Draft Sources for 2019-20 IRP Demand Projections, Demand-Side Resources, and System Parameters

OVERVIEW

This document lists the categories and sources of the assumptions proposed for use in Integrated Resource Planning (IRP) capacity expansion modeling activities in 2019. This is a draft, high-level outline meant to provide transparency into Energy Division's IRP process. On March 27, 2018 CPUC staff released a similar document focused on supply-side resources and price forecasts titled, "Draft Data Sources for 2019-20 IRP Supply-Side Resource Modeling." This document covers remaining inputs and assumptions sources on topics including demand projections, demand-side resources, and system parameters. Below is a brief overview, followed by a draft of proposed data sources for 2019 assumptions, and finally, a set of questions seeking stakeholder input. Stakeholders have 3 weeks (15 business days) to submit informal comments to Energy Division in response to this document. The deadline for submittal is close of business on Tuesday, July 31th, 2018.

The informal written comment received in response to the questions outlined at the end of this document will be considered in the development of numerical updates to the:

- RESOLVE User Interface
- RESOLVE Inputs and Assumptions Document (To be formally introduced into the IRP proceeding via ruling in Fall 2018. Parties will be provided with the opportunity to provide formal feedback on the record.)

This document focuses on sources and assumptions for demand projections and the following demand-side resources:

- Behind-the-meter photovoltaic (BTM PV)
- Energy storage resources
- Demand response (DR)
- Energy efficiency (EE)
- Transportation, building, and other electrification
- Time-of-use (TOU) rates

This document also includes draft inputs and assumptions on:

- Operational constraints and parameters
    - Reserve and frequency response requirements
    - Minimum generation requirement

- Transmission
    - Transmission availability on existing system
    - Cost of transmission upgrades
    - Interregional transmission topology
    - CAISO simultaneous import & export limits

DRAFT SOURCES FOR 2019-20 IRP DEMAND-SIDE RESOURCES

1) Demand-Side Projections

Overview: Projections of future energy demands and demand-side resources in California (and the rest of the WECC) that will be treated as either fixed inputs or candidate demand-side resources, depending on the specific demand component. Generally, the most recent California Energy Commission (CEC) Integrated Energy Policy Report (IEPR) demand forecast and TEPPC Common Case (Anchor Data Set) are the base sources for demand forecast information. In most cases, the minimum required data includes annual projected peak value, annual projected energy value, and hourly shapes.

1.1. Baseline Consumption

- Forecast of annual peak demand and annual total energy consumption for each area in California, including non-CAISO areas, through at least 2030. Baseline consumption forecasts represent the total consumption of electricity by end users, prior to demand-side load modifiers such as energy efficiency and behind-the-meter PV.
    - **Data needs:**
        - Annual energy consumption (GWh)
        - Annual peak demand (MW)
    - **Primary sources:**
        - The most recent CEC IEPR Demand Forecast for in-state demand forecasts
        - The most recent TEPPC Common Case (or Anchor Data Set)[1] for out-of-state demand forecasts (Pacific Northwest and Southwest)
- Hourly profiles representing aggregate consumption of traditional end uses
    - **Data needs:**
        - Hourly profiles corresponding to multiple years of weather (MW)
    - **Primary sources:**
        - CAISO historical hourly load shape
        - Outside California: TEPPC Common Case (or Anchor Data Set)
    - **Additional sources:**
        - CPUC Energy Division Hourly Consumption Profiles representative of weather that occurred 1980-2014
        - CEC IEPR Demand Forecast hourly load shapes by large IOU

