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ENERGY RESEARCH

Western market regionalization: SRP Day-Ahead market benefits analysis

Environmental Defense Fund

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SRP sees higher average system costs when Arizona BAs commit to EDAM over Markets+, although this translates to less than <2%

This analysis aims to identify the potential benefits or costs for Salt River Project (SRP) under three Western US market regionalization scenarios: (1) SRP participates in Markets+, (2) SRP, APS, TEP participate in EDAM, and (3) SRP, APS, TEP, WALC participate in EDAM, with all else remaining equal. Comparisons between scenarios include those of various cost categories, generation mix, and emissions outputs.

Average annual cost breakdown for SRP across modeled scenarios, 2027-2040
$Million/year, real 2024

	SRP in Markets+[3]	AZ EDAM, excl. WALC	AZ EDAM, incl. WALC
Metric			
Production cost	1,426.1	1,376.4	1,327.8
Bilateral trading costs	(35.7)	40.1	91.0
→ Export revenue	(420.0)	(379.2)	(382.2)
→ Import cost	384.2	419.3	473.2
Congestion revenue[1]	(94.1)	(102.7)	(112.0)
Wheeling revenue[1]	(22.5)	(21.2)	(20.6)
Annual costs[2] (SRP)	**1,273.8**	**1,292.6**	**1,286.2**
Annual costs[2] (AZ)	**3,381.7**	**3,342.2**	**3,266.8**

1) Ownership assumed to be split 50-50 with connecting BA unless data on ownership is available. 2) Annual costs after revenues 3) This scenario is equivalent to an AZ Markets+, excl. WALC scenario where APS, SRP, and TEP join Markets+ and WALC remains uncommitted
Sources: Aurora Energy Research

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- SRP experiences an average $12–19M/year cost increase under AZ EDAM configurations relative to Markets+, though total Arizona-wide costs are lower
- **Production costs:** EDAM increases renewable imports from SP15 and reduces thermal exports to APS, lowering SRP's thermal dispatch and production costs
- **Bilateral trading costs:** The EDAM footprint raises SRP's import volumes and costs, while reducing SRPs export volumes to APS as APS accesses a broader pool of generation. The combination of greater imports and lower exports increases SRP's bilateral trading costs
- **Congestion and wheeling revenue:** EDAM drives higher utilization of SRP's transmission interties, particularly for SP15 imports, increasing congestion and wheeling activity

BAs are modeled to join DAMs based on confirmed or assumed commitments in the SRP Markets+ case, with variations across scenarios

