March 3, 2016

Imperial Irrigation District (IID) appreciates the opportunity to comment on the California Independent System Operator (CAISO) presentation during its 2/18/16 Stakeholder meeting discussing the 2015-2016 Transmission Plan results and recommendations. IID's comments are focused on the material related to IID Maximum Import Capability (MIC) and on the 50% Renewable Energy Special Study.

1. CAISO, in its 2013-2014 Transmission Plan page 143 made the following statement regarding IID Maximum Import Capability (MIC), "The ISO has established in accordance with Reliability Requirements BPM section 5.1.3.5 the target maximum import capability (MIC) from the Imperial Irrigation District (IID) to be 1,400 MW in year 2020 to accommodate renewable resources development in this area." Further down on the same page CAISO explains the decrease in IID MIC primarily due to early retirement of SONGS but makes the following commitment, "However, the ISO is planning to identify further upgrades, as part of the 2014-2015 transmission planning process that would be required to achieve the original 1,400 MW MIC target for IID."

   It has been two years since the CAISO's original commitment to restore IID MIC. IID would like to know what efforts CAISO has done or plans to do to meet its commitment?

2. Switching back to the current CAISO 2015-2016 Transmission Plan, CAISO states on page 280, "Since all the constraints observed in Imperial zone can be mitigated by using SPS, the 2015-2016 policy-driven analysis confirms that the mitigation measures recommended in 2014-2016 TP have restored Imperial zone deliverability to ~1,700 to 1,800 MW." If Imperial Zone deliverability have been "restored" then IID MIC should be back to its original value of 1400 MW in 2020. This Transmission Plan, on page 168 last paragraph, assigns IID MIC of 702 MW in 2020. How do you explain this discrepancy?

3. The deliverability numbers of 1700 to 1800 MW in Imperial Zone in the above paragraph are questionable. Imperial zone consists of 98% IID system and only 2% CAISO system. How much of this 1700-1800 MW were modeled in (or determined from) IID system?

4. IID's internal studies have indicated that Imperial CREZ can actually accommodate up to about 2800 MW depending upon where generation is located while respecting the ECO-Miguel constrained path and Path 42 limits. Did CAISO consider the Locational Effectiveness Factor (LEF) for the generators while determining the 1700-1800 MW limit?

5. If CAISO would like to explore the LEF further, IID is recommending that CAISO take a lead and include other interested PTOs and / or Stakeholders including IID to identify

the most promising locations for new renewables in the Imperial CREZ.

6. A discussion paper focusing on the use of Locational based methods to assess Deliverability, prepared by ZGlobal on behalf of IID, is attached for reference.

7. On Page 208 of the Draft Transmission Plan, Table 3.4-3, the Greater Imperial Zone is estimated to have 2633 MW of Renewable resources (in-state portion). How much of this 2633 MW is considered or modeled within the IID service territory? Since IID service territory represents majority of the Imperial Zone, is it reasonable to include IID while modeling renewable resources within Imperial Zone?

An Analysis to Support Use of Locational Based Methods to Assess Deliverability from the Imperial Valley

ZGlobal performed power flow and cost impact analysis to assess the locational effectiveness of generator interconnections in the Imperial Valley area. The objective of this analysis is to quantify the impact that location has when determining the "deliverability" of capacity from various locations in the Imperial Valley area. "Deliverability" in this context refers to a resource's ability to provide resource adequacy capacity to aggregate load located in the CAISO Balancing Authority Area (BAA).

This paper will,

- Provide background information on CAISO's current deliverability assessment methodology and discuss its potential inefficiencies,
- Describe power flow analysis performed to quantify the impact of using a locational-based methodology to assess deliverability from the Imperial Valley area, and
- Provide data to quantify potential cost impact of existing CAISO method vs. locational-based methods.

Background: CAISO Deliverability Assessments

Figure 1. Imperial Valley Area

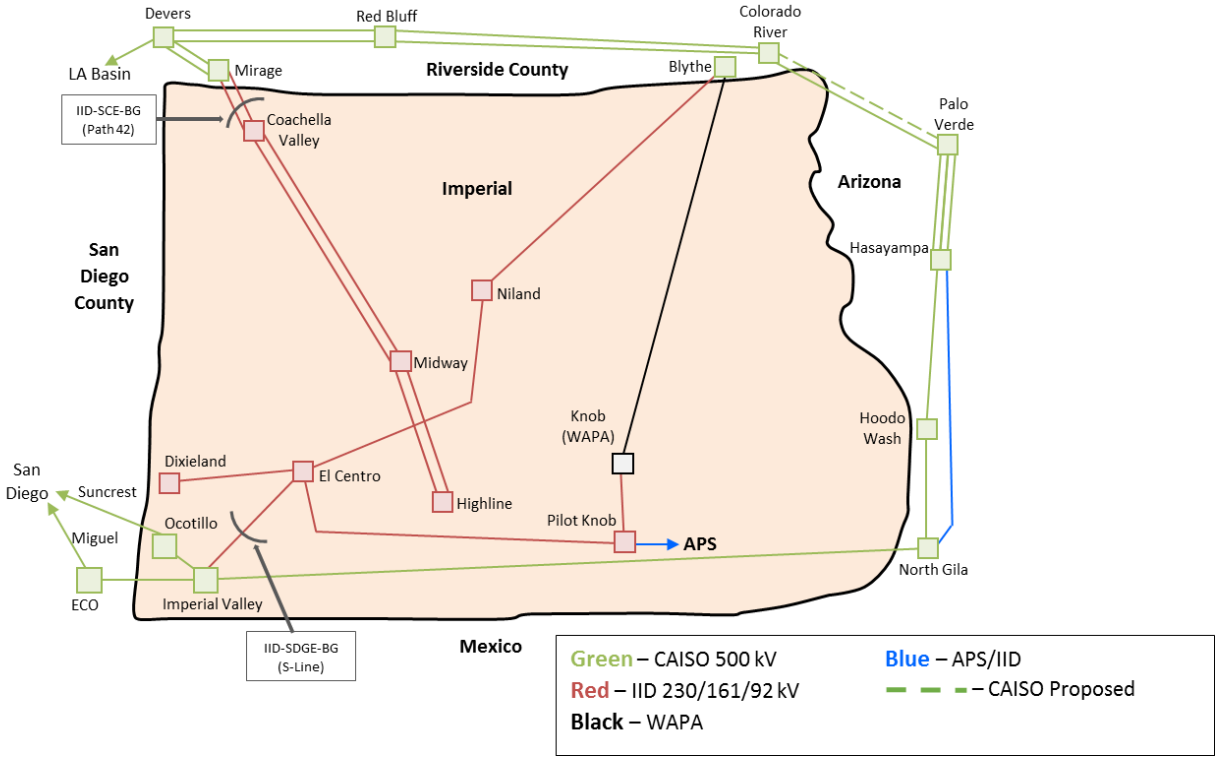

Figure 1 is a rough geographic representation of the Imperial Valley area along with the major transmission lines and corridors that would be expected to limit the deliverability of potential generation to the CAISO BAA. As shown in the diagram, Imperial Valley generation can interconnect to either CAISO'S or Imperial Irrigation District's (IID) transmission system. The major substations for CAISO include Imperial Valley and Ocotillo, while the major substations in IID include Coachella Valley, El Centro, Dixieland, Midway and Highline.

