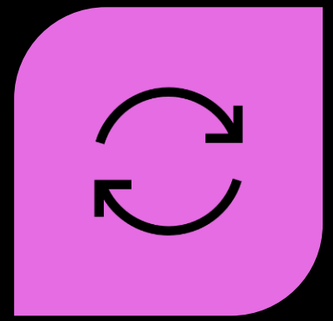
Improve reliability



Manage cost / optimize value



Performance and scalability



Improve cycle time

Using AWS to meet the goals

Highlighted Use Cases



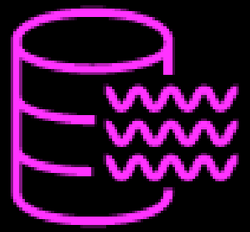
Reduce customer friction

APIs / microservices for digital channels



Increase operational efficiency

Meter data analytics – energy loss detection



Increase operational efficiency

Data lake and internal data marketplace



Reduce customer friction
Increase operational efficiency

Advanced analytics

- Estimated outage restoration time
- Solar generation prediction
- Condition-based pole maintenance

API / microservices for web and mobile app

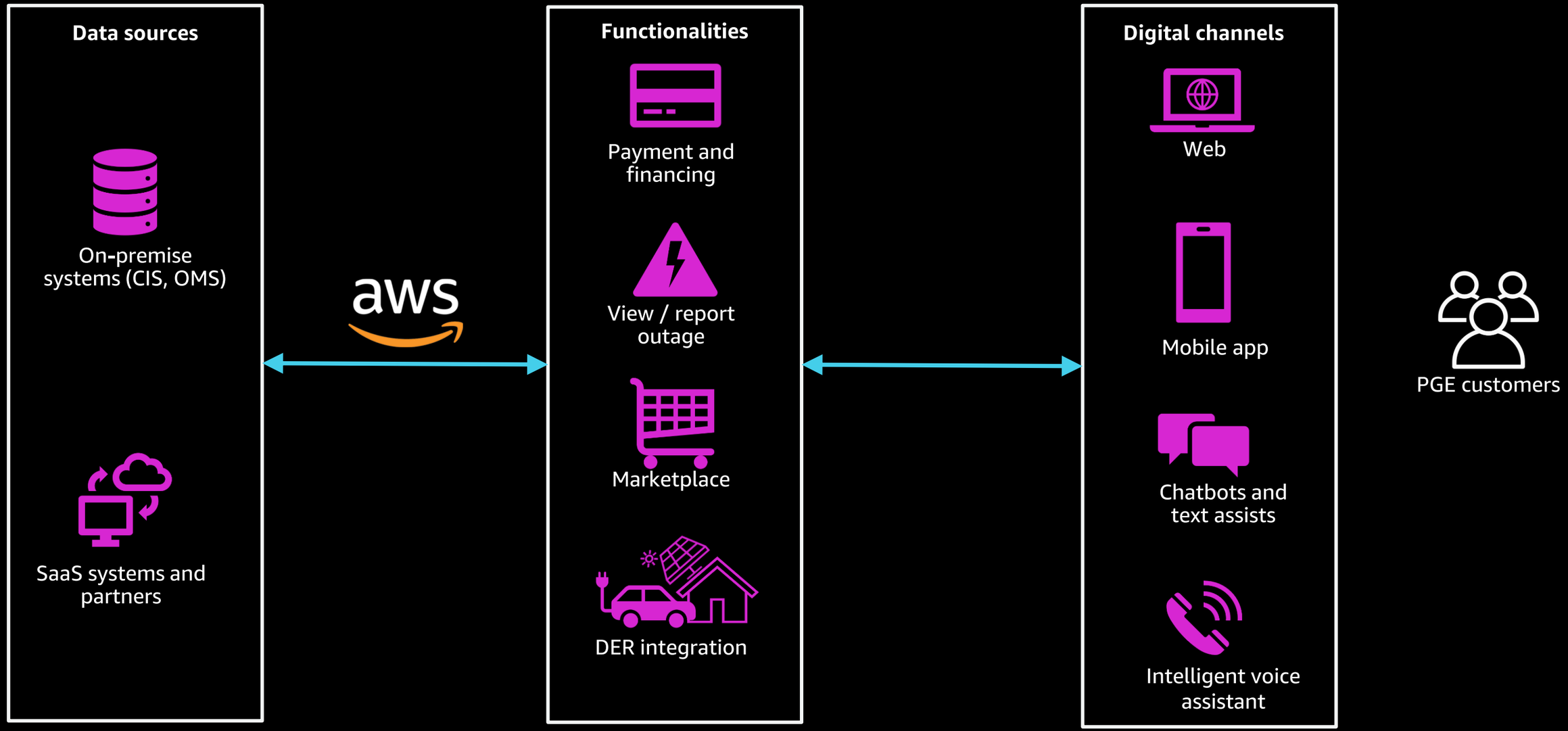


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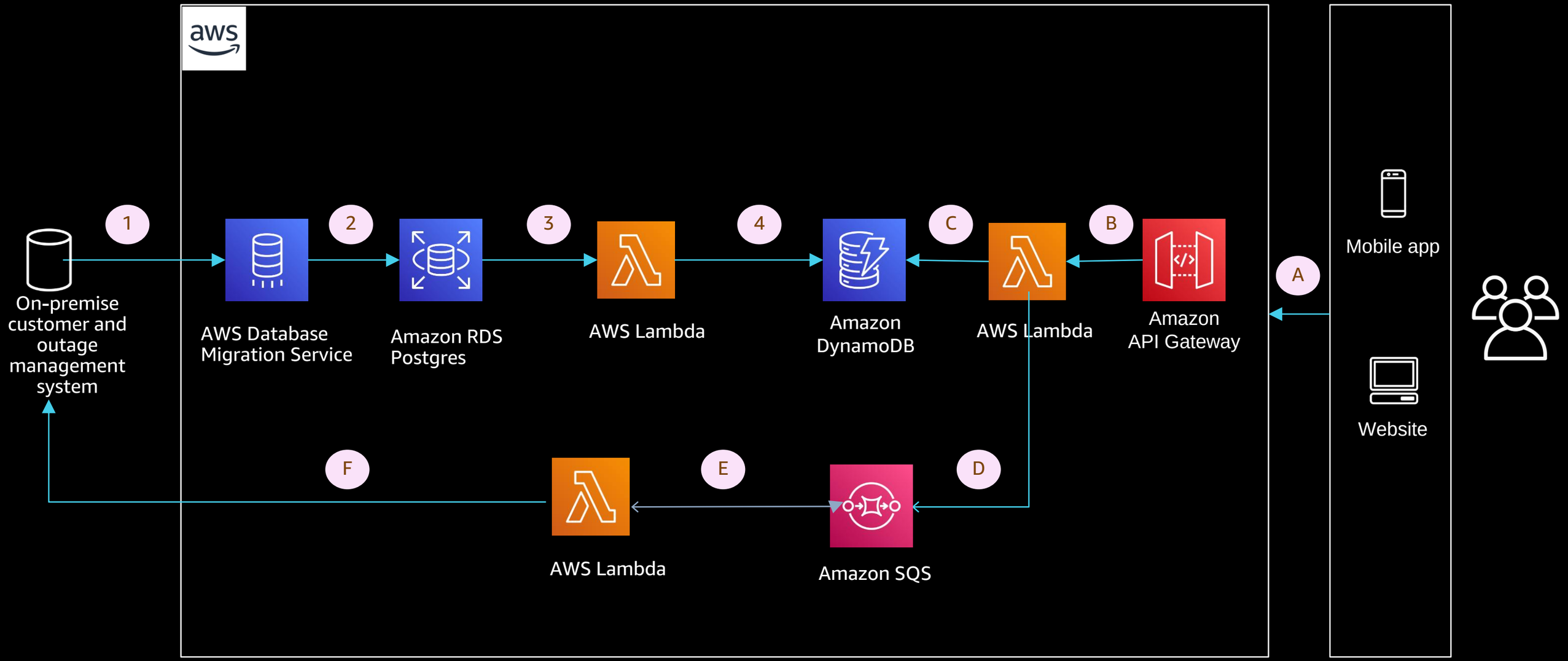
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PGE digital channels