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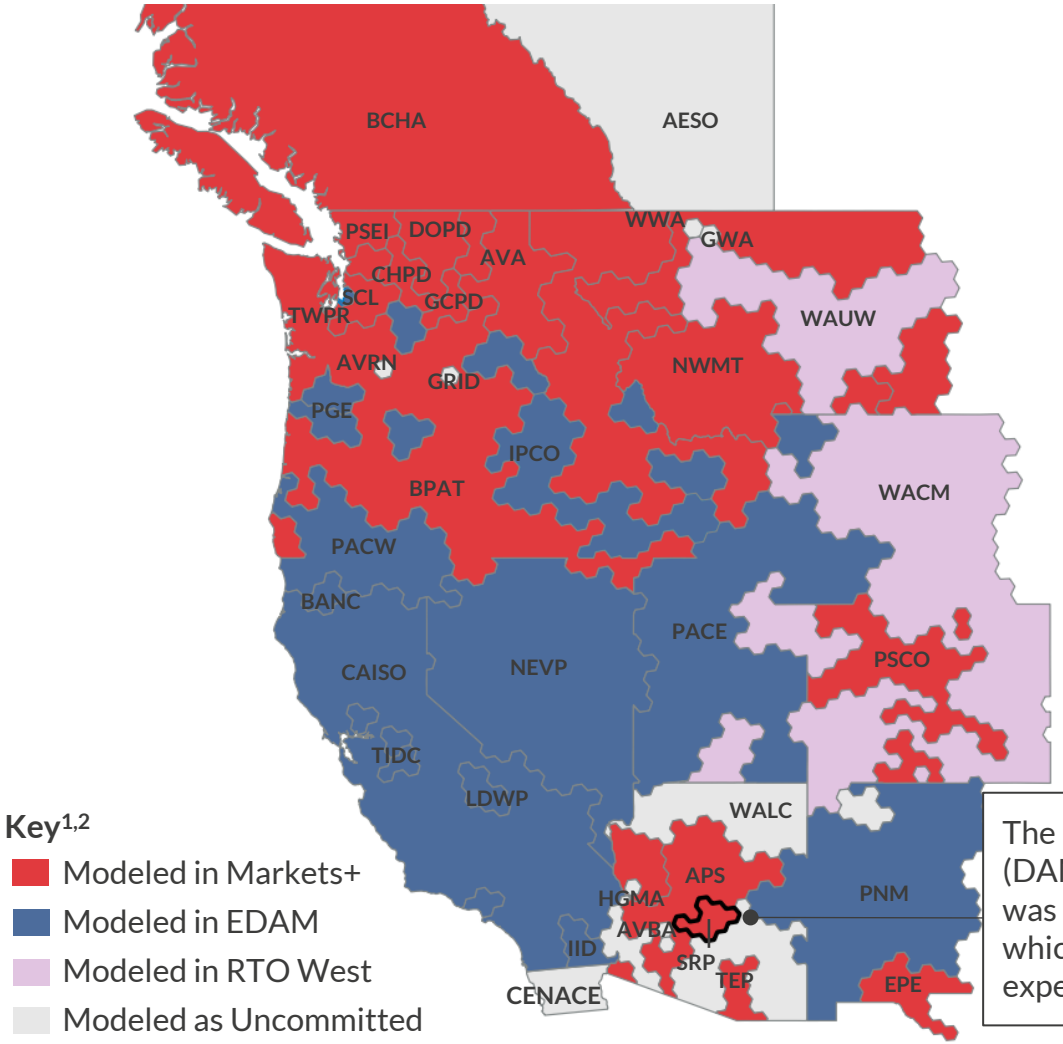
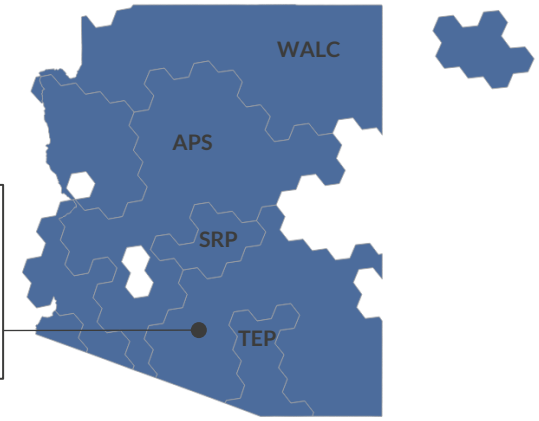
Map of modeled balancing authority (BA) market decisions – SRP Markets+ case



Key[1,2]
- Modeled in Markets+
- Modeled in EDAM
- Modeled in RTO West
- Modeled as Uncommitted

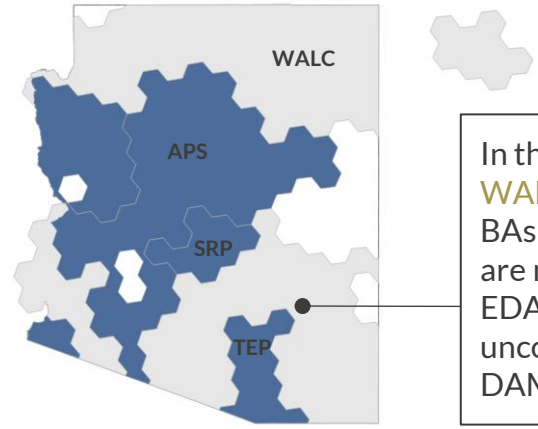
The Day-Ahead Market (DAM) commitment for SRP was modeled under Markets+, which is in line with its expected commitment

Modeled BA market decisions in Arizona – AZ EDAM incl. WALC



In the AZ EDAM incl. WALC scenario, Arizona BAs APS, TEP, SRP, and WALC are modeled to join EDAM