In CAISO's process, deliverability assessments are performed annually and consider various factors such as changes to the system, new generation interconnection requests, and renewable energy procurement targets to meet mandated state policy objectives. As stated in their "On-Peak Deliverability Assessment Methodology," the objective for the assessment is,

> *"…to determine if the aggregate of generation output in a given area can be simultaneously transferred to the remainder of ISO Control Area. Any generators requesting Full Capacity Deliverability Status in their interconnection request to the ISO Controlled Grid will be analyzed for "deliverability" in order to identify the Delivery Network Upgrades necessary to obtain this status.*
>
> *The ISO deliverability test methodology is designed to ensure that facility enhancements and cost responsibilities can be identified in a fair and nondiscriminatory manner.[1]"*

Moreover, in the CAISO methodology, resources external to its BAA have an additional limiting constraint placed on total imported energy by use of a Maximum Import Capability (MIC) target limit[2]. The use of the MIC methodology fundamentally relies on historical import flows and CAISO-determined target import limits rather than assessing import capability strictly based on the physics and locational aspects of the interconnected transmission system. As a result, deliverability for resources imported to CAISO from outside BAAs may be unnecessarily restricted. CAISO's study methodology has particularly impacted the deliverability results of Imperial Valley area generating resources which have interconnections on both the CAISO's and the Imperial Irrigation District's (IID) transmission. Recent deliverability assessments have resulted in zero (0) incremental capacity available for generators interconnecting to IID's transmission, whereas generation from resources interconnecting to CAISO grid were deemed deliverable.[3]

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[1] http://www.caiso.com/Documents/On-PeakDeliverabilityAssessmentMethodology.pdf

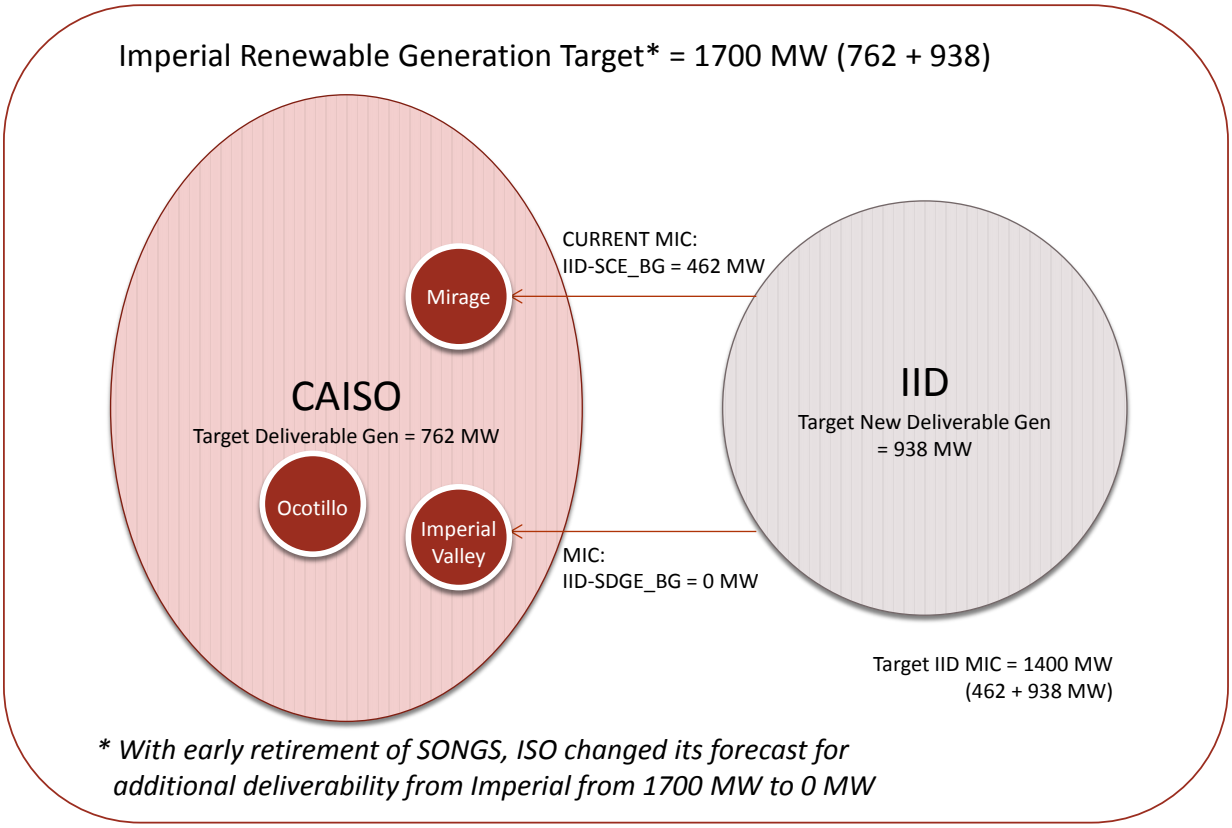
[2] Section 6.1.3.5, Deliverability of Imports, BPM for Reliability Requirements Version 28, https://bpmcm.caiso.com/BPM%20Document%20Library/Reliability%20Requirements/BPM_for_Reliability_Requirements_V28_clean.docx.

[3] Section 3.2.3 Resource adequacy import capability, Board Approved 2014-2015 Transmission Plan dated March 27, 2015, p. 150, http://www.caiso.com/Documents/Board-Approved2014-2015TransmissionPlan.pdf

The following explanations from CAISO illustrate their findings from their 2012-2013, 2013-2014 and 2014-2015 Transmission Planning process for deliverability from Imperial Valley[4]:

- CAISO 2012-2013 Deliverability Assessment found that 1700 MW of new renewable generation is deliverable from the Imperial Area assuming 938 MW from IID and 762 MW from CAISO. With the existing Maximum Import Capability from IID to CAISO on the IID-SCE_BG being 462 MW, this resulted in a target MIC of 1400 MW from IID. However, with the subsequent announcement of SONGS generation retirement, CAISO determined that the 1700 MW deliverability needed to be reduced to 0 MW (Figure 2).

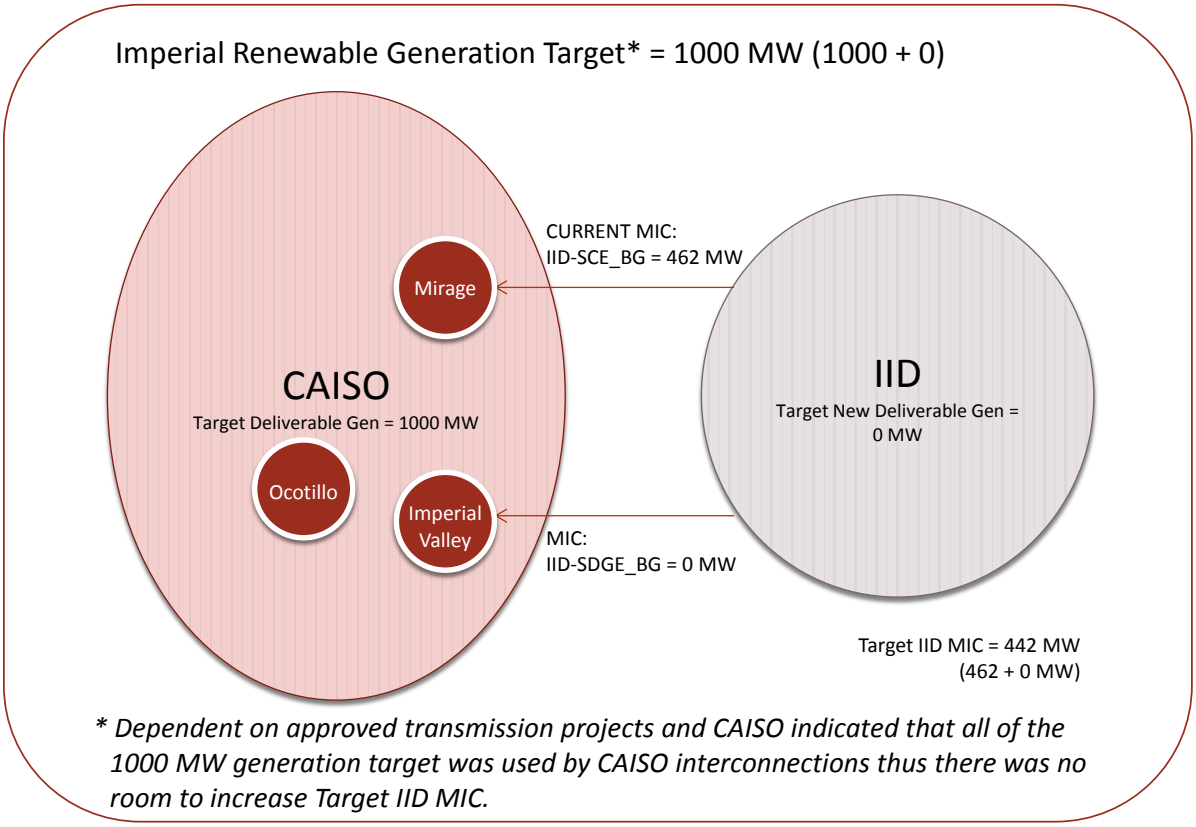
Figure 2. 2012-2013 Deliverability Assessment