REDUCE FRICTION AND EMPOWER CUSTOMER ENERGY JOURNEYS



AWS API / microservices

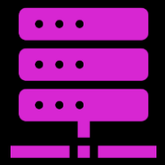


Results



Scalability and performance

Faster response time both on “Blue sky days” and “Black Sky Days” – handled **5X traffic in less than one fourth the time** in a recent major outage event compared to prior on-premise APIs



Reliability and availability

Reduced planned downtime by one tenth compared to on-premise APIs



Customer satisfaction

Appx. 10-point increase in net promoter score survey for satisfaction with digital experience and ease of performing tasks after the new web site was launched

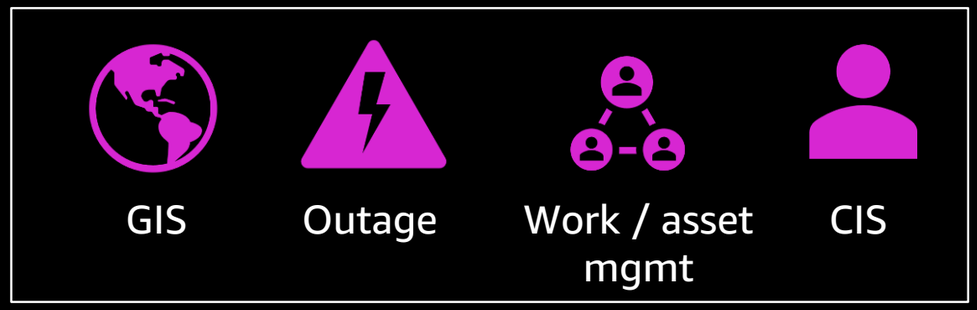
Data lake



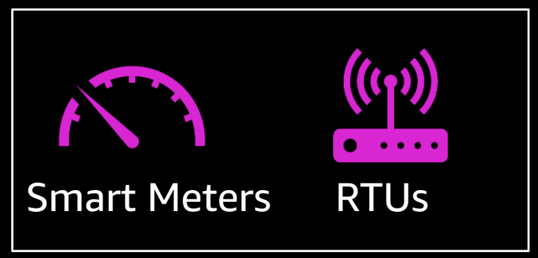
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Data lake – growing data needs for an electric utility