[1] For example: https://www.wecc.biz/SystemAdequacyPlanning/Pages/Datasets.aspx

1.2. Energy Efficiency

- EE as baseline resource:
    - Forecast of annual peak and energy savings associated with various levels of AAEE achievement, for the CAISO area and, if available, non-CAISO areas, through at least 2030.
        - **Data needs:**
            - Annual energy savings from EE (GWh)
            - Annual peak demand reduction from EE (MW)
            - Program incentive and administrative costs ($)
        - **Primary sources:**
            - CPUC Energy Efficiency 2019 Potential & Goals Study
            - Most recent CEC IEPR Demand Forecast
    - Hourly profiles of AAEE savings:
        - **Data needs:**
            - Hourly profiles of AAEE savings in each year for each level of potential achievement (MW)
        - **Primary sources:**
            - CEC IEPR Demand Forecast hourly AAEE shapes by large IOU
            - CEC's Translating Aggregate Energy Efficiency Savings Projections into Hourly System Impacts Report 1.1.3[2] or the most recent version of this document
- Candidate EE measures:
    - In the 2019 IRP, some energy efficiency measures may be modeled in RESOLVE as candidate resources. To avoid double counting, efficiency measures optimized by RESOLVE should be excluded from the AAEE data above. Note: the portfolio of EE measures available for RESOLVE optimization in the 2019 IRP has not been finalized. Incorporation into IRP is dependent upon completion in a timely manner.
        - **Data needs for each candidate EE measure:**
            - Annual investment limits (MWh)
            - Maximum cumulative energy efficiency that can be deployed in each year (MWh)
            - The cost of each measure ($/MWh)
            - Hourly demand reduction shapes
        - **Primary sources:**
            - CPUC Energy Efficiency 2019 Potential & Goals Study

1.3. Behind-the-Meter PV

- BTM PV Baseline:
    - Forecasts of customer adoption of behind-the-meter solar PV for California balancing areas and if available non-California areas, through at least 2030.
        - **Data needs:**

[2] http://docketpublic.energy.ca.gov/PublicDocuments/17-IEPR-03/TN222431_20180205T113507_Investor_Owned_Utilities_2017_Additional_Achievable_Energy_Effe.pdf)

            - Annual installed capacity (MW)
            - Annual average energy production (GWh)
            - Average technology configuration (e.g. tilt, azimuth, inverter loading ratio)
        - **Primary sources:**
            - CEC IEPR Demand Forecast Load Modifier Spreadsheet[3]
            - TEPPC Common Case (or Anchor Data Set)[4]
    - Hourly profile representing aggregate output of behind-the-meter PV solar installations
        - **Data needs:**
            - Hourly profile corresponding to multiple years of weather
        - **Primary source:**
            - NREL Solar Prospector[5] (hourly historical irradiance data used to simulate hourly profiles)
- Candidate BTM PV resource: BTM PV that is incremental to forecast capacity may be treated as a candidate resource in the RESOLVE model.
    - **Data needs:**
        - Annual resource potential (MW) for BTM PM, incremental to forecasted deployment.
        - Annual BTM PV capital cost ($/W) and financing assumptions.
    - **Primary sources**:
        - Resource potential: RPS Calculator Version 6.3
        - Capital cost: many of the demand-side solar PV cost sources also include costs for customer-sited systems:
            - Review of Capital Costs for Generation Technologies (E3 for WECC)
            - IRENA Renewable Power Generation Costs in 2017
            - Tracking the Sun (LBNL)
            - California Solar Initiative data

1.4. Energy Storage (Customer-side)

Customer-sited energy storage may be modeled in the 2019 IRP as either:

- Responding to wholesale price signals
- Maximizing customer bill reduction

Either of these could be represented in RESOLVE as either a baseline (forced in) resource via an adoption forecast or as a candidate resource. Representing a candidate storage resource that is dispatched to minimize customer bills would require additional RESOLVE development.

