HOW TO ACHIEVE HIGH C&I DEMAND RESPONSE GOALS WHEN YOU'VE ALREADY TAPPED OUT LARGE INDUSTRIAL

PEAK LOAD MANAGEMENT ALLIANCE SPRING CONFERENCE 2017

APRIL 5, 2017

Portland General Electric

NAVIGANT

PORTLAND GENERAL ELECTRIC

CASE STUDY

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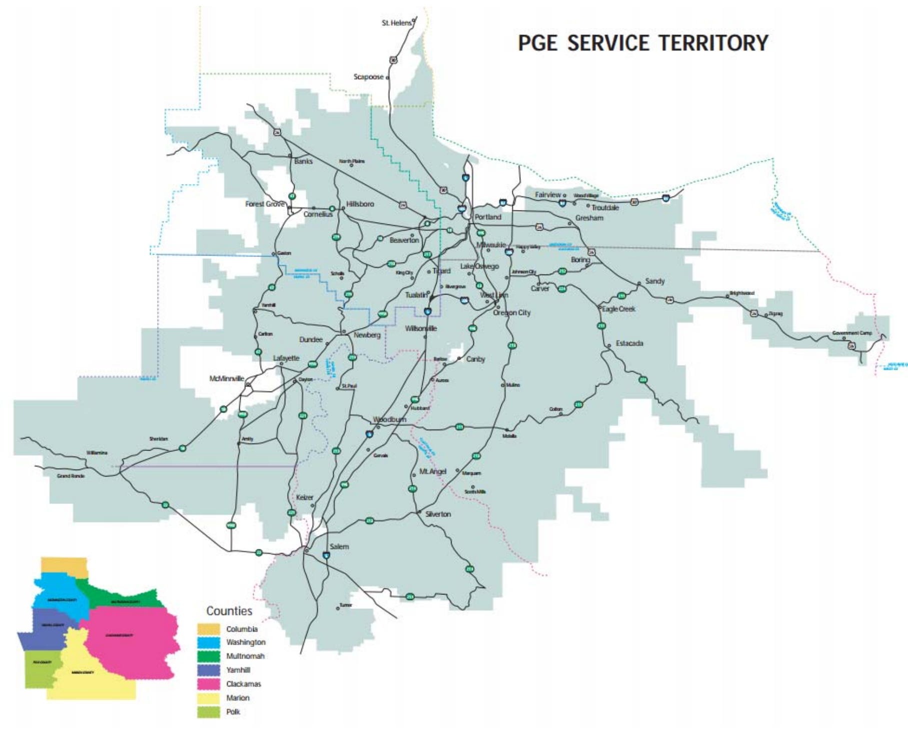
ABOUT PGE

Population of service area	1,800,000
State-approved service area (square miles)	4,000
Cities served	51
Average number of retail customers Residential Commercial Industrial	848,452 742,467 105,802 255
Total number of employees	2,646
Megawatt-hours delivered (retail and direct access)*	19,382,000
Average annual kilowatt-hours per residential customer	9,866
Average annual revenue per residential customer	$1,139
Residential price per kilowatt-hour	11.55 cents
National residential average price per kilowatt-hour	12.56 cents
2015 peak load (July 30, 2015)	3,914 MW
All-time peak load (Dec. 21, 1998)	4,073 MW



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BACKGROUND

- PGE is committed to demand response as a capacity resource
- IRP identifies 78 MW of DR by 2021
  - 27 MW to come from C&I
- Dual peaking utility, with capacity needs in both summer and winter
- PGE currently has two commercial demand response programs:
  - Energy Partner
    - Automated demand response program started in 2013
    - 56 customers
    - 8.4 MW of 10-minute response load
  - Schedule 77
    - Curtailable tariff program started in 2011
    - 1 customer
    - 1.8 MW of 4-hour response load
  - Neither program allows fossil-fuel generation or retail direct access customers to participate
- Separate dispatchable standby generation program includes 113 MW of 10-minute response load

