

# Summary of RESOLVE Model Changes

RESOLVE updates in the 2021 No New DER case since the 2019 RSP model

## Background

Between the 2019 RSP and Spring 2021, when the 2021 ACC was developed, the IRP has implemented a set of RESOLVE modeling updates to capture the most up-to-date data and assumptions as part of continuous IRP modeling improvement.

The 2021 No New DER case was produced using a RESOLVE data vintage from early 2021, to take advantage of the more up-to-date assumptions compared to the 2019 RSP to produce the inputs for the 2021 ACC. These updates will be discussed in the following sections.

## RESOLVE Model Updates Since the 2019 RSP

### Load forecast

1. System energy and peak demand forecasts were updated based CEC's 2019 IEPR forecasts
2. Building electrification shapes were updated. Heat pump load shapes were updated based on E3's RESHAPE model; all other building electrification shapes were updated based on CEC's load shape forecasts.<sup>1</sup>
3. The 2019 RSP assumed a 2 GW PRM adjustment starting in 2026. IRP moved the need up to 2024, which is consistent with the timeline for mid-term reliability procurement need currently being identified in IRP.
4. Additional minor RESOLVE updates and corrections.<sup>2</sup>

### Candidate resource costs

1. Solar, wind, and other renewable candidate resources
  - a. Costs were updated from 2018 NREL ATB to [2020 NREL ATB](#).
  - b. Implemented a 9% transmission cost haircut for out-of-state wind resources to account for resource oversizing relative to transmission for bringing out-of-state resources into California.
  - c. Updated the ITC and PTC schedules for the resource cost financial assumptions according to the Dec 2020 tax extender bill.
2. Offshore wind cost assumptions were updated based on the CA-specific 2020 vintage NREL/BOEM study.

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<sup>1</sup> E3 updated its RESHAPE model to produce updated space heating and water heating building electrification load shapes and used the CEC California IOU Electricity Load Shapes Report (<https://ww2.energy.ca.gov/2019publications/CEC-500-2019-046/CEC-500-2019-046.pdf>) for cooking and clothes drying loads. These shapes only apply to the PATHWAYS-based loads modeled in 2045, since the 2019 IEPR contains no explicit building electrification loads. Per the 2019-20 IRP Inputs and Assumptions, the previous assumptions used an older version of RESHAPE for space heating loads and relied on E3 PATHWAYS' load shapes for water heating, cooking, and clothes drying.

<sup>2</sup> These include re-adding 22 MW of Riverside East and Palm Springs wind left out of the RPS supply curve, properly assigning the transmission zone for Mountain Pass / El Dorado solar PV, and other minor updates.

3. Lithium-ion battery costs were updated to [Lazard's Levelized Cost of Storage study v5.0](#).
4. Costs for pumped storage and flow battery remain unchanged.

Figure 1 illustrates the cost assumptions changes from the 2019 RSP level.