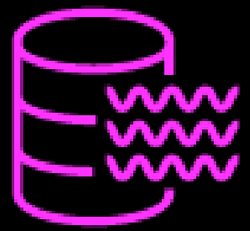


CIS, GIS, outage and work / asset management

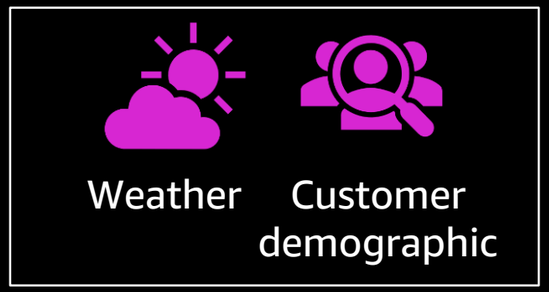


Meter data and OT data

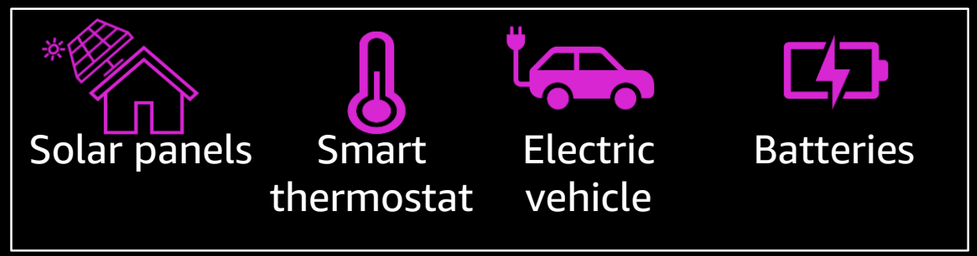
~40M meter consumption interval data per day



Data lake



External data sources



“Behind the meter” consumer devices data

~10,000 + solar; ~19,000 smart thermostats

PGE data lake on AWS

Data sources

On-premise data sources

SaaS, DER Third-party data

Device data

Data ingestion

AWS Database Migration Service

AWS Lambda

MATILLION

Snowflake data lake

Landing Zone

Refined Zone

Internal data marketplace

Asset 360

Customer 360

Outage

Finance

Amazon S3

MATILLION

AWS Glue

Consumers

Amazon QuickSight

Amazon SageMaker

tableau

External partnerships

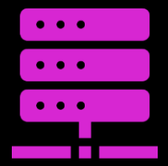
Governance, security, and operationalization

Results



Cost Savings

Planning to decommission the legacy warehouse solutions for finance and customer by 2021 which **saves money on the licensing cost, storage, and servers**



Scalability and performance

Ability to isolate, increase compute independent of storage resulting in performance improvements



Customer and stakeholder satisfaction

- Use Case 1: Usage and billing data sharing with cities saved **~168 hours/year** for each customer to report hours for EPA helping on sustainability goals
- Use Case 2: Decarbonization dashboard (PGE internal) helped track carbon footprint across fleets and facilities for PGE