- CAISO 2013-2014 Deliverability Assessment found that with approved transmission projects the Imperial Area renewable portfolio of 1000 MW was achievable. Based on current project status at the time of the studies, they noted that the 1000 MW deliverability was already used by projects interconnecting to the CAISO. Thus, there is no additional deliverability allocation for IID connected projects. Therefore, the CAISO did not increase MIC from the 462 MW level. (Figure 3)

[4] Technical Addendum to the July 2, 2014 Imperial County Transmission Consultation Draft Discussion Paper dated July 30, 2014, http://www.caiso.com/Documents/TechnicalAddendum-ImperialCountyDeliverability.pdf. Also, Section 3.2.3 of 2014-2015 Transmission Plan, dated March 27, 2015.

Figure 3. 2013-2014 Deliverability Assessment



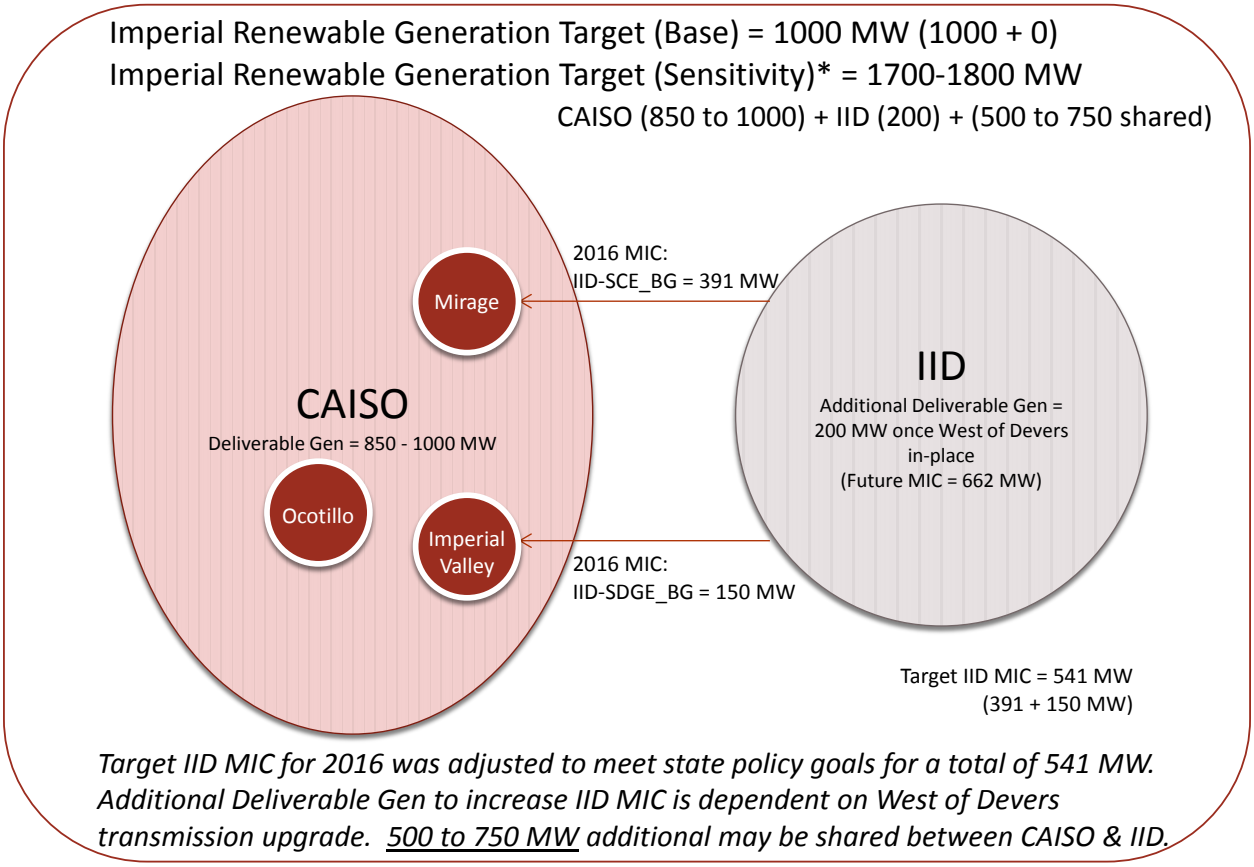
** Dependent on approved transmission projects and CAISO indicated that all of the 1000 MW generation target was used by CAISO interconnections thus there was no room to increase Target IID MIC.*

- In CAISO's 2014-2015 Deliverability Assessment, CAISO ran analysis for a 1000 MW deliverability target for Imperial Valley as a base portfolio as well a sensitivity case for a 2500 MW target. They determined that with the approved transmission project upgrades and recommended mitigations, the Imperial Valley deliverability could be restored to the pre-SONGS retirement levels (i.e. – 1700 – 1800 MW). However, they also noted that "potential additional renewable generation development in the Imperial area may exceed remaining forecast deliverability given the projects that are already in the ISO and IID interconnection processes." More importantly they concluded "the ISO will maintain the current 462 MW level of MIC from IID until West of Devers upgrades are in place; at that time MIC will be increased by 200 MW in order to reflect generation connecting to IID that have CPUC-approved PPAs with utilities in the ISO grid that include resource adequacy capacity." Additionally, assuming the potential for 1700 – 1800 MW deliverability from Imperial Valley, they stated that about 850 – 1000 MW is connected to ISO grid; thus, from a practical perspective only around 500 to 750 MW of additional generation may be accommodated and this deliverability "may be shared between new resources not already under PPA contract in the Imperial Zone (connected to either ISO or IID)."[5] Despite

[5] Table of Advisory Estimates for Future Resource Adequacy Import Capability Years 2015-2024, CAISO, http://www.caiso.com/Documents/AdvisoryEstimates-FutureResourceAdequacyImportCapability_Years2015-2024.pdf

noting that 500 to 750 MW of additional generation may be accommodated between CAISO and IID, the MIC for future years beyond 2016 only accounted for an additional 200 MW. (Figure 4)

Figure 4. 2014-2015 Deliverability Assessment



CAISO's explanation of its last 3 years of deliverability assessments highlights that the methodology does not align deliverability allocation between CAISO and IID interconnections based on the actual physical constraints of the two interconnected systems.