- Forecasts of customer adoption of behind-the-meter energy storage for the CAISO area and if available non-CAISO areas, through at least 2030.
    - **Data needs:**
        - Annual installed power capacity (MW)

[3] http://energy.ca.gov/2017_energypolicy/documents/#demand
[4] For example: https://www.wecc.biz/SystemAdequacyPlanning/Pages/Datasets.aspx
[5] NREL's Solar Prospector can be accessed here: https://maps.nrel.gov/solar-prospector/

        - Annual installed energy capacity (MWh)
    - **Primary source:**
        - The most recent CEC IEPR Demand Forecast
- Hourly profile representing the aggregate output of behind-the-meter energy storage installations that is dispatched to maximize customer bill reduction
    - **Data needs:**
        - Hourly charge and discharge profile corresponding to different grid conditions (month/hour/weekday/weekend, etc.) and/or electricity rates. Charge and discharge profiles would need to evolve with expected grid conditions between present day and the end year of IRP analysis (at least 2030).
    - **Primary source:**
        - 2016 SGIP Advanced Energy Storage Impact Evaluation (or subsequent update).[6] Profiles representing the aggregate charge and discharge profiles of BTM storage could potentially be developed for present-day storage dispatch, but additional information would be needed to project future profile shapes to 2030 and beyond.
- Operational Parameters– for customer storage dispatched in response to wholesale signals:
    - **Data needs:**
        - Assumed operational parameters for each technology option:
            - Round-trip losses (%)
            - Ability to contribute to reserve requirements (spin/frequency response/regulation/load following)
- Cost parameters – for candidate customer storage resources
    - **Data needs:**
        - Current cost, performance, and financing assumptions (used to develop forward-looking projections of levelized capacity cost, $/kW-yr):
            - Capital cost, $/kW (power block) and $/kWh (reservoir)
            - Fixed O&M, $/kW-yr
            - Financing inputs (cost of capital, capital structure, contract duration etc.)
            - Tax credits (PTC, ITC)
        - Assumed future cost reductions for battery technology (multiple levels of cost reduction will be examined)
        - Value provided to customer that is incremental to value streams already quantified in RESOLVE (example: customer value of back-up power), $/kW-yr
    - **Primary sources:**
        - Lazard's Levelized Cost of Storage 3.0 or later
        - Industry market research and literature review

1.5. Other On-Site Generation (Baseline)

- Forecast of production from non-PV on-site generation (e.g. CHP) for each year of planning horizon.
    - **Data needs:**

[6] www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442454964 and http://www.cpuc.ca.gov/General.aspx?id=7890

        - Yearly forecast of total annual generation from non-PV on-site resources (GWh) in CAISO.
        - Yearly forecast of total annual peak reduction from non-PV on-site resources (MW) in CAISO.
        - GHG emissions rate attributable to electric generation (tCO2/MWh)
    - **Primary source:**
        - CEC IEPR Demand Forecast Load Modifier Spreadsheet[7]

1.6. Electric Vehicles (Baseline)

- Forecast of demand associated with electric vehicles for each year of planning horizon. Multiple levels of EV adoption will be studied as sensitivities, including the quantity embedded in the current CEC demand forecast.
    - **Data needs:**
        - Annual forecast of energy consumption due to electric vehicle adoption (GWh)
    - **Primary source:**
        - The most recent CEC IEPR Demand Forecast
- Hourly profile of electric vehicle electricity demand. Multiple alternative profiles will be examined through sensitivity analysis, including (1) home charging only; (2) a combination of home & workplace charging; and (3) flexible charging.
    - **Data needs:**
        - Hourly profile for electric vehicle charging
    - **Primary sources:**
        - IEPR EV Shapes
        - Prior E3 analysis of EV charging patterns included in PATHWAYS studies[8]

1.7. Other Transportation Electrification (Baseline)

- Forecast of demand associated with electrification of other end-uses (e.g. ports, high-speed rail, airport ground equipment) for each year of planning horizon.
    - **Data needs:**
        - Annual forecast of energy consumption due to electrification of other end uses (GWh)
    - **Primary source:**
        - The most recent CEC IEPR Demand Forecast
- Hourly profiles associated with electrification of other end-uses to meet carbon goals.
    - **Data needs:**
        - Hourly profiles for electrification of other end-uses
    - **Assumptions:**
        - Assume same underlying load shape as the consumption load shape since no specific shape is available