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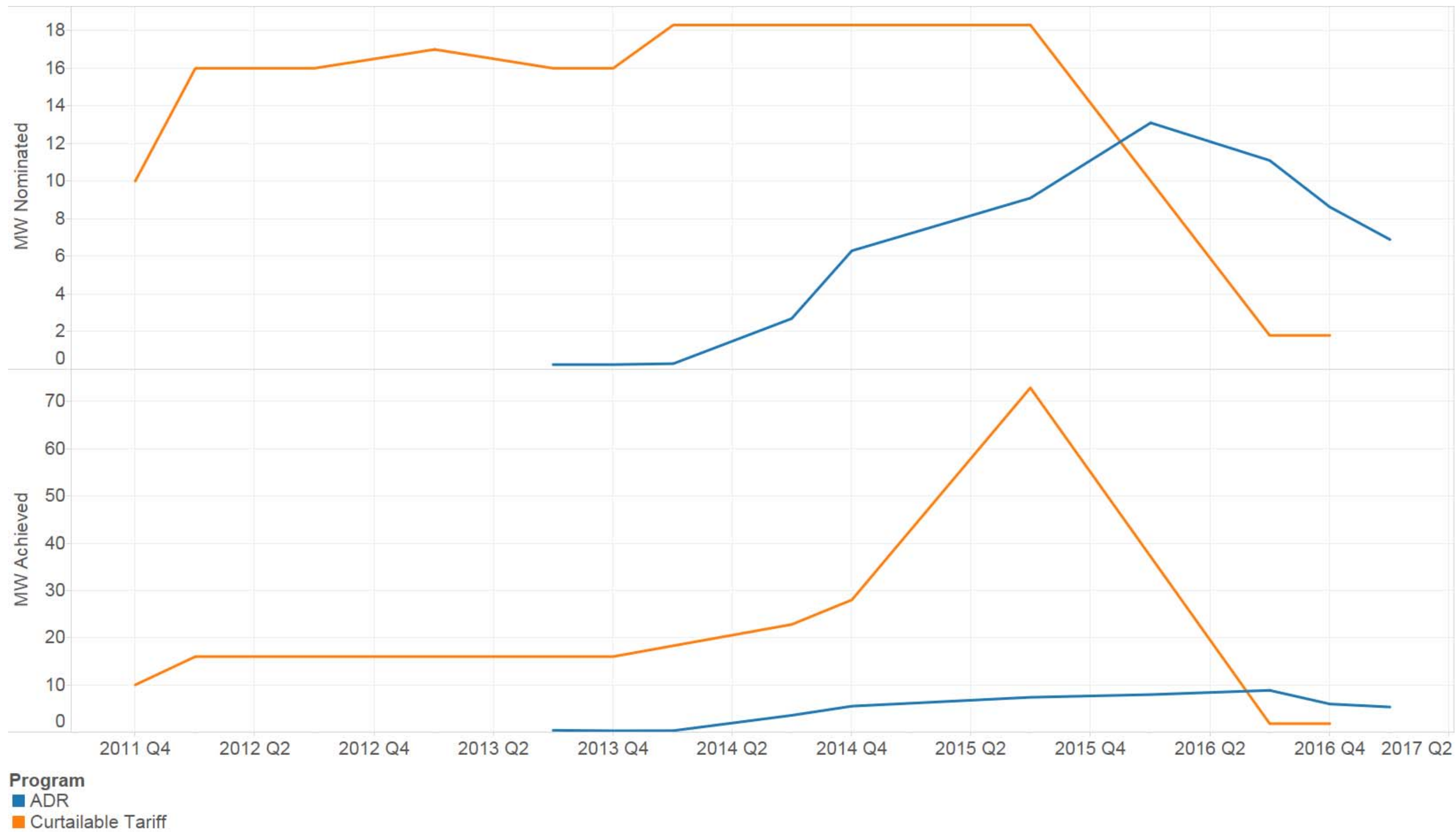
CURRENT PROGRAMS

- Energy Partner:
  - Most successful participants have been municipal water bureaus
  - Have lost several large customers due to retail direct access
  - Nominations have dropped for many customers over time
- Schedule 77
  - At peak, program was at 18.3 MW nomination
  - Single, 16 MW-nomination paper mill went out of business, dramatically reducing portfolio
  - Current customer is large steel mill
- Successful with a small set of customers, but limited growth opportunities