Impact of Using a Locational-based Methodology for Assessments

As stated earlier, the objective of CAISO deliverability assessments is to determine if new generation will be able to provide its resource adequacy capacity to load located in the CAISO BAA. Scenarios or base cases are developed to represent peak loading conditions and generation is dispatched per the criteria described in the methodology's Table 1, shown below:

Table 1: Resource Dispatch Assumptions (CAISO Deliverability Assessments)

Resource Type	Base Case Dispatch	Available to Selectively Increase Output for Worst-Case Dispatch?	Available to Scale Down Output Proportionally with all Control Area Capacity Resources?
Existing Capacity Resources (Note 1)	80% to 95% of Summer Peak Net Qualified Capacity (NQC)	Y Up to 100% of NQC	Y
Proposed Full Capacity Resources (Note 2)	80% to 95% of Summer Peak Qualified Capacity (QC)	Y Up to 100% of QC	N
Energy-Only Resources	Minimum commitment and dispatch to balance load and maintain expected imports	N	Y
Imports (Note 3)	Maximum summer peak simultaneous historical net imports by branch group		
Load			
• Non-pump load.	1 in 5 simultaneous peak load level for CAISO	N	N
• Pump load	Within expected range for Summer peak load hours (Note 4).	N	N

Refer to CAISO's *ISO Generator Deliverability Assessment Methodology On-Peak Deliverability Assessment Methodology for Resource Adequacy Purposes, Updated 4-10-2009* for an explanation of Note 1 through 4.[6]

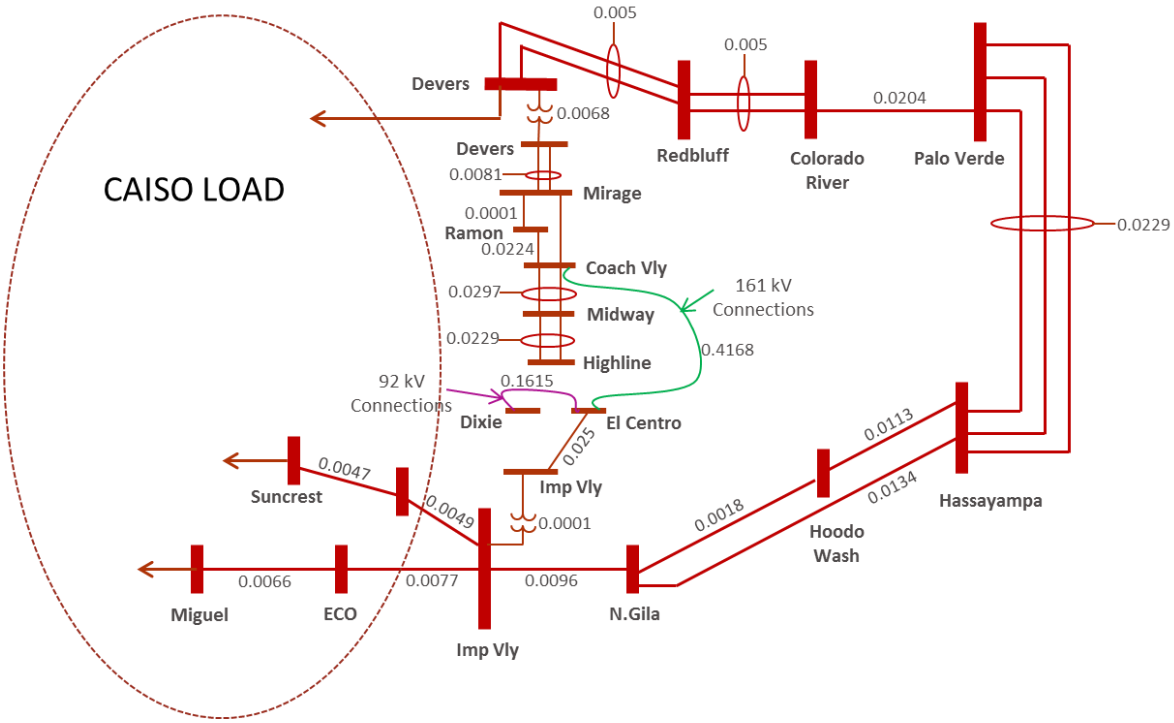
CAISO then performs a contingency analysis screening to identify if there are any potential limitations to the target dispatch levels. For example, limitations could be due to transmission overloads or voltage instability. For each limitation or "constraint" found, a 5% electrical circle is drawn around the generators that contribute greater than 5% distribution factor flow impact to the constraint. The 5% circle represents the relevant study area and additional power flows are performed by incrementally increasing output of the contributing generators to find the worst dispatch level for the constraint. When adjusting the output, CAISO's notes starts "with units with the largest impact on the transmission facility." Once this constraint scenario is established, further analysis determines what mitigation is required to allow for the deliverability of the impacted capacity.

What is not clear from CAISO methodology is the effectiveness of a generator's location on resolving the constraint. To further examine this, ZGlobal performed power flow analysis to illustrate the importance

[6] http://www.caiso.com/Documents/On-PeakDeliverabilityAssessmentMethodology.pdf

of considering a generator's locational impact when studying deliverability. An impedance diagram of the Imperial Valley area and its vicinity is shown in Figure 5. Generators interconnecting to substations in this area will have an impact on any deliverability constraints found with respect to delivering to load in the CAISO BAA. As indicated in the diagram, the physical parameters of the system will dictate the flow on the transmission system based on where generators inject power and thus have a different effect on contributing or resolving a transmission bottleneck.

Figure 5. Impedance Diagram for Imperial Valley Area



For example, in its power flow analysis ZGlobal determined the ECO-Miguel 500 kV line to be a constraint for deliverability from Imperial Valley. Power flow assessments were then run to calculate for various generator locations its "Generator Shift Factor" with respect to contributing to the flow on the ECO-Miguel 500 kV line. The Generator Shift Factor is a measure of the proportional flow on the ECO-Miguel 500 kV when injecting 1 MW at the generator location to deliver 1 MW load in the CAISO BAA. Figure 6 and Figure 7 illustrates the power flow results for injecting 100 MW at the CAISO's Imperial Valley and IID's Coachella Valley substations respectively. Since 100 MW injection at Imperial Valley substation contributes 34 MW flow on the ECO-Miguel 500 kV line, its shift factor is 0.34. Similarly, the shift factor for generator at Coachella Valley is 0.02.

Figure 6. Impact of 100 MW Generator Interconnected at Imperial Valley Substation on ECO-Miguel 500 kV Constraint