Modeled BA market decisions in Arizona – AZ EDAM excl. WALC

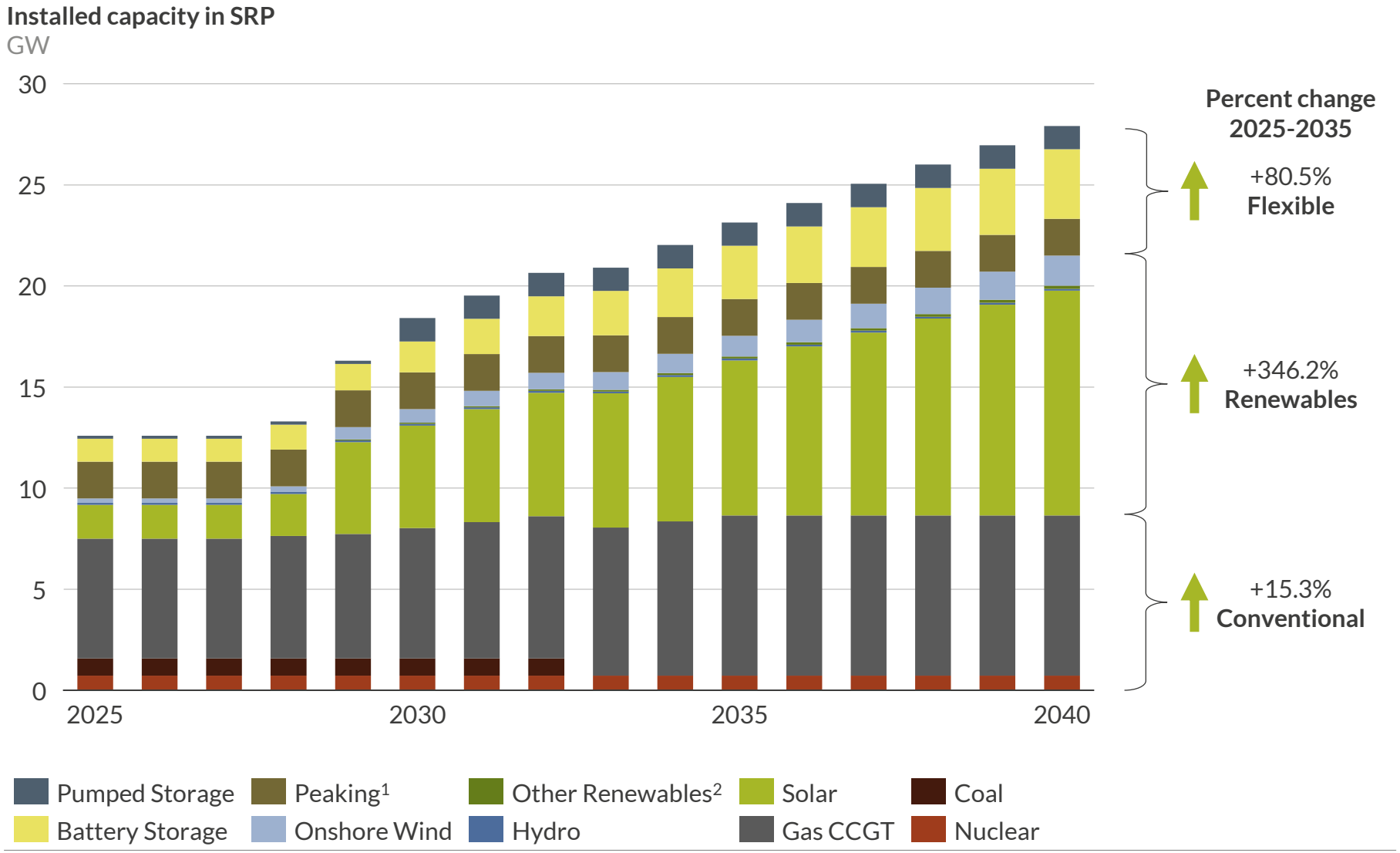


In the AZ EDAM excl. WALC scenario, Arizona BAs APS, TEP, and SRP are modeled to join EDAM. WALC remains uncommitted to either DAM

1) BAs with announced commitments are modeled as participating in the respective offering. BAs that are undecided or have no public leaning are modeled as uncommitted and therefore do not participate in any offering 2) Some BAs are modeled to join a market after the initial markets go live. All DAM positions are finalized by 2030.