PROGRAM PROGRESS



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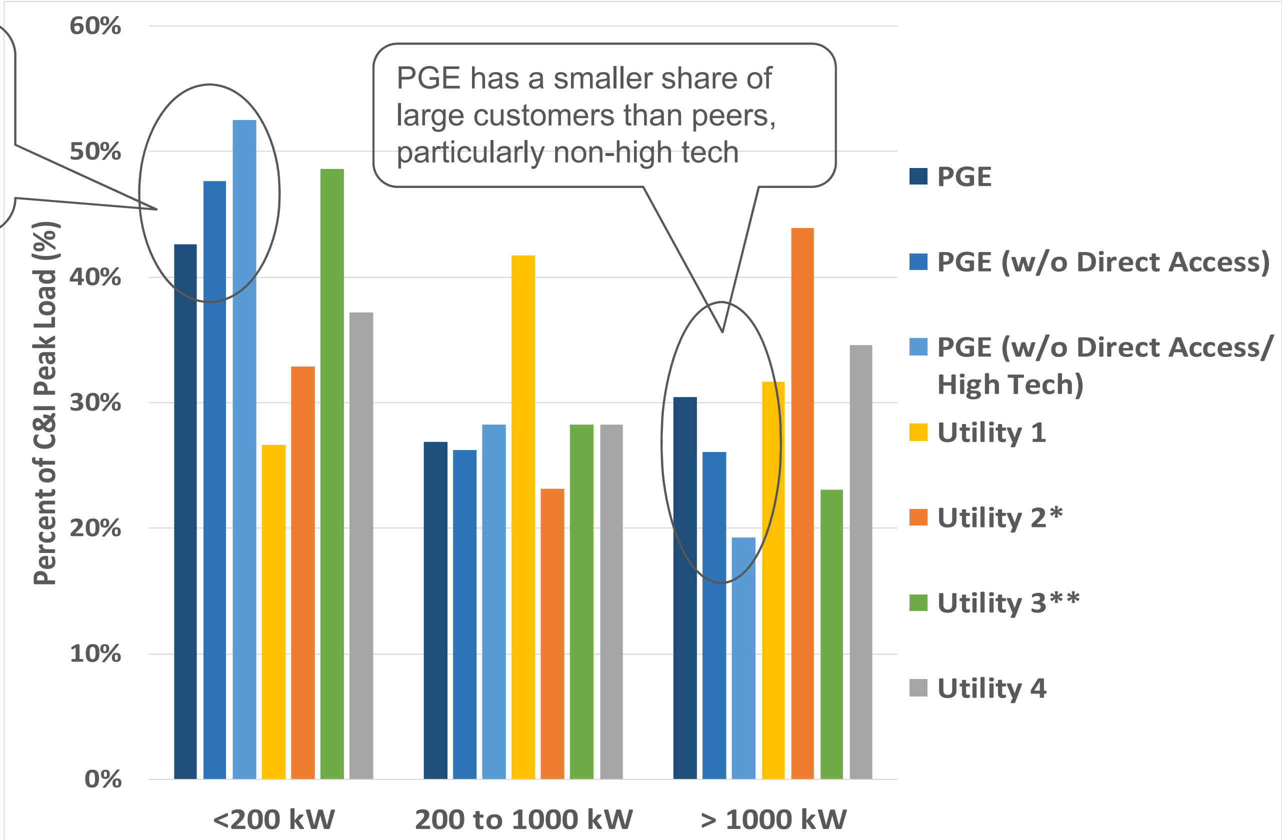
PHILOSOPHY OF PROGRAM DESIGN:
ENERGY PARTNER

Current Program

Resource Needs	Program Design	DR Resource Characteristics
• 20-30 MW • Summer 12-10pm • Winter 6-11am & 4-9pm • 10-minute response	• Incentives for average curtailment over entire window of availability • Little flexibility in hours provided • Fast response required (but rarely used)	• ~10 MW (less than desired) • Summer versus winter differences • Customer resource limitations