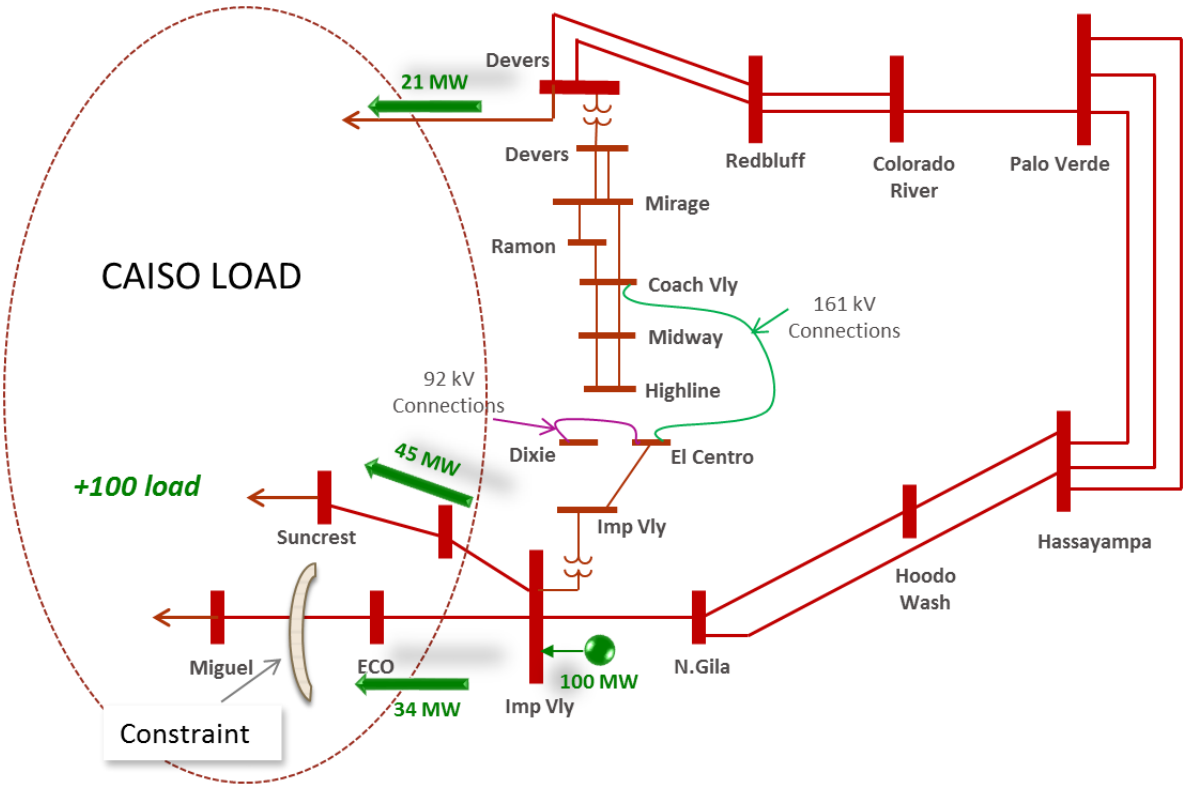
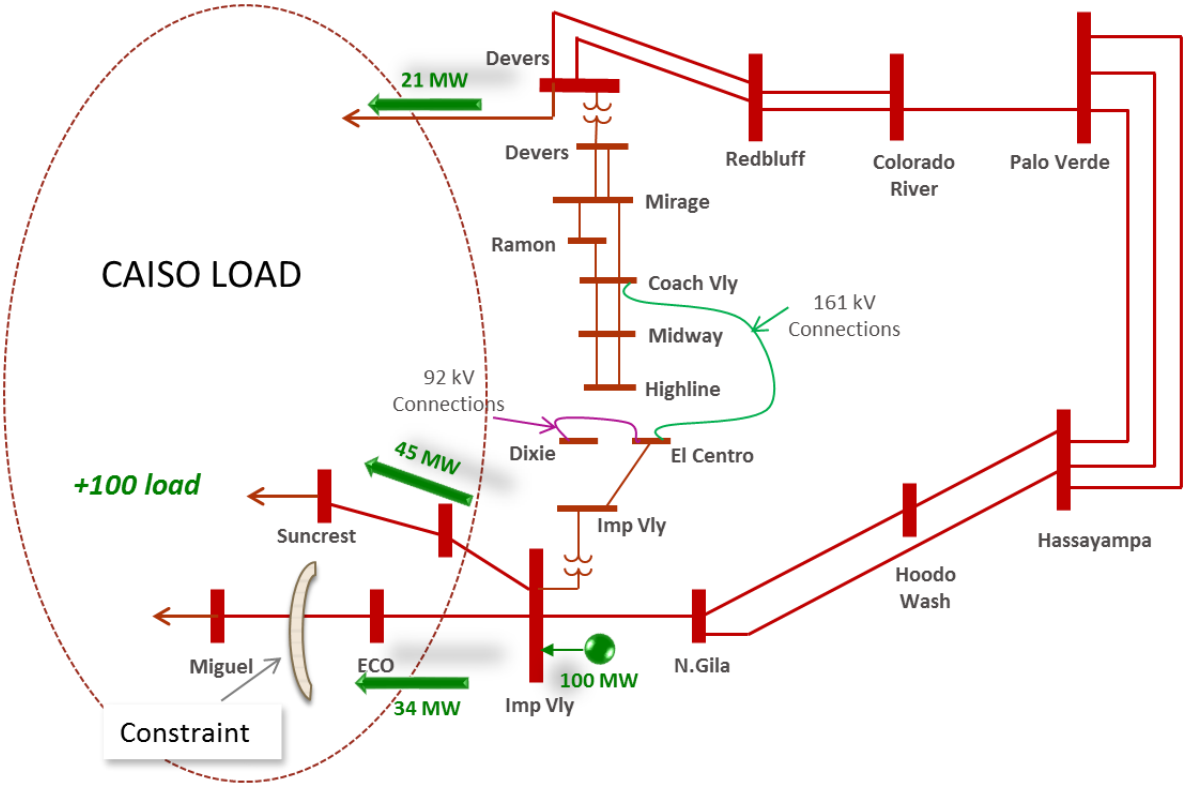


Figure 7. Impact of 100 MW Generator Interconnected at Coachella Valley Substation on ECO-Miguel 500 kV Constraint



Accordingly, to further assess locational impact ZGlobal ran additional analysis to calculate the shift factors for recent online renewable generation. The results of the power flow analysis are shown in Table 2. On average, the generators that are interconnected to CAISO impact the ECO-Miguel 500 kV constraint by 35.1% compared with the generators that are interconnected to IID which impact the constraint by only 13% on average. Figure 8 and Figure 9 provides a locational representation of the total capacity for the CAISO interconnected and IID interconnected generation with respect to its impact on the deliverability constraint.

Table 2. Locational Impact of Recent Online Generation to the ECO-Miguel 500 kV Deliverability Constraint

General POI	Generator	IOU	Min MW	Technology	Vintage	Location	BAA	Impact on Eco-Miguel 500kV Constrained path (%)	Impact on Eco-Miguel 500kV Constrained path (MW)
A	Ocotillo Express Wind Project	SDG&E	265	Wind	New	Ocotillo, CA	CAISO/IVS	35	92.75
	Campo Verde/Mt. Signal	SDG&E	49	Solar PV	New	Fillare Ranch, Imperial Valley	CAISO/IVS	35	17.15
	Imperial Solar Energy Center - South	SDG&E	130	Solar PV	New	El Centro, CA	CAISO/IVS	35	45.5
	Centinela Solar (expansion)	SDG&E	30	Solar PV	New	Calexico, CA	CAISO/IVS	35	10.5
	Imperial Solar Energy Center - West	SDG&E	130	Solar PV	New	El Centro, CA	CAISO/IVS	35	45.5
	Mt. Signal Solar II	SCE	154	Solar	New	Calexico, Imperial County, CA	CAISO/IVS	35	53.732
	Mt. Signal Solar IV	SCE	252	Solar	New	Calexico, Imperial County, CA	CAISO/IVS	35	88.312
	Subtotal		1010					35	353.444
B	Arlington Valley Solar Energy II	SDG&E	127	Solar PV	New	Arlington, AZ	CAISO	40	50.8
C	Kumeyaay Wind	SDG&E	51	Wind	New	San Diego County	CAISO	25	12.75
Subtotal (1)			**1188**					**35.10%**	**416.994**
D	SG2 Imperial Valley	SDG&E	150	Solar PV	New	Calipatria, CA	IID	15	22.5
	Calipatria	SDG&E	20	Solar PV	New	Calipatria, CA	IID	15	3
	Midway Solar Farm I	PG&E	50	Solar PV	New	Calipatria, CA	IID	15	7.5
	Subtotal		220					15	33
E	ORNI 18	SCE	50	Geothermal	New	North Brawley, CA	IID	2	1
F	Seville Tallbear LLC	SDG&E	20	Solar PV	New	Calipatria, CA	IID	18	3.6
Subtotal (2)			**290**					**13%**	**37.6**
Total			**1478**						**454.6**