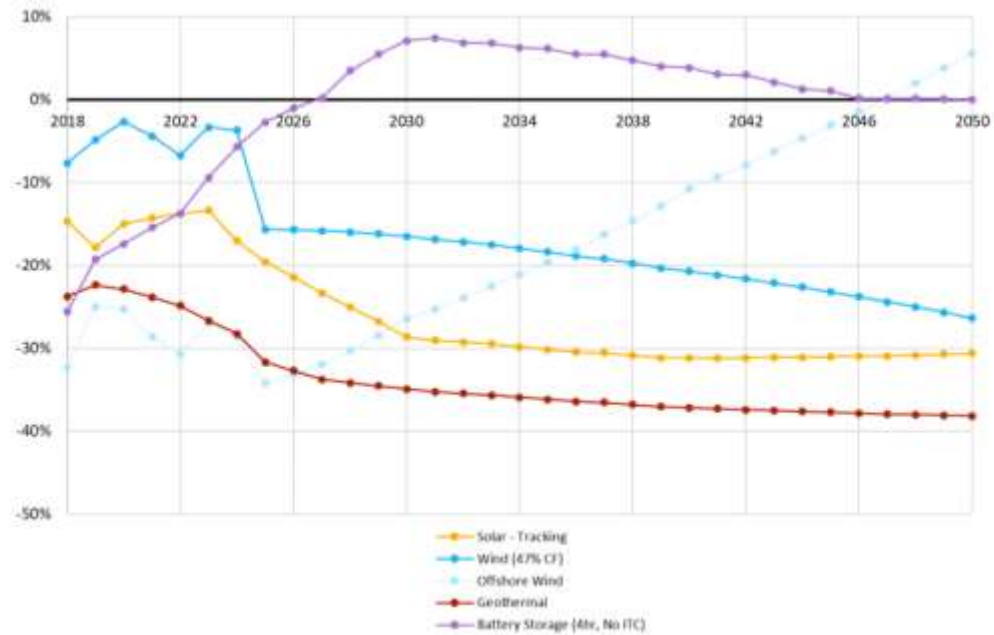


Figure 1 Total levelized fixed costs % changes from the 2019 RSP

### Candidate resource potential

1. The 2019 RSP capped out-of-state wind resource potential at 3 GW throughout the modeling horizon. The latest RESOLVE cases relaxed this cap in years after 2030.
2. Using update offshore wind cost and potential data developed from the NREL/BOEM study, the latest RESOLVE cases have included offshore wind as a candidate resource in all cases, assuming availability starting in 2030. In the 2019 RSP offshore wind was only considered a sensitivity resource.

### Gas and carbon prices

Gas and carbon prices were updated based on the June 2020 CEC IEPR forecast.

### Baseline resources

Baseline resources were updated to incorporate the recommendations from the GHG ground-truthing work, which was presented in the Dec 2020 MAG webinar

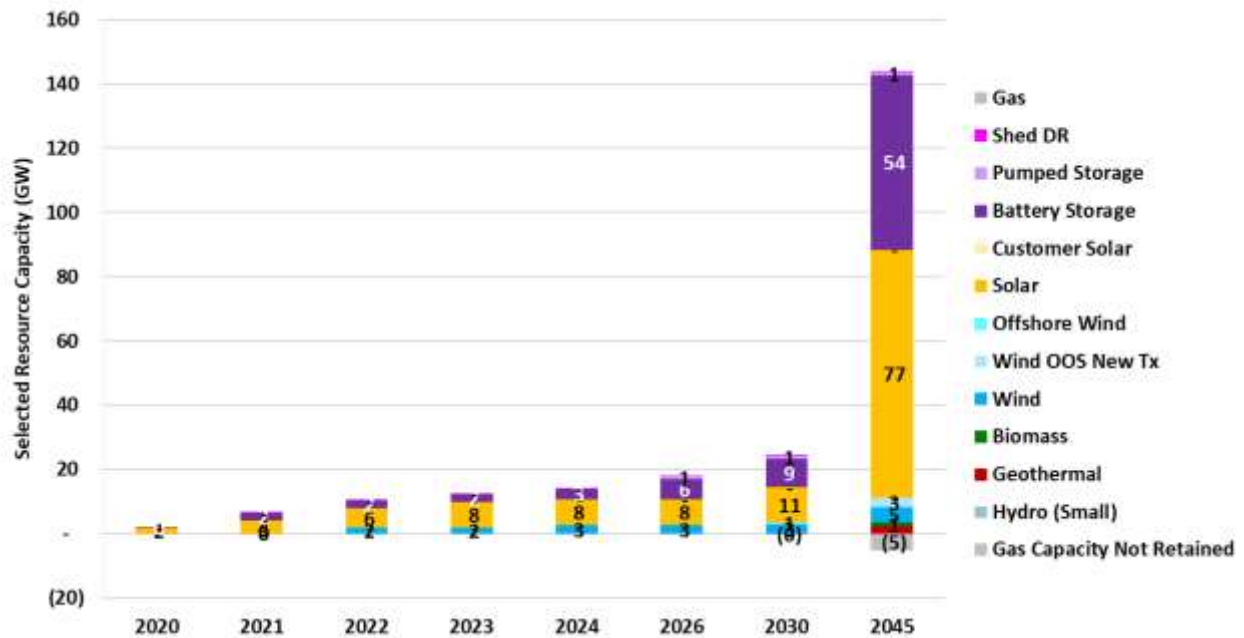
([ftp://ftp.cpuc.ca.gov/energy/modeling/IRP%20Model%20Improvement%20and%20GHG%20Groundtruthing\\_updated.pdf](ftp://ftp.cpuc.ca.gov/energy/modeling/IRP%20Model%20Improvement%20and%20GHG%20Groundtruthing_updated.pdf)). This updated resulted in -1.4 GW of solar, -0.3 GW of wind, and -0.3 GW of geothermal in the assumed baseline resources, as well as lower geothermal and biomass capacity factors.

## Base Case Results Changes

The new Base Case builds more renewable resources in 2030 largely due to the GHG ground-truthing baseline resource capacity and capacity factor adjustment, as well as the higher load level in the 2019 IEPR forecast.

In 2045, the new Base Case results in a more diversified resource mix due to the higher availability of out-of-state wind and the availability of offshore wind.

### 2019 RSP



New 46 MMT base case

