Transmission Capability Estimates as an input to the CPUC Integrated Resource Plan (IRP) Portfolio Development

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May 28, 2019

Background

- The ISO periodically provides to the CPUC, the transmission capability estimates for major renewable zones for the specific purpose of providing input into portfolio development as part of the CPUC's IRP process
- In an effort to provide more information to the stakeholders, the ISO published a white paper[1] dated May 20, 2019 to describe
  - The components and interpretation of transmission capability estimation
  - Sources of information used for estimating transmission capability; and
  - Steps involved in estimation of transmission capability and conceptual upgrade information

[1] http://www.caiso.com/Documents/WhitePaper-TransmissionCapabilityEstimates-InputtoCPUCIntegratedResourcePlanPortfolioDevelopment.pdf

Agenda

1. Context

2. Components and interpretation of transmission capability estimation

3. Sources of information used in transmission capability estimation

4. Steps involved in transmission capability estimation for the purpose of IRP portfolio development

1. Context

Background: Renewable portfolio development and the ISO transmission planning process (TPP)

- In accordance with the May 2010 memorandum of understanding between the ISO and the California Public Utilities Commission (CPUC), and in coordination with the California Energy Commission (CEC), the CPUC develops the resource portfolios to be used by the ISO in its annual transmission planning process (TPP).

- The ISO utilizes the portfolios transmitted by the CPUC in performing reliability, policy and economic assessments in the TPP, with a particular emphasis on identifying policy-driven transmission needs necessary to accommodate renewable generation.

Background: Transmission capability as an input into portfolio development

- The CPUC currently maintains and utilizes the RESOLVE tool for portfolio development
- RESOLVE co-optimizes investment and dispatch for identifying least-cost resource portfolios
- RESOLVE assumes a set of baseline resources and selects candidate resources in several renewable zones
- Transmission capability estimates are one the factors that affect resource amounts selected in specific renewable zones

Background: Transmission capability estimation is an iterative framework

- The ISO periodically provides the transmission capability estimates to the CPUC

- The resulting renewable portfolios are studied in TPP; the ISO relies on policy-driven assessments to identify policy-driven upgrades (Category 1 and 2) as well as to test and refine the transmission capability estimates

- Transmission capability estimates are – as the name suggests – estimates

2. Components and interpretation of transmission capability estimation

Components and interpretation of transmission capability estimates

- Amount of new resources that can be accommodated on the transmission system emanating from certain transmission renewable generation pockets of interest

- Four components
  A. Capability of the existing and approved transmission to accommodate full capacity deliverability status (FCDS) resources,
  B. Incremental FCDS capability amounts provided by previously identified conceptual upgrades,
  C. Cost estimates for the previously identified conceptual upgrades, and,
  D. Capability of the existing and approved transmission to accommodate energy only deliverability status (EODS) resources.

Components and interpretation of transmission capability estimates

Capability of the existing and approved transmission to accommodate FCDS resources

Incremental FCDS capability amounts provided by previously identified conceptual upgrades

Cost estimates for the conceptual upgrades

Capability of the existing and approved transmission to accommodate EODS resources

Transmission capability estimates to support CPUC's IRP process

Transmission zones and sub-zones	Estimated FCDS Capability (MW)				Incremental Upgrade Cost Estimate ($million)				Estimated EODS Capability** (MW)
	A: Existing System	B: Minor Upgrades	B: Major Upgrade #1	B: Major Upgrade #2	C: Existing System	C: Minor Upgrades	C: Major Upgrade #1	C: Major Upgrade #2	D: Existing System
Northern CA	**2,000**		**2,000**				**$ 285**		**3,900**
- Round mountain	500								2,100
- Humboldt	-								100
- Sacramento River	2,000								4,600
- Solano	600		2,000				$ 322		1,300
Southern PG&E	**1,100**		**1,000**				**$ 55**		**TBD**
- Westlands	1,100		1,000				$ 55		TBD
- Kern and Greater Carrizo	1,000		1,500				$ 241		TBD
- Carrizo	400		700				$ 53		400
- Central Valley North & Los Banos	1,000		1,000				$ 274		TBD
Tehachapi	**4,300**	**1,000**				**$ 100**			**5,100**
Greater Kramer (North of Lugo)	600		400				**$ 146**		**600**
- North of Victor	300		400				$ 485		300
- Inyokern and North of Kramer	100		400				$ 485		100
- Pisgah	400		400				$ 261		400
Southern CA Desert and Southern NV	**3,000**		**2,800**				**$ 2,156**		**9,600**
- Eldorado/Mtn Pass (230 kV)	250		1,400				$ 76		2,400
- Southern NV (GLW-VEA)	700		1,400				$ 150		700
- Greater Imperial*	1,200		1,400				$ 2,334		3,100
- Riverside East & Palm Springs	2,950		1,500				$ 2,156		5,500

* Subject to mitigation of the S-line constraint.