Meter data analytics



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Energy loss detection

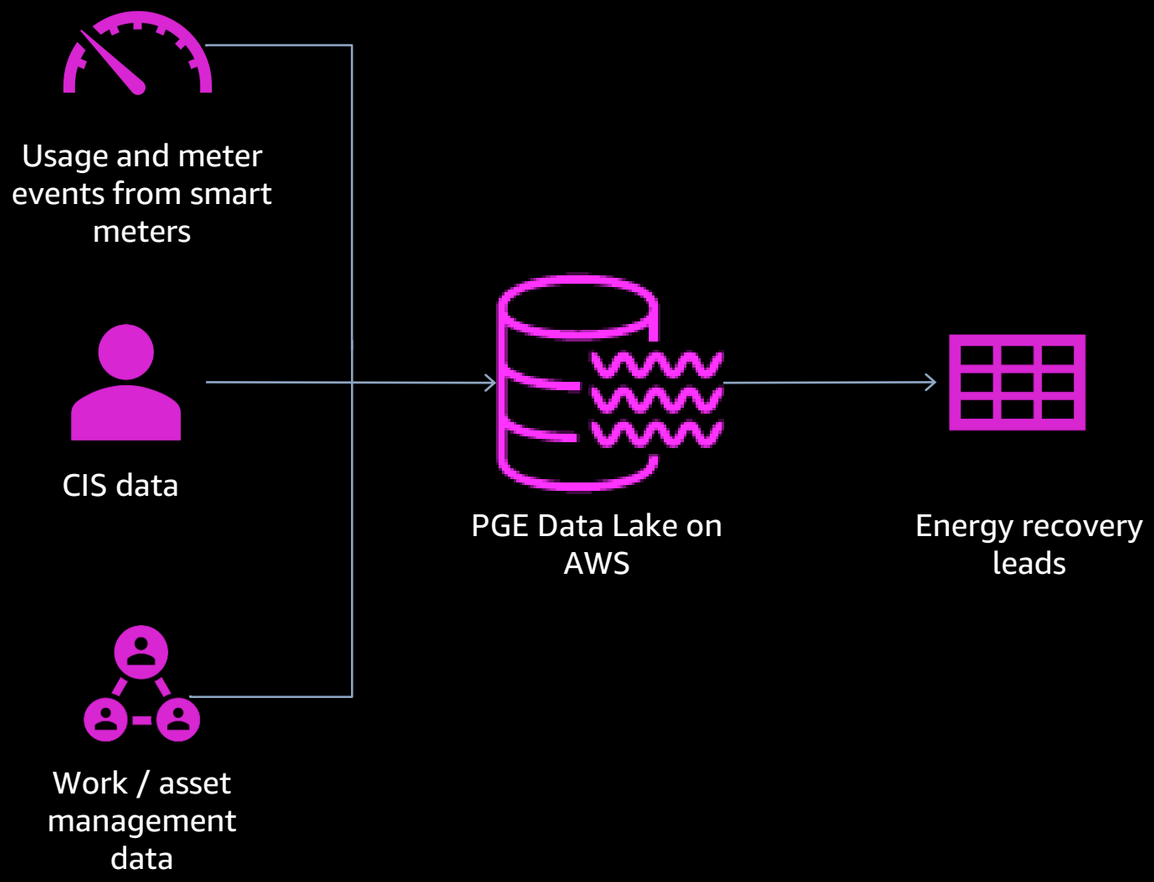
Detect potential leads for energy theft or safety issues

Challenges

- Manual work to augment data
- Unnecessary field visits



Our solution and benefits



Solution Highlights

- Datasets: AMI interval and alarm data, work asset management data
- Technology:
  - AWS DMS, AWS S3
  - Snowflake, Matillion, R

Benefits

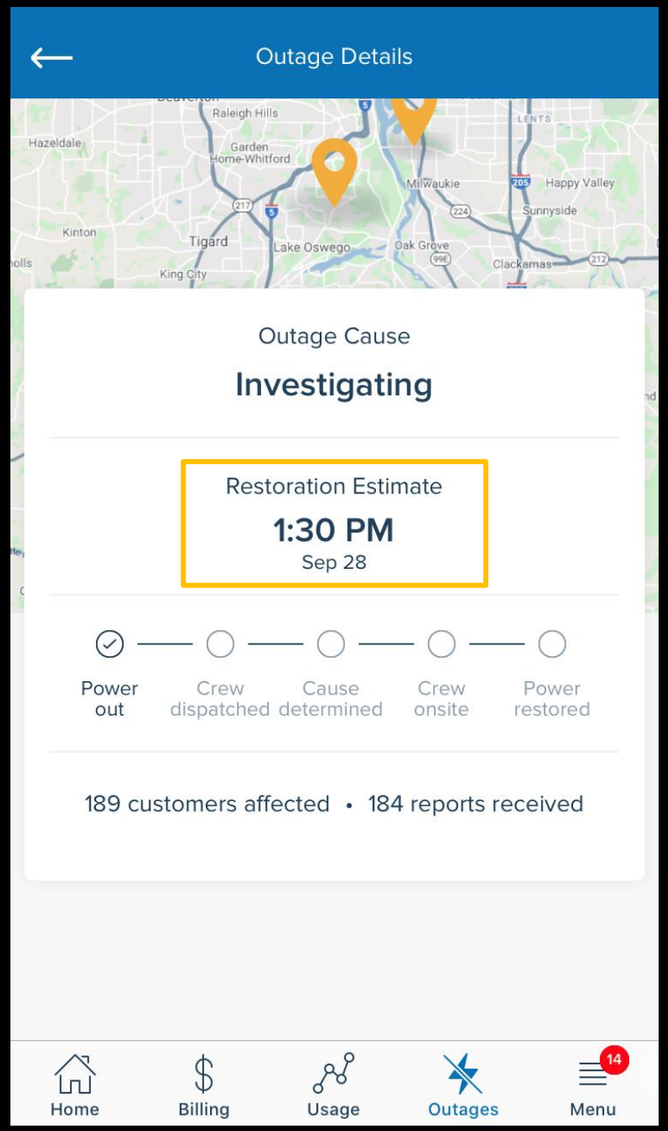
- Accuracy rate increased by 50%
- $500K saved in vendor costs
- $80K savings in avoided field visits
- $50K infrastructure savings