BENCHMARKING PEAK LOAD OF C&I CUSTOMER SEGMENTS HIGHLIGHTED DIFFERENCES IN DR POTENTIAL AND ENROLLMENT ACROSS UTILITIES

The blue bars are PGE, which show a larger share of smaller customers than peers



Source: Navigant, 2017 and utility data.
** Utility 2 based on Average Monthly Load data and size breakdowns of <500kW, 500-1000 kW and >1000 kW*
*** Utility 3 based on size breakdowns of <300 kW, 300-1000 kW and >1000 kW*

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LESSONS LEARNED

- Be mindful of what you actually need from the resource
  - What is the relatively value of:
    - Firm/non-firm
    - 10-minute, 4-hour, day-ahead
    - Different availability windows
- Meet the customers where they are
  - Find the convergence of resource need and customer needs
  - Consider program lifecycle, perhaps providing easy-entry programs at first
- Coordinate with Energy Trust on combined opportunities
- Municipal customers will be key to the success of our programs:
  - Community-minded
  - Very successful in current program
  - Industrial load flexible and available year-round
  - Less susceptible to business shocks
  - Not likely to go direct access

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Future Program

Customer Needs	Program Design	DR Resource Characteristics
• Benefits commensurate with effort/hassle (e.g., sustainability, incentives) • Added value from PGE (e.g., interval data/automation) • Maintaining production and/or comfort	• Flexible capacity by season & hour • Incentives for narrower window • Expanded target market • New technologies to facilitate participation • Value-added data & services	• Increased participation • Greater diversity of customers and loads • More satisfied and committed participation

LANDSCAPE FOR ACHIEVING DR GOALS

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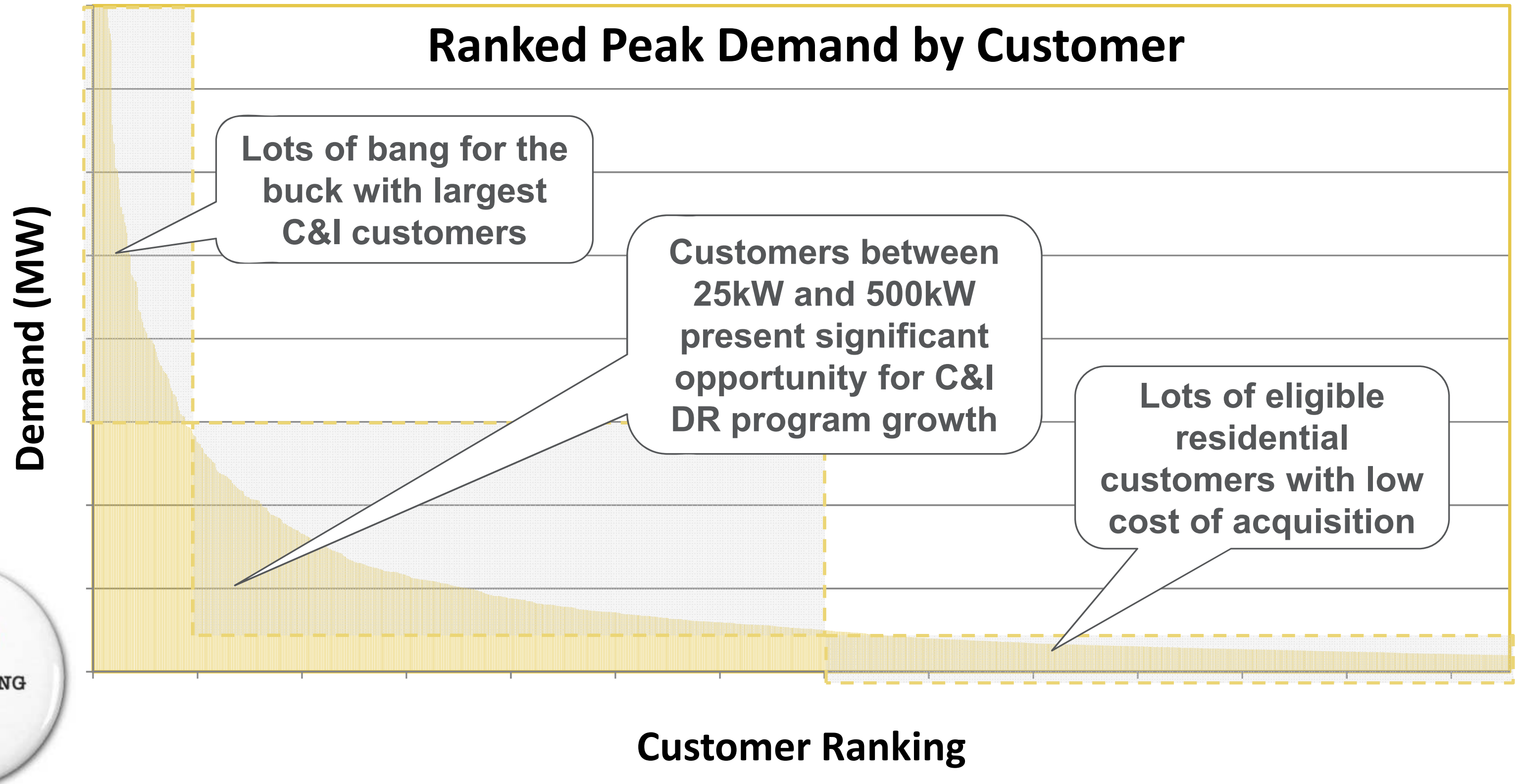
MIDDLE GROUND FOR DR PROGRAM GROWTH