Sources: Aurora Energy Research, CAISO, SPP

Aurora modeled SRP's capacity mix following SRP's 2023 ISP Balanced System Plan through to 2035



1) Peaking includes OCGT, reciprocating engines. 2) Other Renewables includes biomass and geothermal.

Sources: Aurora Energy Research, SRP

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- Aurora modeled SRP installed capacity based on existing installed capacity owned and contracted, with capacity growth through to 2035 following the SRP Integrated System Plan (ISP) released in 2023
- SRP plans to add approximately 11.5GW of new resources by 2035, driven by load growth and thermal retirements. Of note is the utility's commitment to retire its entire coal fleet by 2032
- Although SRP is not included in the RPS program in Arizona, the utility has a goal to reduce carbon emissions to 90% of its 2005 baseline by 2050

SRP forecasts significant load growth throughout the Phoenix metro area as a result of increased commercial activity and population growth

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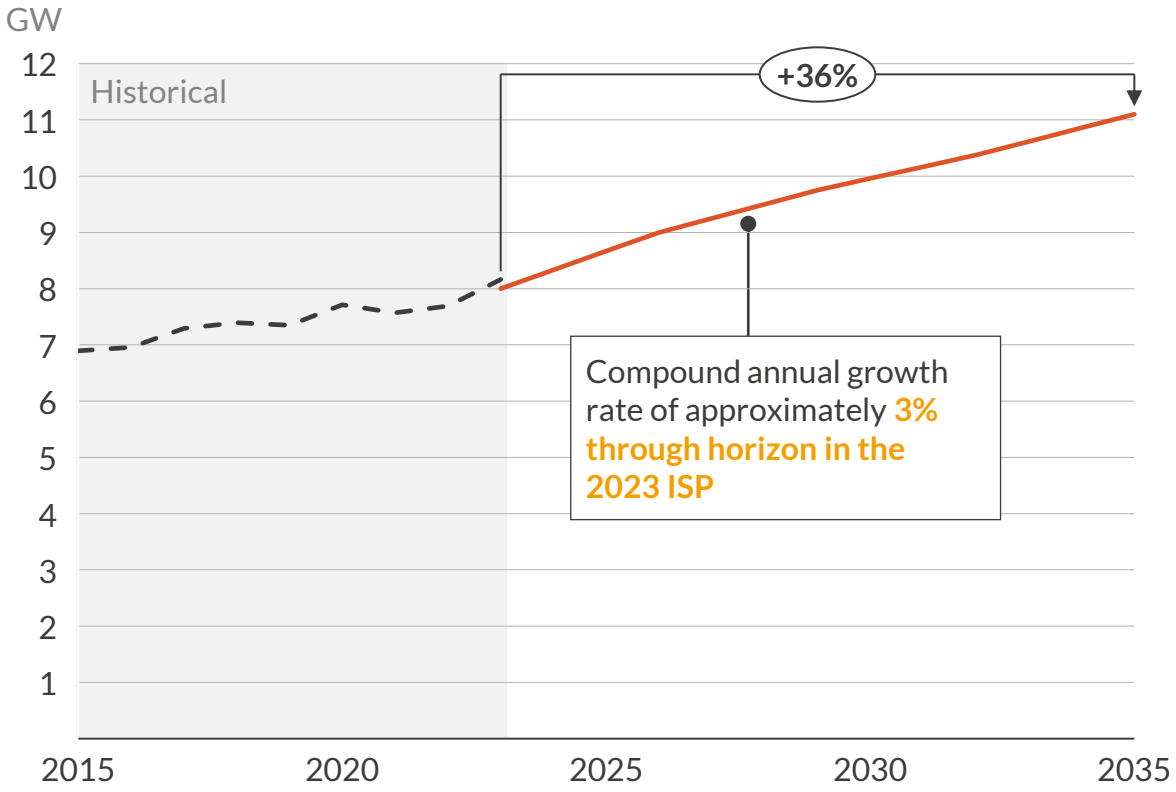
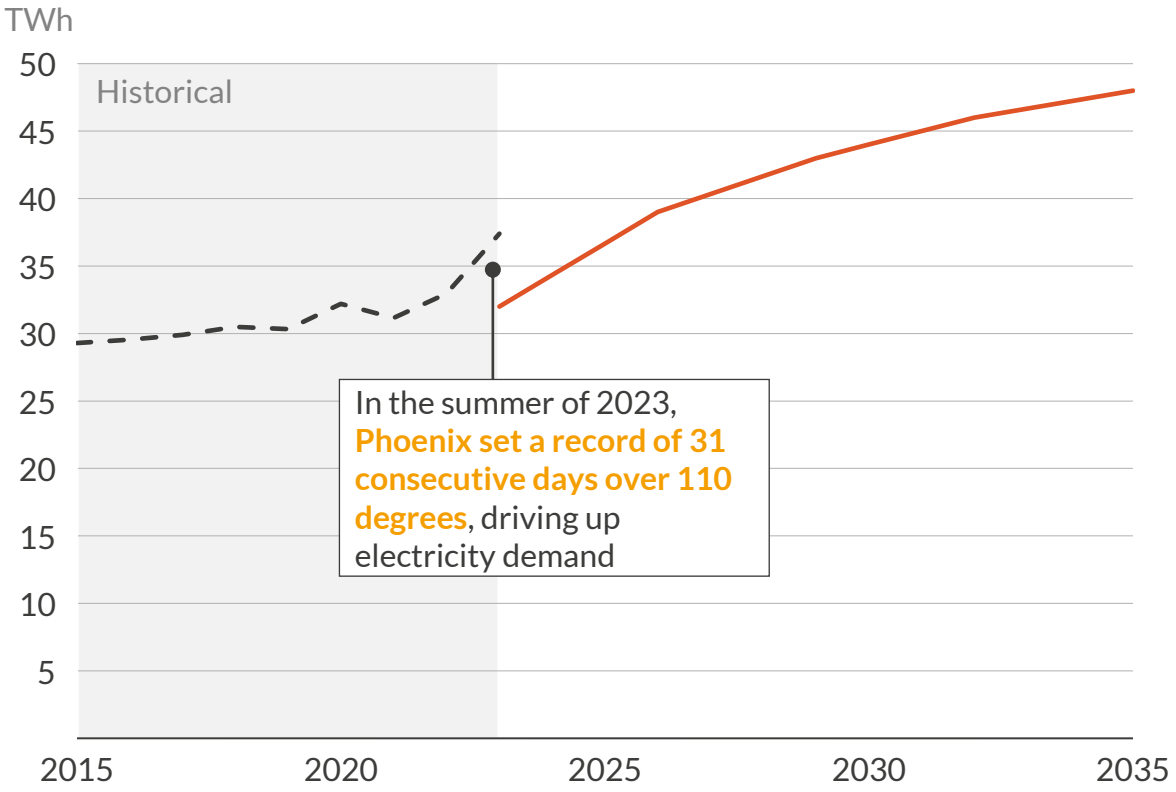
SRP coincidental peak demand[1,2,3]