Estimated outage restoration time



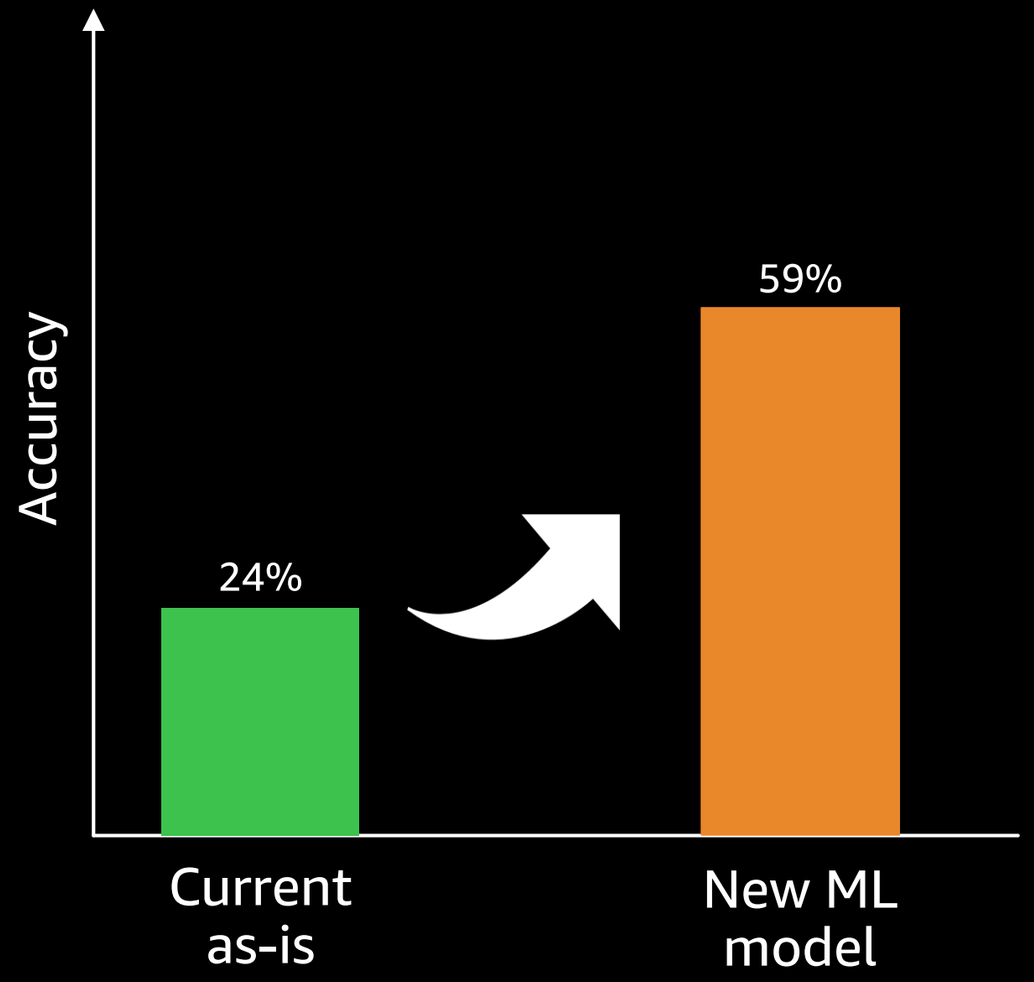
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Estimated Time to Repair (ETR) Challenge



- Desire to proactively notify customers about outages
- Initial restoration estimation sometimes inaccurate
- Too many ETR updates; confusing to customers
- Customers cannot plan around outages

Our solution and benefits



Solution highlights

- Data: current / historic outage info, weather
- Technology:
  - Amazon SageMaker Endpoint with auto-scale
  - Amazon SNS

Benefits

- **Customer satisfaction up**
- Reduce ~700k unnecessary ETR notifications / year
- **Reduced crew manual effort** to maintain ETR updates