** Estimate EODS capability numbers are inclusive of the FCDS estimates. So the incremental EODS capability = Estimated EODS capability - Estimated FCDS capability

NOTE:
(i) The transmission areas indented in the table are subsets of the overarching transmission areas listed immediately above the indented areas.
(ii) The transmission capability estimates rely on the latest generation interconnection studies as one of the inputs. Estimated available transmission has been reduced by the amount of renewable resources that have come online by December 31, 2018 assuming that all these resources have a contract with an entity within CAISO BA.
(ii) The estimated capability added due to major upgrades and corresponding costs are ballpark numbers and are conceptual in nature.

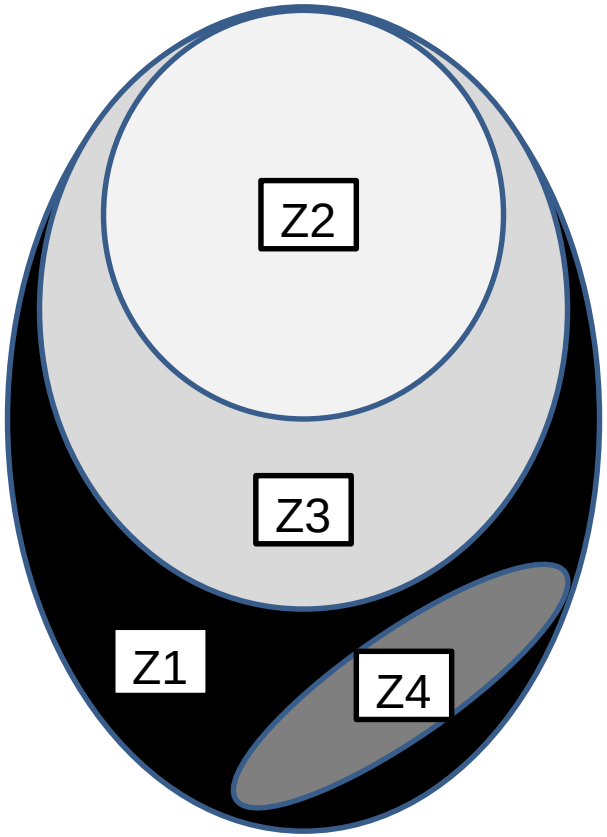
Several overarching zones and nested sub-zones create challenges for transmission capability estimation

- A single new resources is often found to adversely impact multiple transmission constraints

- A resource selected in a sub-zone Z2 will adversely impact three transmission constraints
  1. A constraint limiting sub-zone Z2
  2. A constraint limiting sub-zone Z3
  3. A constraint limiting the overarching zone Z1

- Sub-zone Z4 does not overlap with Z2 and Z3, but the total of Z2 + Z3 + Z4 cannot exceed the limitation placed on Z1

Transmission zone with nested limitations



3. Sources of information used in transmission capability estimation

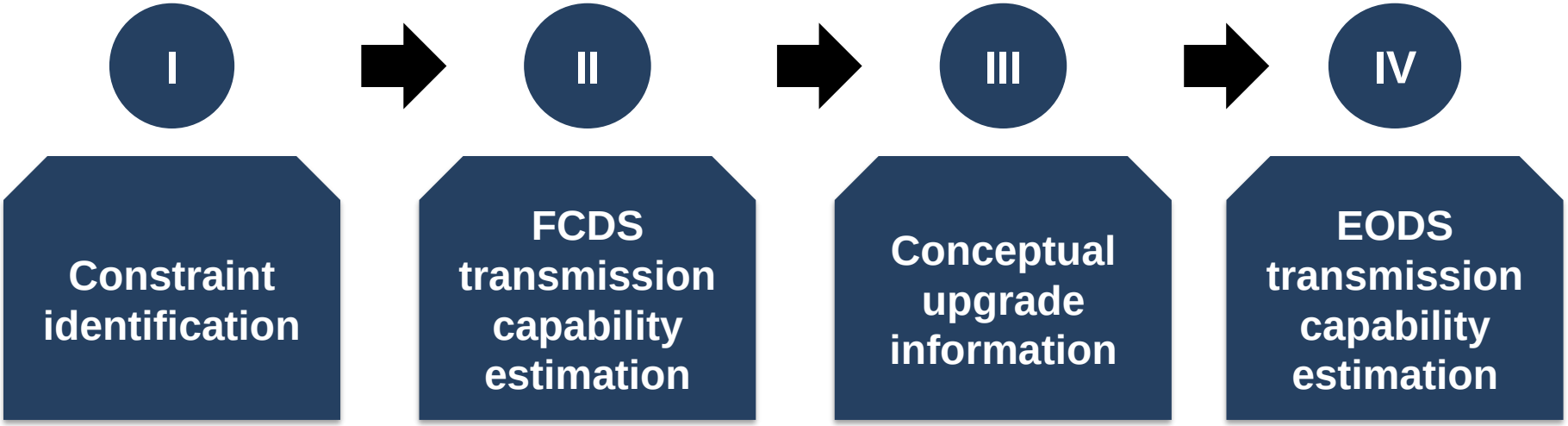
The primary source is generation interconnection studies; TPP studies is the supplementary source