[7] http://energy.ca.gov/2017_energypolicy/documents/#demand
[8] E3's simulation and analysis of charging patterns is described here: https://www.ethree.com/documents/California_PATHWAYS_Technical_Appendix_20150720.pdf

1.8. Building Electrification (Baseline)

- Forecast of demand associated with building electrification to meet carbon goals for each year of planning horizon.
    - **Data needs:**
        - Annual forecast of energy consumption due to building electrification (GWh)
    - **Data source:**
        - PATHWAYS studies[9]
- Hourly profiles associated with building electrification to meet carbon goals.
    - **Data needs:**
        - Hourly profiles for building electrification
    - **Primary source:**
        - Deep Decarbonization in a High Renewables Future: Updated Results from the California PATHWAYS model (CEC)[10]

1.9. Demand Response

- Baseline Demand Response:
    - Forecast of annual peak load impact of existing shed demand response programs, which will be treated as fixed inputs in the 2019 IRP
        - **Data needs:**
            - Annual forecast of peak demand impact of demand-response programs (MW).
            - Forecast monthly load impact for existing demand-response programs (MW), by utility/program.
            - Forecast of annual utility cost to continue existing DR programs ($), by utility/program
                - Program admin
                - Customer payments
                - Other costs
        - **Primary source:**
            - 2018 Demand Response Load Impact Reports for each utility:
                - PG&E[11]
                - SCE[12]
                - SDG&E[13]
        - **Supplemental sources**:
            - Demand Response Auction Mechanism data
            - All-inclusive bid procurement data
            - Publicly available reports and information regarding:
                - Electric vehicle storage acting as DR

[9] https://www.ethree.com/documents/California_PATHWAYS_Technical_Appendix_20150720.pdf
[10] https://www.ethree.com/projects/
[11] https://pgera.azurewebsites.net/Regulation/search (select "Demand Response OIR 2013" from the dropdown menu, select 04/01/16 and PG&E as the party)
[12] www.sce.com/applications (enter "R.13-09-011" in search box and click "GO")
[13] http://www.sdge.com/regulatory-filing/10486/oir-enhance-role-dr-meeting-state-resource-planning-ops-reqmt

    - Self-Generation Incentive Program storage acting as DR
- Candidate Demand Response potential
    - **Data needs:**
        - Cost, potential, and characteristics of candidate "shed" demand response programs, including:
            - Cost ($/kW-yr)
            - Potential (MW)
            - Operational constraints (#/frequency/duration of calls)
        - Cost, potential, and characteristics of candidate "shift" demand response programs, including:
            - Cost ($/kWh-yr)
            - Potential (MWh)
            - Operational constraints (daily and hourly availability)
        - Cost, potential, and characteristics of candidate "shimmy" demand response programs, including:
            - Cost ($/kW-yr)
            - Potential (MW)
            - Operational constraints (how it would participate and operate in ancillary service market)
    - **Primary sources:**
        - Latest version of California Demand Response Potential Study[14]
        - LBNL 2018 shift DR modeling updates

1.10. TOU Rates (Baseline/Load modifier)

- Hourly load impact profile
    - **Data needs:**
        - Annual forecast of peak demand impact (MW) of time-of-use (TOU) rates for residential and non-residential customers.
        - Hourly load impact of TOU rates. Hourly shapes may change from year-to-year.
    - **Primary sources:**
        - The most recent CEC IEPR Demand Forecast
    - **Additional sources:**
        - Christensen Associates Statewide Time-of-Use Scenario Modeling Study
        - Joint Agency (CPUC-CEC-CAISO) Staff Paper on Time-of-Use Load Impacts[15]
        - MRW Study on Potential Load Impacts of Residential Time of Use Rates in California[16]

1.11. Distribution Deferral Capacity and Cost

- A method for capturing distribution deferral capacity and costs in 2019 IRP modeling was presented by E3 in the 5/30/18 IRP MAG webinar.[17] A proposal for producing inputs for that

[14] http://www.cpuc.ca.gov/General.aspx?id=10622
[15] Available at: http://www.cpuc.ca.gov/General.aspx?id=6442451195 (under IRP Assumptions heading)
[16] Available at: http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442451338

method was presented by the Joint IOUs in the 6/29/18 MAG webinar[18]. These proposals could potentially be incorporated into 2019 IRP Reference System Plan development.