- SRP's demand forecast anticipates a 0.67-degree Fahrenheit temperature increase per decade, consistent with the Intergovernmental Panel on Climate Change's Representative Concentration Pathway 4.5
- Demand growth is driven primarily by economic and population growth in the Phoenix metro area, mostly in the southeast portion of SRP's service territory

SRP annual system load[1,2,3]



- SRP has a goal to support the enablement of 500,000 EVs in its service territory by 2035 and plans to manage 90% of EV charging through price plans, dispatchable load management, and other "smart" technologies
- SRP plans to double its demand response capabilities to 300MW by 2035

Historical — 2023 ISP

1) Peak demand and forecasted annual system load accounts for energy efficiency, behind-the-meter technologies, and demand response. 2) Historical peak demand and annual load data is post-DSR. 3) Demand forecasts are SRP's "Current Trends" forecast.

Sources: Aurora Energy Research, WECC, SRP

Decreased exports and increased imports drive higher bilateral trade costs for SRP under AZ EDAM configurations

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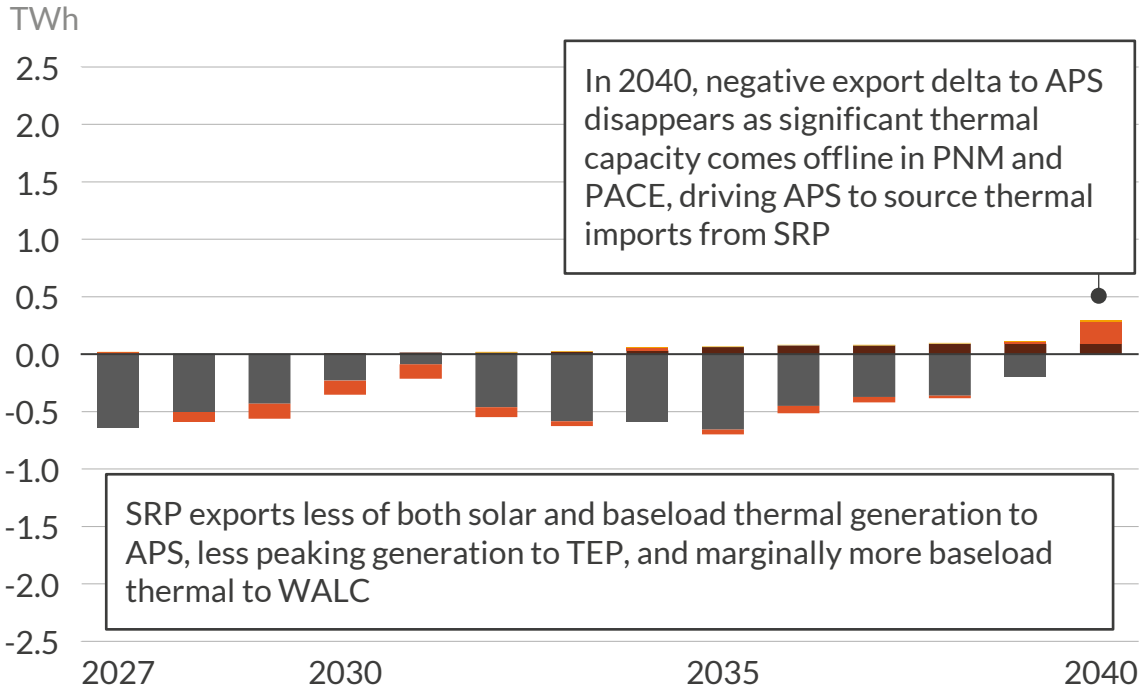
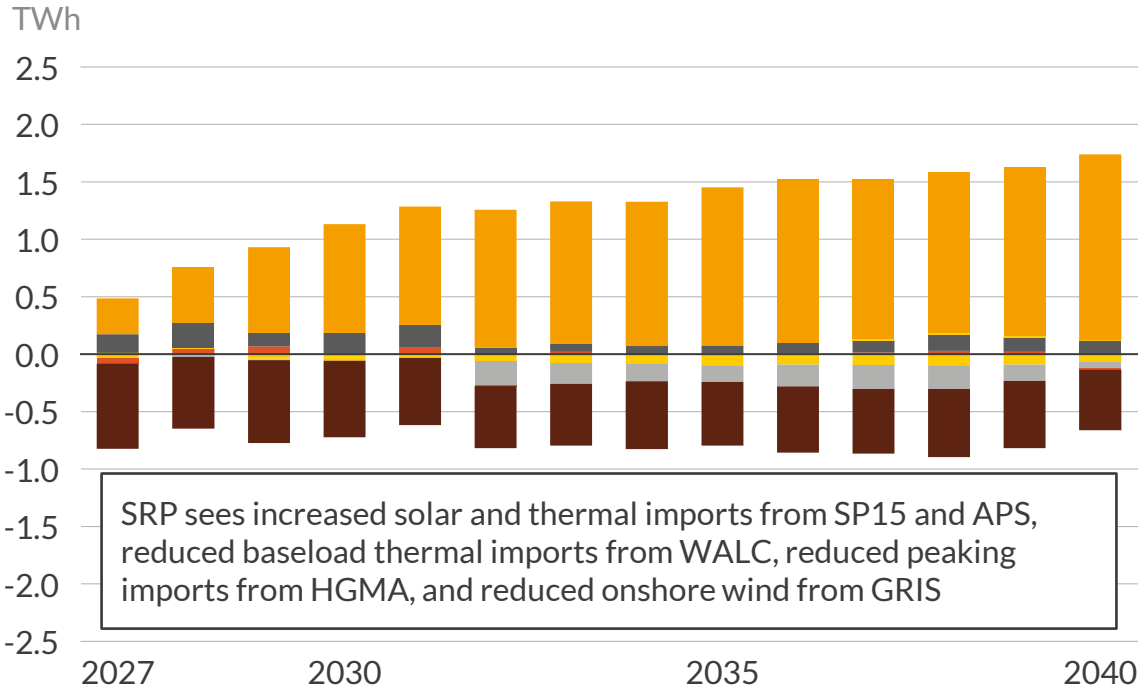
Delta in SRP export volumes, AZ EDAM excl. WALC – SRP Markets+[1] scenario