Figure 8. Flow Impact of CAISO Interconnected Generation

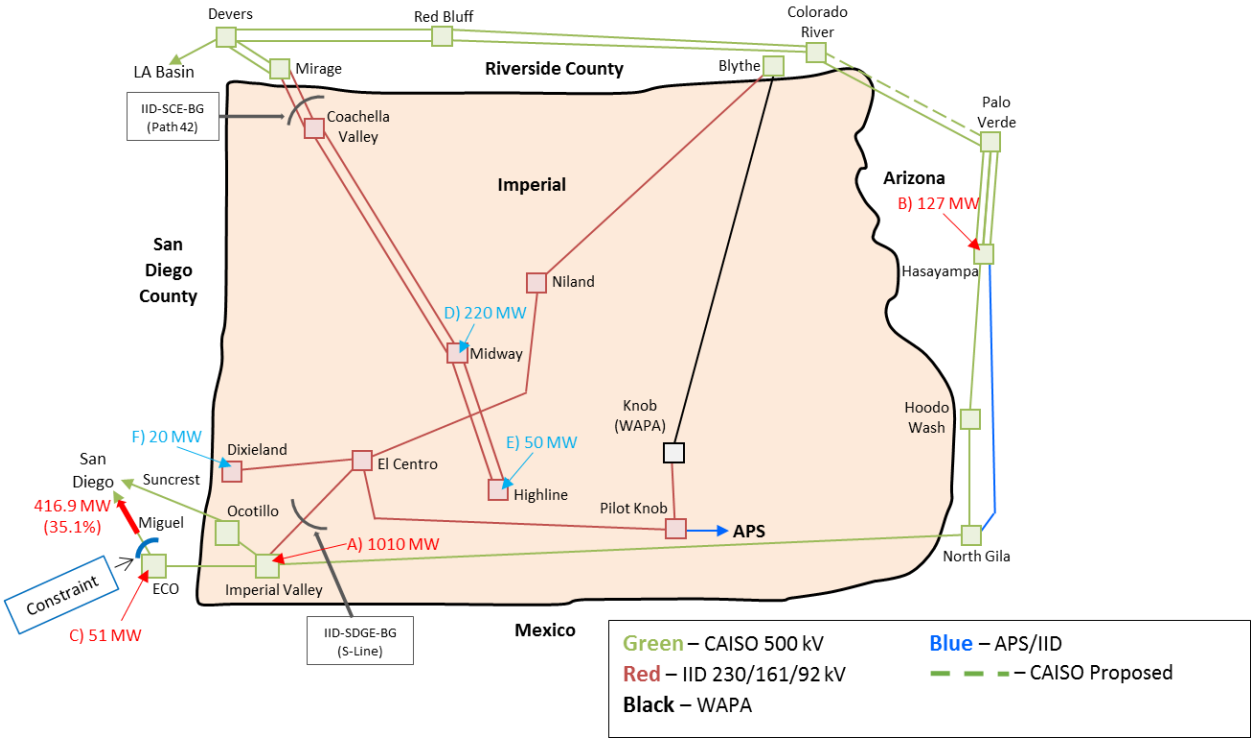
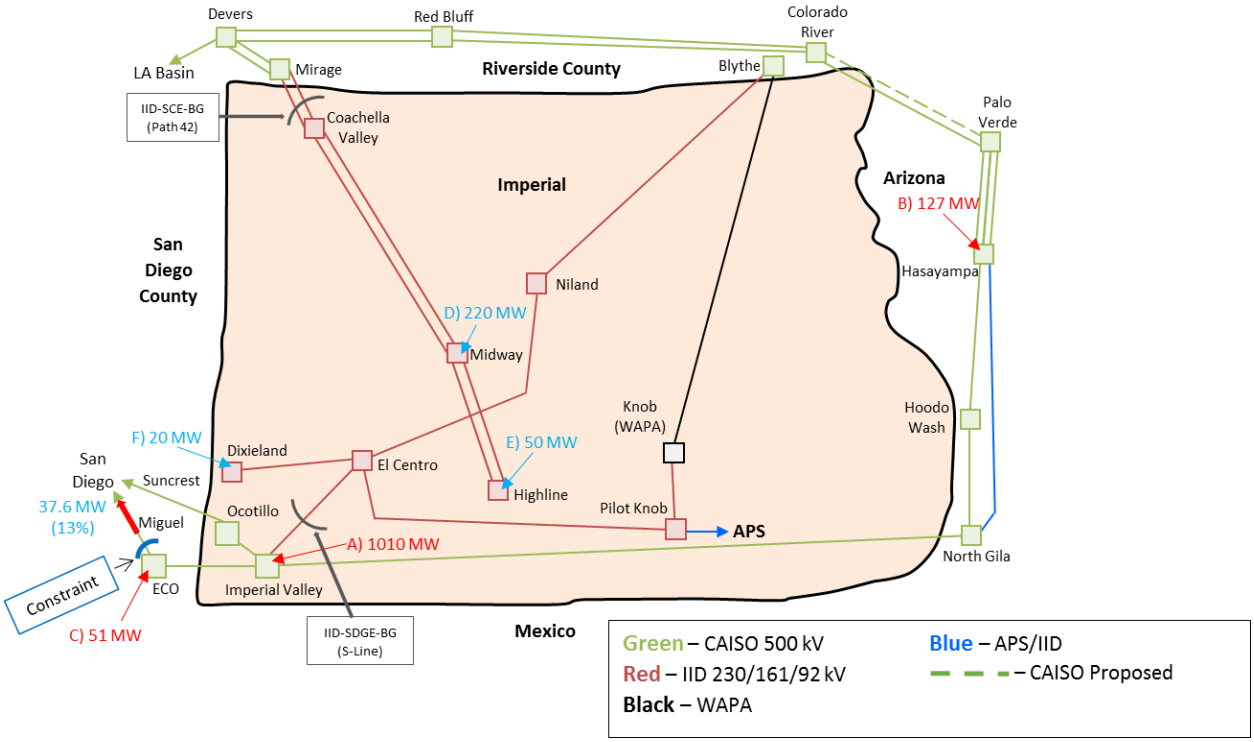