Solar generation prediction

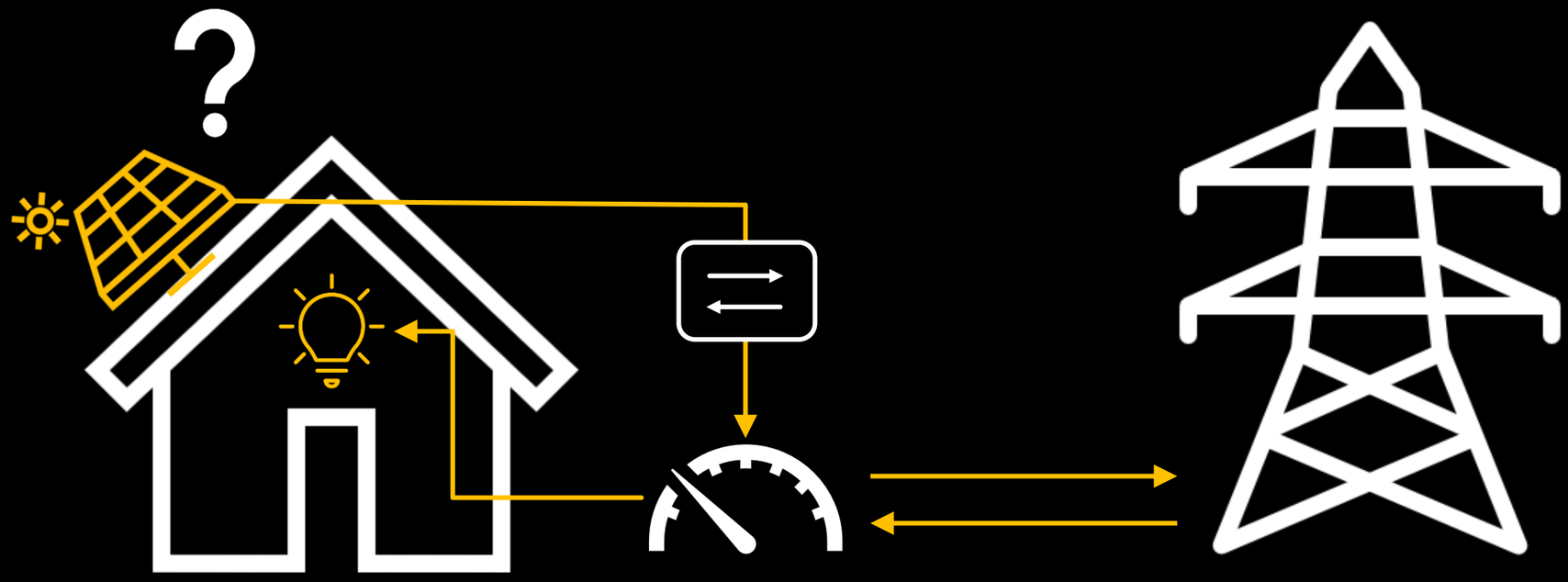


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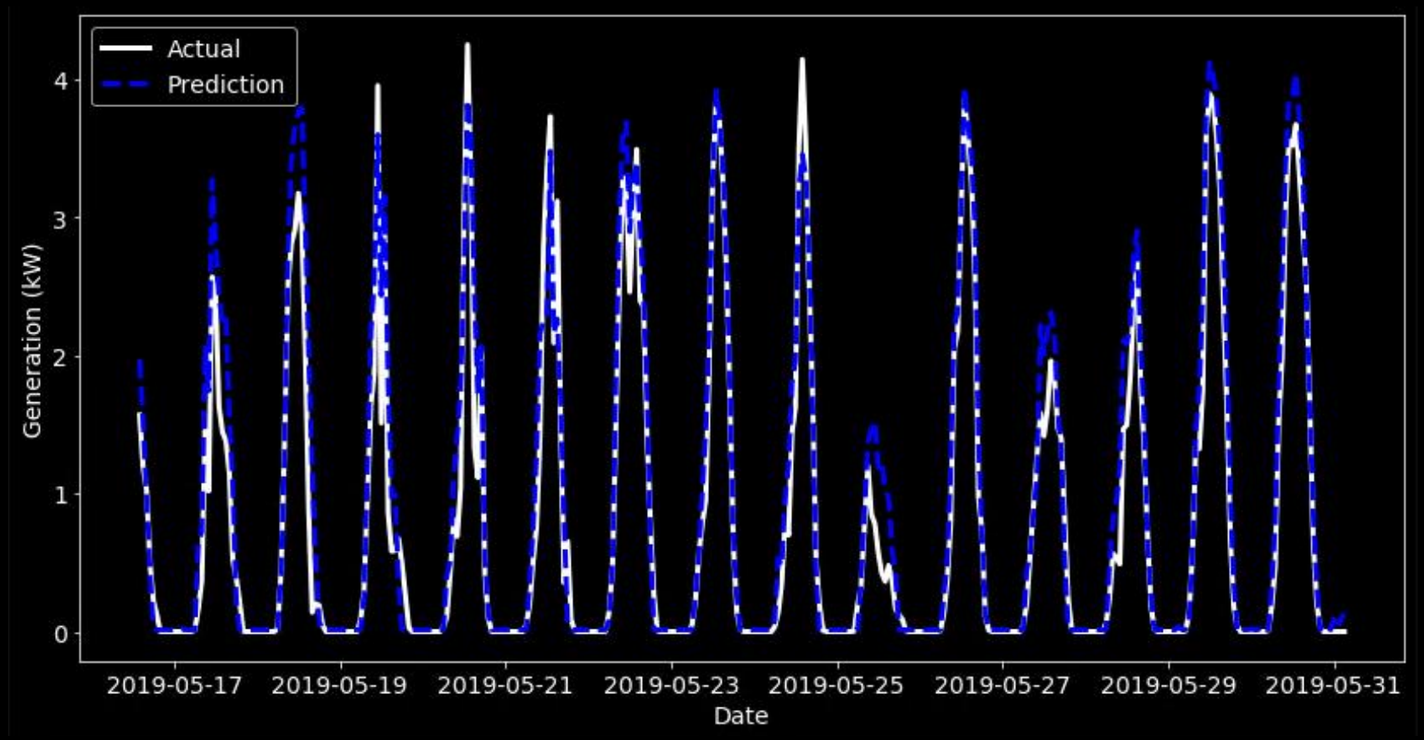
Challenge