Delta in SRP import volumes, AZ EDAM excl. WALC – SRP Markets+[1] scenario



- SRP has historically been a significant exporter to APS, particularly of baseload thermal generation
- However, under the EDAM scenarios, APS can access increased renewables and thermal from the wider EDAM footprint, especially from PNM and PACE. As a result, SRP exports less to APS, driving its lower export revenues in the EDAM scenarios relative to the SRP Markets+ scenario

- Under the EDAM scenarios, SRP can import from SP15 without facing seams costs. This drives higher imports of both thermals and renewables to SRP, offsetting its domestic baseload generation in tandem
- Under the AZ EDAM excl. WALC scenario, SRP sees reduced imports from WALC relative to the SRP Markets+ scenario as hurdle rates for trade between Uncommitted BAs with EDAM are higher due to synchronization costs. However, this delta disappears under the AZ EDAM incl. WALC scenario when WALC joins the EDAM footprint

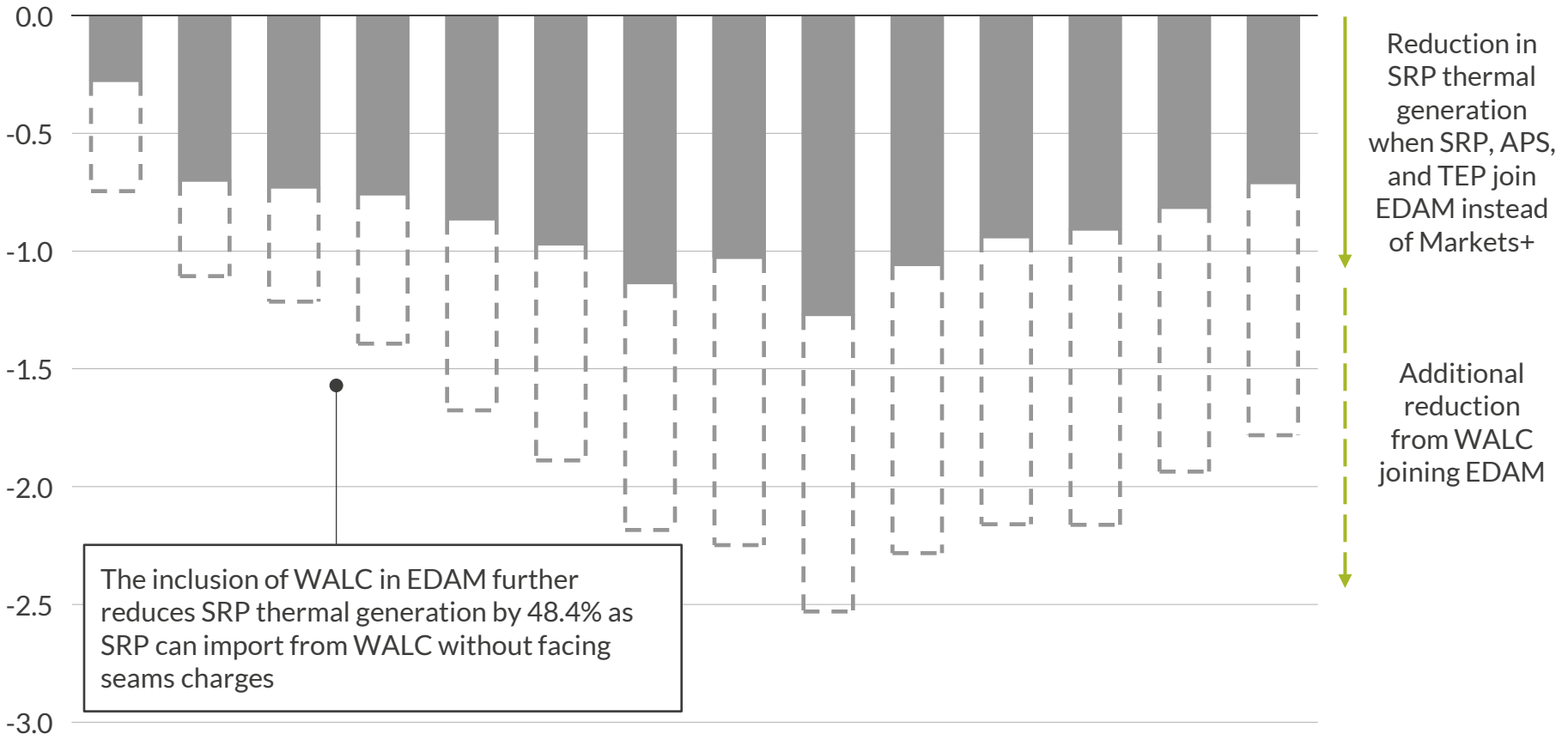
SP15 AVBA APS GRIS HGMA TEP WALC

3) This scenario is equivalent to an AZ Markets+, excl. WALC scenario where APS, SRP, and TEP join Markets+ and WALC remains uncommitted

Sources: Aurora Energy Research

Decreased thermal generation in SRP in the AZ EDAM scenarios drives lower production costs relative to the Markets+ scenario

Yearly thermal generation delta in SRP, 2027 – 2040
TWh



- When Arizona participates in EDAM, SRP sees reduced export volumes, particularly to APS, and increased import volumes, particularly from SP15. The increase in net imports reduces domestic production and the associated production cost for SRP under AZ EDAM as opposed to SRP Markets+