- **Data needs:**
  - Supply curve of deferrable distribution capacity projects (MW) and associated costs ($/MW-yr) for the CAISO footprint.
  - Quantity of DERs associated with each segment of the distribution deferral supply curve (MW for each supply curve segment)
  - Incurred distribution costs ($/MW-yr) and deployment threshold (MW) for any DER that may cause additional distribution costs to be incurred past the threshold.
- **Primary sources:**
  - Distribution Resources Plan analyses
    - Grid Needs Assessment (GNA)
    - Distribution Deferral Opportunity Report (DDOR)

2) System Parameters

Operational Constraints & Parameters

Overview: Additional assumptions needed to model the operations of the CAISO-controlled grid within the WECC power system.

2.1. Reserve Requirements

2.1.1. Load Following

- **Description:** Hourly load following reserve commitment target – large enough to handle range of variability and uncertainty in net load in multi-hour to 5-minute time frame**.**
- **Data needs:** Distributions of hourly load, wind, solar, and net load; distributions of historical forecast error; a method to use this data to calculate hourly targets.
- **Primary source:**
  - E3 analysis based on methods documented in NREL's Eastern Wind Integration Study and using forecast data developed by E3 and NREL
- **Additional source:**
  - Method described in most recent version of the RA/IRP Unified Inputs and Assumptions document[19]
  - Method in Sep 2016 PCM Requirements Ruling[20]

[17] http://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/ElectPowerProcurementGeneration/irp/2018/Consideration%20of%20Locational%20Value%20in%20IRP%205-30-18%20IRP%20MAG.pdf

[18] http://cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/ElectPowerProcurementGeneration/irp/2018/Joint%20IOU%20DER%20Avoided%20Distribution%20Costs.pdf

[19] For example: http://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/ElectPowerProcurementGeneration/irp/2018/1Unified_IA_main_draft_20180220.pdf

[20] Available at: http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442451199

2.1.2. Frequency Response

- **Description:** Operational constraint to ensure CAISO can meet its obligations under NERC BAL-003-1 standard.
- **Data needs:** CAISO's expected share of Western Interconnect frequency response in the future; assumptions on what resources will provide frequency response and how to implement in model; how much frequency response will CAISO procure from neighbors.
- **Primary sources:**
  - CAISO Frequency Response Initiative[21]
  - Method described in most recent version of the RA/IRP Unified Inputs and Assumptions document[22]
  - Method in Sep 2016 PCM Requirements Ruling[23]

2.1.3. Spin & Non-Spin

- **Description:** Operating reserves intended to handle large, sudden, unexpected generator or transmission outages (contingencies)**.**
- **Data needs:** Specification on what amount of spinning and non-spinning[24] reserves must be held in all hours during normal grid operation.
- **Primary source:**
  - Method described in most recent version of the RA/IRP Unified Inputs and Assumptions document[25]

2.2. Minimum Generation Requirement

2.2.1. CAISO Minimum Generation Needs

- **Description:** No constraint for the CAISO area – it is assumed the CAISO area frequency response constraint is a sufficient proxy for the reliability services represented by "minimum generation requirements" in the model.
- **Data needs:** See frequency response constraint above.
- **Primary source:** See frequency response constraint above.

2.2.2. Other Regions

- **Description:** A constraint that certain minimum amounts of generation with certain attributes are online at all times to provide certain reliability services that are not possible to explicitly model (e.g. inertia, local capacity, reactive power, voltage stability) – applied balancing areas within California. No constraint for areas outside CA. 2017 IRP modeling did not include minimum generation constraints for any modeled region.