- PGE can only measure net-energy consumption
- Limited visibility to customer solar generation
- Inaccurate grid capacity assessment and unnecessary equipment upgrade



Solar net-metering

Our solution and benefits



Solution highlights

- Data: meter, panel capacity, weather
- Technology:
  - Amazon SageMaker batch transform API
  - Amazon SageMaker Spark Processor
  - Amazon Lambda for schedule
- Performance:
  - MAPE: 3.1%

Benefits

- **50% process time reduction** in new solar customer screening process

Condition-based pole maintenance



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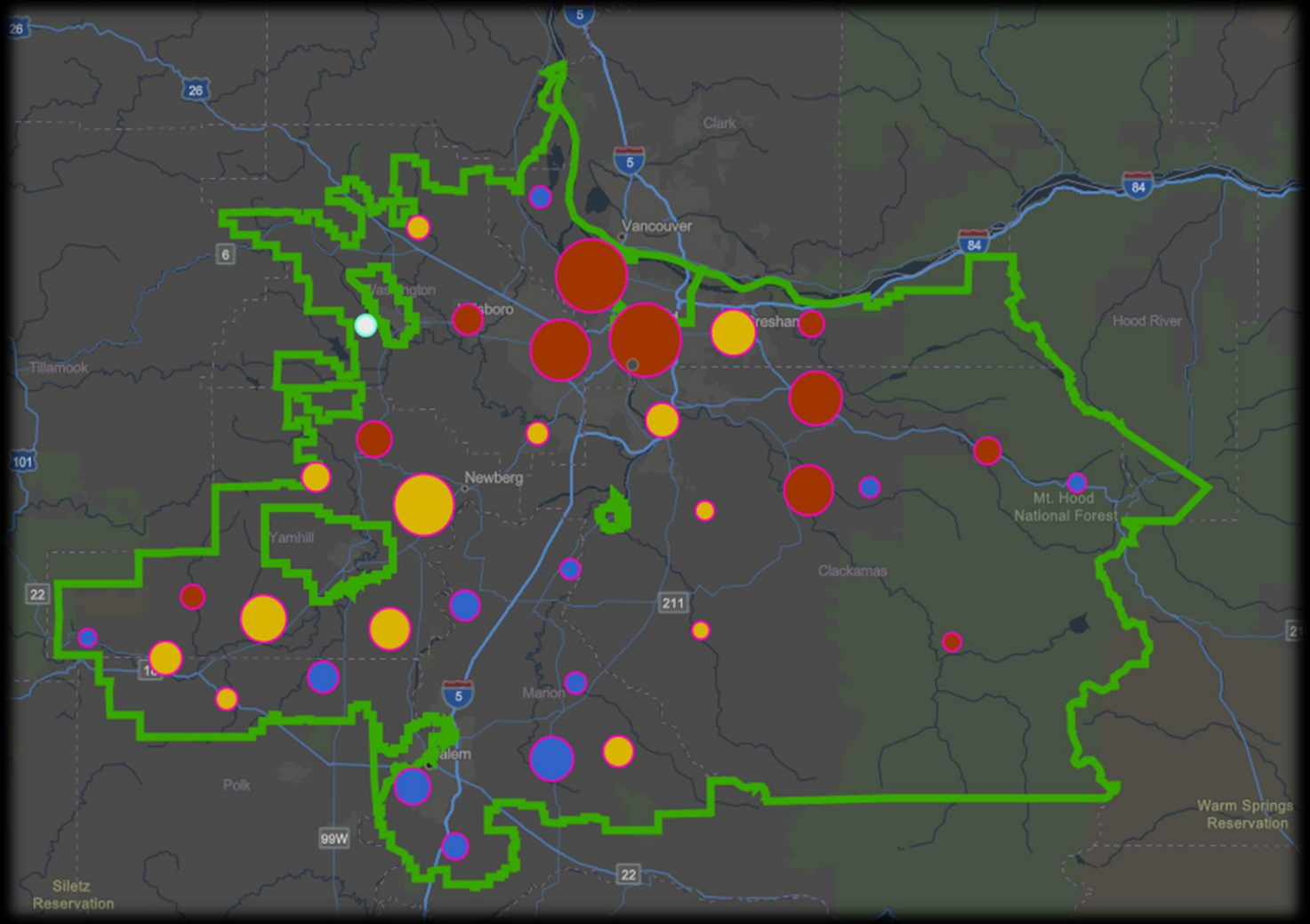
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Challenge