- The reduced domestic thermal generation drives a 3.1-4%, or ~0.4MMtCO2, reduction in annual SRP emissions under the AZ EDAM scenarios compared to the Markets+ scenario
- While not quantified in the system cost metrics, there are benefits associated with reduced carbon emissions that can counteract some of the cost increases in the EDAM scenarios

Sources: Aurora Energy Research

Transfers between markets, RTOs, or uncommitted BAs are expected to face friction charges due to differences in market optimization

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Transfers to Markets+		
Source BA	Sink BA	Friction charge[1]
Markets+	Markets+	$0/MWh
EDAM	Markets+	$3/MWh
RTO West	Markets+	$1.5/MWh
Uncommitted	Markets+	$3/MWh

Transfers to EDAM		
Source BA	Sink BA	Friction charge[1]
EDAM	EDAM	$0/MWh
Markets+	EDAM	$3/MWh
RTO West	EDAM	$3/MWh
Uncommitted	EDAM	$6/MWh

Transfers to RTO West		
Source BA	Sink BA	Friction charge[1]
RTO West	RTO West	$0/MWh
EDAM	RTO West	$1.5/MWh[2]
Markets+	RTO West	$0.75/MWh
Uncommitted	RTO West	$1.5/MWh

Transfers to uncommitted BAs		
Source BA	Sink BA	Friction charge[1]
Uncommitted	Uncommitted	$6/MWh
EDAM	Uncommitted	$6/MWh
Markets+	Uncommitted	$6/MWh
RTO West	Uncommitted	$6/MWh

1) Friction charges are additive to wheeling rates and carbon adders (imports to CA or WA). The full hurdle rate for trades between BAs is modeled as the sum of wheeling rates, friction charges, and carbon adders. Wheeling rates between BAs in the same DAM are reduced to $0/MWh 2) EDAM to CAISO transfers see a $0/MWh friction charge.

Sources: Aurora Energy Research

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