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[21] Available at: https://www.caiso.com/Documents/DraftFinalProposal_FrequencyResponse.pdf

[22] For example: http://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/ElectPowerProcurementGeneration/irp/2018/1Unified_IA_main_draft_20180220.pdf

[2323] Available at: http://www.cpuc.ca.gov/WorkArea/DownloadAsset.aspx?id=6442451199

[24] Non-spinning reserves currently are not modeled in RESOLVE.

[25] For example: http://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/ElectPowerProcurementGeneration/irp/2018/1Unified_IA_main_draft_20180220.pdf

- **Data needs:** None, unless there is desire to improve the crude modeling proxy intended to represent provision of these reliability services.
- **Primary sources: N/A**

Transmission

Overview: Representation of the availability of the transmission system to facilitate renewable development and power system operations.

2.3. Transmission Availability on Existing System

- **Description:** Available capacity on existing transmission infrastructure for new renewable development.
- **Data needs:**
  - Available capacity (MW) in each CREZ/WREZ for new Full Capacity Deliverability Status (FCDS) resources
  - Available capacity (MW) in each CREZ/WREZ for new Energy Only (EO) resources
- **Primary source:**
  - The most recent available CAISO Transmission Plan[26]

2.4. Cost of Transmission Upgrades

- **Description:** Cost of upgrades to existing transmission infrastructure for new renewable development associated with each CREZ for renewables
- **Data needs:**
  - Costs ($) and capacity (MW) of "minor" and "major" upgrades for each CREZ/WREZ
  - Costs ($) and capacity (MW) of "conceptual" new transmission projects for each CREZ/WREZ
- **Primary source:**
  - The most recent available CAISO Transmission Plan (minor/major upgrades)[27]
- **Additional source:**
  - RETI 2.0 Western Outreach Project Report[28]

2.5. Interregional Transmission Topology

- **Description:** Simplified zonal transmission topology needed for operational modeling of WECC.
- **Data needs:**
  - Transmission capacity (MW) between each "zone" represented in the operational module of the RESOLVE capacity expansion model.
- **Primary source:**
  - CAISO LTPP PLEXOS model zonal topology

[26] Available at: https://www.caiso.com/Documents/Board-Approved2015-2016TransmissionPlan.pdf
[27] Available at: https://www.caiso.com/Documents/Board-Approved2015-2016TransmissionPlan.pdf
[28] Available at: http://docketpublic.energy.ca.gov/PublicDocuments/15-RETI-02/TN214121_20161021T082642_RETI_20_Western_Outreach_Project_Report.pdf

2.6. CAISO Simultaneous Import & Export Limits

- **Description:** A max constraint on imports & exports for each line or group of lines connecting CAISO zones to external zones in the model. Since the level of future exports from CAISO is both uncertain and significant in its impact on renewable integration, multiple levels of export constraints will be examined.
- **Data needs:** A list of physical and institutional transfer limits between balancing areas (including any dedicated imports).
- **Primary sources:**
    - CAISO's SB350 regionalization study RESOLVE model[29]
    - Method described in most recent version of the RA/IRP Unified Inputs and Assumptions document[30]
    - CAISO LTPP PLEXOS model zonal topology

QUESTIONS FOR STAKEHOLDERS

CPUC staff is seeking stakeholder input to the questions included below. Question headers correspond to the sections found on pages 2-12 of this document. Please respond to questions in the order they are presented. As a reminder, all data sources proposed in stakeholder comments should meet the below listed criteria.