- Full pole inspection selection criteria largely determined by human experience

- Critical poles can cause huge outages to customers

Our solution and benefits



Split-top damage

Woodpecker damage

Decay damage

Solution highlights

- Data: pole info, weather, geo-space
- Technology:
  - ✓ Amazon SageMaker batch transform API
  - ✓ Amazon Lambda for schedule
- Performance:
  - ✓ F1 Score: 0.82

Benefits

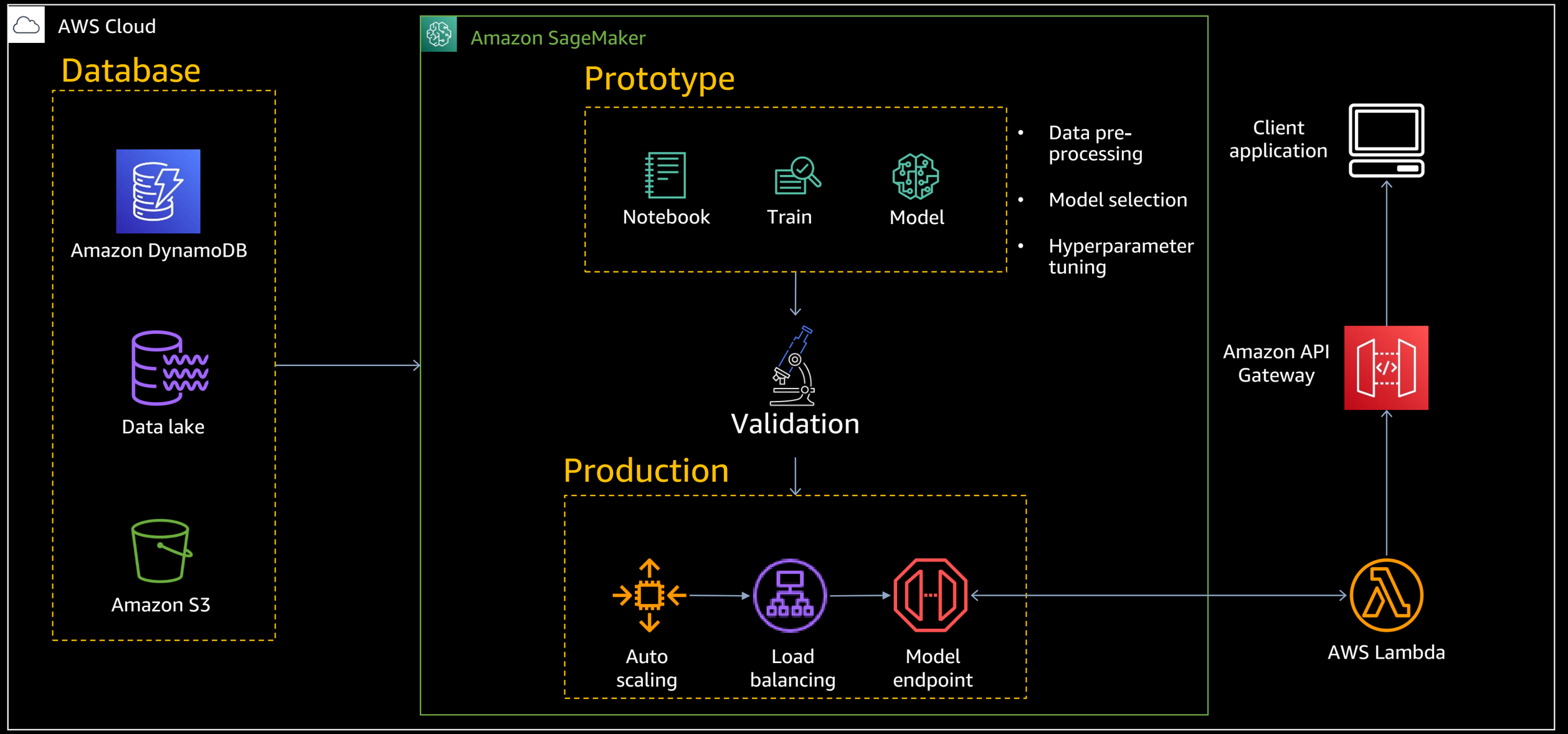
- Improving full pole inspection efficiency by 65%
- Reduction of unplanned outages

Our ML framework



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ML development workflow with Amazon SageMaker



Learnings



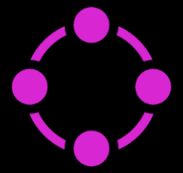
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Learnings



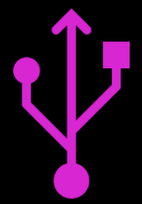
People

- Just-in-time training
- Break-down silos across roles



Process

- Invest in deployment and test automation
- Watch your cost (design for function, performance, and cost)
- Leverage AWS well-architected reviews



Technology

- Serverless is the mantra
- Better over perfect – experiment, learn, and course correct

Thank you!

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