Figure 9. Flow Impact of IID Interconnected Generators

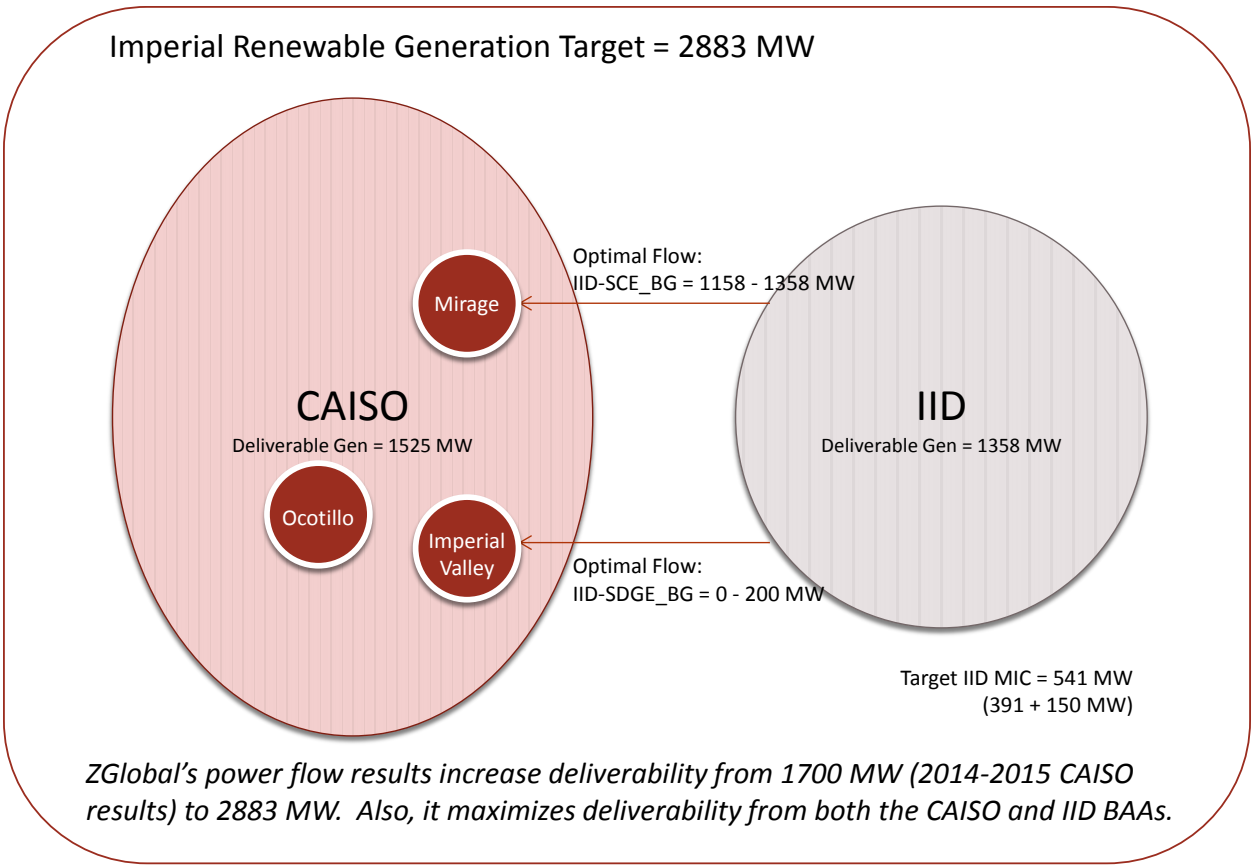


The power flow analysis demonstrates that quantifying the locational effects of generator output should be considered when assessing deliverability. The data shows that there could be more deliverability from the entire Imperial Valley area if more generators were located at points that have lower impact to the identified constraints. This concept of studying the locational impacts is already used by CAISO when assessing deliverability for the LA Basin and San Diego to meet local reliability needs. The final Board approved 2014-2015 Transmission Plan, provides a table of locational effectiveness factors for buses in the LA Basin and San Diego areas that are helpful to lower the loading concerns of the major constraints causing local reliability concerns in the area. CAISO further notes that the purpose of calculating the LEF's is to "…determine existing resources' effectiveness in mitigating post-transient voltage instability; or determine the LEFs of new proposed potential resources to mitigate a reliability concern. The latter was the focus of interest of the load serving entities (LSEs) as well as of the generation developers who would like to propose their projects as part of the LSE's procurement process." [7] Since they have adopted this approach to study local area reliability needs, it seems logical that the same concept can be used to assess deliverability from the Imperial Valley area.

To further support use of a locational-based methodology, ZGlobal continued with its analysis by quantifying an optimal resource dispatch that maximizes the total delivery from both the CAISO and IID BAAs while assuring transmission constraints are mitigated. As described in Figure 10, incorporating the locational effectiveness of generator locations allowed the total deliverability from Imperial Valley to increase to 2883 MW compared with CAISO's 2014-2015 assessment of 1700 – 1800 MW. Also, the deliverability allocation between the CAISO BAA and the IID BAA was 1525 MW and 1358 MW compared with 1000 MW and 662 MW respectively. This exercise demonstrates that incorporating a locational-based assessment has the advantage of maximizing the efficiency of interconnected transmission grid.

[7] Section 3.3. Locational Effectiveness Factors, Board Approved 2014-2015 ISO Transmission Plan dated March 27, 2015, p.152, , http://www.caiso.com/Documents/Board-Approved2014-2015TransmissionPlan.pdf

Figure 10. ZGlobal's Locational-based Deliverability Assessment Results



ZGlobal's power flow results increase deliverability from 1700 MW (2014-2015 CAISO results) to 2883 MW. Also, it maximizes deliverability from both the CAISO and IID BAAs.

Cost Impact of Current Deliverability Targets

Approximately 1010 MW of new renewable capacity has been interconnected to ISO grid since 2013 (Table 3).

Table 3. New Generation Interconnections to ISO Grid

General POI	Generator	IOU	Min MW	Technology	Vintage	Location	BAA	COD (in-service)
A	Ocotillo Express Wind Project	SDG&E	265	Wind	New	Ocotillo, CA	CAISO/IVS	7/30/2013
	Campo Verde/Mt. Signal	SDG&E	49	Solar PV	New	Fillare Ranch, Imperial Valley	CAISO/IVS	10/22/2013
	Imperial Solar Energy Center - South	SDG&E	130	Solar PV	New	El Centro, CA	CAISO/IVS	10/11/2013
	Centinela Solar (expansion)	SDG&E	30	Solar PV	New	Calexico, CA	CAISO/IVS	8/15/2014
	Imperial Solar Energy Center - West	SDG&E	130	Solar PV	New	El Centro, CA	CAISO/IVS	1/17/2015
	Mt. Signal Solar II	SCE	154	Solar	New	Calexico, Imperial County, CA	CAISO/IVS	2015
	Mt. Signal Solar IV	SCE	252	Solar	New	Calexico, Imperial County, CA	CAISO/IVS	3/4/2014
	Subtotal		1010					

The higher concentration of area resources connected to ISO grid at Imperial Valley substation is potentially resulting in higher congestion costs to the SDG&E and SCE load areas. ZGlobal reviewed Day Ahead Market congestion costs for 2014 and 2015 for the following constraints identified by CAISO in the 2014-2015 Transmission Plan as a deliverability constraint impacting Imperial Valley area[8]:

- Miguel 500/230 kV #1 or #2
- Sycamore-Suncrest 230 kV #1 or #2
- Suncrest 500/230 kV #1 or #2
- IV-ECO 500 kV
- ECO-Miguel 500 kV
- Path 46

Of the six limiting constraints identified, 3 constraints were binding in the Day Ahead market for each of the 2-year period as shown in Table 4:

Table 4. Historical Day Ahead Congestion Summary for Constraints Limiting Imperial Valley Area Deliverability

Year	CONSTRAINT	# of Congested Hours	AVG Shadow Price ($/MWh)
2014	22356_IMPRLVLY_230_22360_IMPRLVLY_500_XF_80	10	7.66
	22886_SUNCREST_230_22832_SYCAMORE_230_BR_1 _1	20	18.93
	22832_SYCAMORE_230_22835_SXTAP2 _230_BR_1A_1	3	61.37
	MIGUEL_BKs_MXFLW_NG	9	32.21
2014 Summary		**42**	**22.12**
2015	22356_IMPRLVLY_230_22360_IMPRLVLY_500_XF_80	55	69.40
	22886_SUNCREST_230_22832_SYCAMORE_230_BR_2 _1	2	10.38
	22464_MIGUEL _230_22467_MLSXTAP _230_BR_1 _1	4	11.72
2015 Summary		**61**	**63.68**
2-year Summary		**103**	**46.73**

[8] Table 4.3-15: Base Portfolio deliverability assessment results-Imperial Valley Deliverability Constraints, 2014-2015 Board Approved Transmission Plan dated March 27, 2015

During hours of the constraint, the relevant load serving entity effectively pays congestion costs to move energy from the ISO interconnection point at ISO's Imperial Valley 230 kV station to its demand. This congestion cost is quantified at the difference between the marginal cost of congestion (MCC) at the sink and source. In the case of the renewable energy in Table 3 the source price is effectively the MCC at Imperial Valley 230 kV substation and the sink price is either the Default Load Aggregation Price (DLAP) for SDG&E or SCE load areas published by CAISO for each market. During the hours of congestion shown in Table 4, the 2-year average congestion cost to transfer energy from Imperial Valley 230 kV station to demand in SDG&E or SCE was $29.31/MWh and $27.38/MWh respectively (Table 5).