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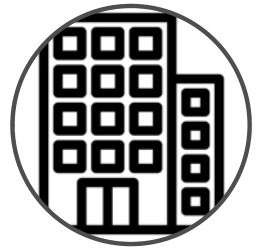
DEFINITION OF THE "MIDDLE GROUND"

Small Business

25-200 kW

Restaurants, Medical offices, Retail shops

Central Air Conditioners



Medium Business

200-500 kW

Schools, Storage Facilities, Big Box Retailers, Movie Theaters, Medium-size Offices, Shopping Malls, etc.

Central Air Conditioners and Roof-top HVAC units

Small & Medium Business (SMB)

Icons compliments of Rafael Empinotti & iconsphere from Noun Project

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WHY ARE WE TALKING ABOUT THIS TODAY?

Reasons for Pursuing Small/Medium Business DR

- Large C&I program participation plateauing or declining
- Utilities facing increasing pressure to expand DR programs
- Growing interest in DR as a customer engagement opportunity for customers
- New technologies opening up new opportunities

WHY HAVEN’T WE BEEN PURSUING THIS MIDDLE GROUND MORE ACTIVELY?

Challenges with Pursuing Small/Medium Business DR

- Challenges with outreach to the customer
- Need a crystal clear value proposition to the customer
- Technical challenges with delivery
- Challenges with demonstrating the cost effectiveness of the program

LESSONS LEARNED

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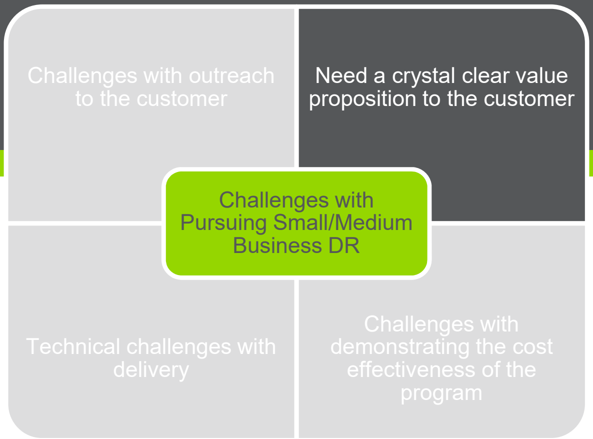
OVERCOMING CHALLENGES WITH OUTREACH TO THE CUSTOMER

- Pepco Holdings Inc. case study:
  - Leverage email and telemarketing channels to:
    - Help warm the door
    - Offer upfront education and screening
    - Assist in setting appointments
  - However, **face-to-face contact** is the primary channel for bulk of enrollments