Data Source Criteria

Data sources should meet these criteria:

- Publicly available
- Technically credible
- Cost data reflects future costs
- Cost data can be used to develop all-in technology costs
- Resource potential data is geographically specific at level of transmission zones used in RESOLVE

In addition, data sources to update or create new candidate resources should meet these criteria:

- Resource must have plausible trajectory to commercial availability by 2030.
- Magnitude of potential impact on future portfolio costs and composition must be sufficient to justify changes to model functionality and run-time

[29] Available at: https://www.caiso.com/Pages/documentsbygroup.aspx?GroupID=4C17574F-73AE-40E3-942C-59C3A13BBDF1

[30] For example: http://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/ElectPowerProcurementGeneration/irp/2018/1Unified_IA_main_draft_20180220.pdf

Questions

Demand-Side Projection

1.2. Energy Efficiency

Question 1: Does the method presented by E3 and Navigant in the 4/27/18 IRP MAG[31] present a viable means for optimizing EE resources in IRP modeling? Why or why not?

Question 2: What are the advantages or disadvantages of using inputs directly from the 2019 EE Potential and Goals process for baseline EE modeled in 2019 IRP?

1.3. Behind-the-meter PV

Question 3: Are there other data sources that should be considered for baseline and candidate BTM PV?

1.4. Energy Storage (Customer-side)

Question 4: What data sources should be considered to forecast BTM energy storage adoption?

Question 5: What assumptions should be made about how BTM energy storage responds to price signals, either wholesale or utility rates? What data sources should be considered for developing BTM energy storage charge and discharge shapes? Will the price signals and resulting dispatch accurately capture the potential future value of BTM storage? If candidate BTM energy storage is modeled as responding to rates, what assumptions regarding future rate structures would need to be made?

Question 6: Do parties have suggestions on how to represent hybrid resources (e.g. storage and solar) in RESOLVE? Can this be modeled by reducing the capital cost of the storage resource and paired resource to account for costs savings from co-locating facilities and Investment Tax Credit (ITC) savings? If so, what data should the CPUC rely on to accurately capture cost reductions? How can the CPUC accurately estimate any reduction in savings caused by any operational constraints placed on hybrid resources by ITC rules or shared infrastructure?

1.6. Electric Vehicles

Question 7: In addition to the CEC IEPR Demand Forecast, what other public data sources should be considered for representing EV adoption forecasts in IRP? What sources best represent the Governor's goal of 5 million zero-emission vehicles on the road in California by 2030?

Question 8: What data sources should be considered in developing EV charging shapes for IRP?

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31 http://www.cpuc.ca.gov/uploadedFiles/CPUCWebsite/Content/UtilitiesIndustries/Energy/EnergyPrograms/ElectPowerProcurementGeneration/irp/2018/Slides%20for%20MAG%20Meeting%202018-04-27%20v2.pdf

Question 9: Are there any other data sources to consider that could inform the assessment of the potential value of smart charging in IRP?

1.9. Demand Response

Question 10: Are there other data sources that should be considered for baseline and candidate DR?

Question 11: Are there other methods that should be considered for modeling candidate DR? What would be the advantages or disadvantages of these proposed approaches?

1.11. Distribution Deferral Capacity and Cost

Question 12: Could different methods, aside from the E3 proposal, be used for incorporating distribution-level impacts into IRP modeling?

Question 13: Are there other data sources that should be considered for estimates of avoided distribution costs and quantities, beyond the DRP-based analysis proposed by the IOUs in the June MAG?

Question 14: Are there different methods that can be used to apply data generated by DRP-based tools in IRP, aside from the methods proposed by the IOUs in the June MAG?

Miscellaneous Question

Question 15: Should staff represent electric loads associated with hydrogen production in IRP modeling, and if so, how? What data sources should be considered?

Question 16: Should staff represent transmission avoided cost in IRP modeling? If so, how? Please provide a specific approach for deriving the costs and quantities and include suggested data sources for each.

General Questions

Question 17: Are there any additional data sources (not described in your responses to Questions 1 – 16) that should be considered to meet the data needs described in this document. Please describe and provide a link for any suggested data sources. Explain how the data source meets the data source criteria listed above.

Question 18: Are there any additional comments that you would like to share with Energy Division staff?