1. Current and past GIDAP studies (primary source of information)
   - Lends itself particularly well to the transmission capability estimation effort
   - Amount of active generation in ISO's generation interconnection queue far exceeds the total generation resources that are typically selected as part of the portfolios
   - GIDAP assessments expose transmission constraints which typically would not be identified in the TPP assessments of generation amounts in the portfolios

2. Current and past TPP studies
   - ISO assesses the transmission impacts of renewable portfolios transmitted by the CPUC
   - Insights about the reliability impact of the portfolios on the transmission system, deliverability constraints that would limit portfolio resource deliverability and renewable curtailment observed in the production cost simulations
   - Act as a supplementary source of information for transmission capability estimation

4. Steps involved in transmission capability estimation for the purpose of IRP portfolio development

Steps involved in transmission capability estimation



I. Constraint identification for estimation of existing available transmission capability in a renewable zone

- A recent appropriate GIDAP cluster study is referenced to identify the limiting constraints affecting a particular renewable zone

- The focus is on area-wide transmission limitations, so typically the constraints are area deliverability constraints

II. FCDS transmission capability estimation

- The ISO relies on transmission plan deliverability (TPD) calculations performed for the constraints identified in step 1
- The TPD number calculated in GIDAP studies needs to be adjusted for the purpose of transmission capability estimation
- The adjustment is required because the TPD calculation assumes that any resource that was not online as of the date of transmittal of the latest official base portfolio by the CPUC to the ISO is a future resource
- Thus, the TPD number is usually bigger than the currently available transmission capability because several resources assumed to be future resources in the last official RPS portfolio are now on-line and have utilized some portion of the available TPD

III. Conceptual upgrade information

- Allows the RESOLVE model to consider the trade-off between selecting only resources that fit within the existing transmission capability estimates or selecting resources beyond the existing transmission capability estimates and incurring the cost of additional transmission

- Estimates for this component include
  - The amount of incremental transmission capability that could be added by building a transmission upgrade; and
  - The cost of this conceptual transmission upgrade

IV. EODS transmission capability estimation

- Accomplished by using the FCDS transmission capability estimate as a starting point; additional EODS resources can be accommodated as long as EODS resources only displace other generation and imports within the study area

- Gas generation in the study area and imports into the study area are assumed to have a significant marginal cost while renewable resources identified in the portfolios are assumed to be zero marginal cost resources

- The approach relies on generalized assumptions for rough estimation purposes and does not specifically take into account operational considerations

Considerations for future work

- Timing and frequency of updates

- Support the CPUC and CEC staff on accounting for nested transmission limitations
  - Help incorporate nested limitations in RESOLVE or
  - Support the CEC staff to account for nested limitations while mapping the portfolio generic resources

Appendix A: Geographical representation of nested transmission capability estimates

Confidential – Subject to Transmission Planning NDA
Document Available on ISO Market Participant Portal

Northern CA transmission capability estimates

- Diagram contains CEII and has been redacted

Southern PG&E transmission capability estimates

- Diagram contains CEII and has been redacted

Greater Kramer transmission capability estimates

- Diagram contains CEII and has been redacted

Southern CA desert and Southern NV transmission capability estimates

- Diagram contains CEII and has been redacted

Comments requested

- Please submit comments to regionaltransmission@caiso.com
- Stakeholder comments are to be submitted within two weeks after stakeholder meetings: **by June 11, 2019**