- Other best practices:
  - Change thinking from “marketing” to “consumer education” & “customer-centricity”
  - Appeal to sense of Community and “green” values
  - When communicating face-to-face, provide compelling leave-behinds

Concepts compliments of

MAKING A CLEAR VALUE PROPOSITION TO THE CUSTOMER



- Pepco Holdings Inc. case study:
  - **Bundle DR + EE** as part of the value proposition that is delivered during face-to-face contact

- Other best practices:
  - Design a **customer-centric program**
  - Keep it simple/easy and offer choice (with an easy-to-choose default option)
  - Tailor programs to each "type" of SMB business model with segmentation data
  - Bundle other value-added offerings (e.g., bill alerts, bill average plans, etc.)

Concepts compliments of comverge energy made better

OVERCOMING TECHNICAL CHALLENGES WITH DELIVERY

Challenges with outreach to the customer

Need a crystal clear value proposition to the customer

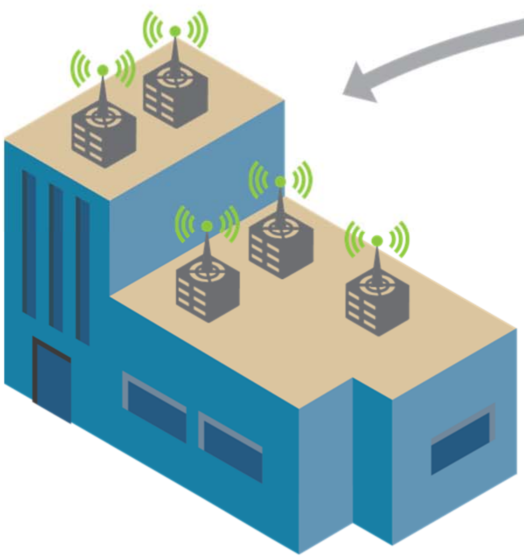
Challenges with Pursuing Small/Medium Business DR

Technical challenges with delivery

Challenges with demonstrating the cost effectiveness of the program

- New technologies including connected smart thermostats and networked RTU optimization via wireless

Customer building with rooftop HVAC



Encycle Swarm Servers

Swarm Logic technology provides:

- Demand peak and consumption reduction
- Demand response participation
- HVAC operational analytics and visibility
- Set and forget 24/7/365 operations

Installation options include:

- Swarm Controller - wireless controllers
- SwarmStat - smart thermostats
- Swarm Service - cloud API for third party controls

Web Portal

Compliments of ENCYCLE SMARTER ENERGY

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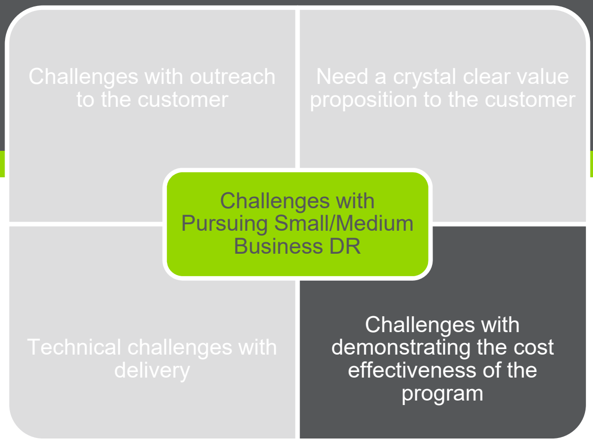
DEMONSTRATING THE COST EFFECTIVENESS OF THE PROGRAM



- Participant cost effectiveness
  - Bundled DR + EE improves payback for customer
  - Technologies provided at no cost or lower cost to customer than previous delivery methods

- Program administrator cost effectiveness
  - Existing SMB programs at SDG&E, PNM, SMECO, Central Hudson, PHI and Duke Energy, among others
  - Time horizon for cost effectiveness evaluation may matter, due to potentially higher acquisition costs

PHILOSOPHY OF PROGRAM DESIGN:
FUTURE PROGRAM

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