Table 5. Congestion Cost ($/MWh) to Deliver from Imperial Valley 230 kV to SDG&E and SCE

Cost to Deliver from IV 230 kV	SDG&E	SCE
Year	Average of P2P CONG ($/MWh)	Average of P2P CONG ($/MWh)
2014	11.25	6.95
22356_IMPRLVLY_230_22360_IMPRLVLY_500_XF_80	5.50	5.06
22832_SYCAMORE_230_22835_SXTAP2 _230_BR_1A_1	17.01	10.14
22886_SUNCREST_230_22832_SYCAMORE_230_BR_1 _1	10.16	7.27
MIGUEL_BKs_MXFLW_NG	18.12	7.27
2015	41.75	41.45
22356_IMPRLVLY_230_22360_IMPRLVLY_500_XF_80	45.97	45.73
22464_MIGUEL _230_22467_MLSXTAP _230_BR_1 _1	2.44	2.10
22886_SUNCREST_230_22832_SYCAMORE_230_BR_2 _1	4.34	2.42
2-year Average ($/MWh)	**29.31**	**27.38**

This congestion rent is 268 - 354% higher than deliveries from IID from the IID-SCE intertie at Coachella/Mirage and 11-12% higher than from the IID-SDGE interface at El Centro. Congestion costs from those two locations were $7.95/MWh and $6.02/MWh for deliveries from Coachella and $26.25/MWh and $24.31/MWh for deliveries from El Centro. Table 6 and Table 7 summarize the point-to-point costs by constraint and location.

Table 6. Congestion Cost ($/MWh) to Deliver from IID-SCE Interface to SDG&E and SCE

Cost to Deliver from Coachella (IID-SCE_BG)	SDG&E	SCE
Year	Average of P2P CONG ($/MWh)	Average of P2P CONG ($/MWh)
2014	6.22	1.92
22356_IMPRLVLY_230_22360_IMPRLVLY_500_XF_80	0.88	0.44
22832_SYCAMORE_230_22835_SXTAP2 _230_BR_1A_1	9.79	2.93
22886_SUNCREST_230_22832_SYCAMORE_230_BR_1 _1	4.41	1.51
MIGUEL_BKs_MXFLW_NG	14.97	4.12
2015	9.15	8.84
22356_IMPRLVLY_230_22360_IMPRLVLY_500_XF_80	9.84	9.60
22464_MIGUEL _230_22467_MLSXTAP _230_BR_1 _1	2.83	2.49
22886_SUNCREST_230_22832_SYCAMORE_230_BR_2 _1	2.65	0.73
2-year Average ($/MWh)	**7.95**	**6.02**

Table 7. Congestion Cost ($/MWh) to Deliver from IID-SDGE Interface to SDG&E and SCE

Cost to Deliver from El Centro (IID-SDGE_BG)	SDG&E	SCE
Year/Month	Average of P2P CONG ($/MWh)	Average of P2P CONG ($/MWh)
2014	12.52	8.22
22356_IMPRLVLY_230_22360_IMPRLVLY_500_XF_80	4.93	4.49
22832_SYCAMORE_230_22835_SXTAP2 _230_BR_1A_1	16.27	9.41
22886_SUNCREST_230_22832_SYCAMORE_230_BR_1 _1	9.86	6.96
MIGUEL_BKs_MXFLW_NG	25.61	14.76
2015	35.70	35.40
22356_IMPRLVLY_230_22360_IMPRLVLY_500_XF_80	39.28	39.03
22464_MIGUEL _230_22467_MLSXTAP _230_BR_1 _1	2.42	2.08
22886_SUNCREST_230_22832_SYCAMORE_230_BR_2 _1	4.01	2.09
2-year Average ($/MWh)	**26.25**	**24.31**

Assuming average CAISO wind and solar capacity factors for the 1010 MW, the congestion amount to deliver from ISO-interconnected bus *during the congested hours* is estimated to be $444.6K (Table 8).

Table 8. Estimated Congestion Cost-to-Load ($) to Deliver 1010 MW Capacity from IV 230 kV to SDG&E and SCE

Year	Energy MWh	AVG cf	Congestion Cost-to-Load ($)
2014	13,030	0.51	$148,308
2015	6,883	0.19	$137,132
SDG&E SubTotal	**19,913**	**0.32**	**$285,440**
2014	12,768	0.75	$90,546
2015	5,750	0.23	$68,631
SCE SubTotal	**18,518**	**0.44**	**$159,176**
Total for 1010 MW Capacity	**38,431**	**0.38**	**$444,616**

Given the power flow analysis performed, if we assumed that an additional 1010 MW could be delivered from the IID-SCE intertie and it would have less than 2% impact on the constraints that affected congestion from Imperial Valley historically, the congestion cost-to-load is estimated to be $192.6K. This is about a 57% decrease in congestion costs compared with ISO grid connected deliveries (Table 9).

Table 9. Estimated Congestion Cost-to-Load ($) to Deliver 1010 MW Capacity from IID-SCE Intertie to SDG&E and SCE

Year	Energy MWh	AVG cf	Congestion Cost-to-Load ($)
2014	13,030	0.51	$81,117
2015	6,883	0.19	$49,939
SDG&E SubTotal	**19,913**	**0.32**	**$131,056**
2014	12,768	0.75	$25,172
2015	5,750	0.23	$36,361
SCE SubTotal	**18,518**	**0.44**	**$61,533**
Total for 1010 MW Capacity	**38,431**	**0.38**	**$192,589**

Deliveries from either ISO-connected or IID-connected generation is impacted by all system congestion. Using 2015 actually hourly MCCs, the total congestion amount to deliver 1010 MW capacity to SDG&E and SCE was estimated and compared for ISO-connected versus IID-connected generators delivering to the IID-SCE or IID-SDGE interties. The results are shown in Table 10. Total congestion amount for 2015 for all hours is $3.59 million and $2.48 million to deliver from Imperial Valley 230 kV to SDG&E and SCE respectively. This amount includes the congestion for all constraints in the system. In comparison, the estimated congestion amount for deliveries from the IID-SCE intertie (Coachella) is $2.12 million and $1.21 million which is a cost difference of between -$1.4 and -$1.2 million.

Table 10. Estimated 2015 Congestion Cost Comparison from Imperial Valley for 1010 MW Capacity

SINK	SOURCE	Energy MWh	AVG cf	Annual Congestion Cost ($)	Congestion Cost Delta from IV230 ($)	AVG MCC @Source	MCC Diff from IV230
DLAP_SDGE-APND	IMPRLVLY_2_B1	1,310,240	0.25	$3,590,108		-1.95	
	COACHELV_2_N101	1,310,240	0.25	$2,123,525	-$1,466,583	-1.03	0.92
	ELCENTRO_2_N001	1,310,240	0.25	$3,233,806	-$356,301	-1.64	0.30
DLAP_SCE-APND	IMPRLVLY_2_B1	909,074.4	0.26	$2,483,796		-1.95	
	COACHELV_2_N101	909,074.4	0.26	$1,212,748	-$1,271,047	-1.03	0.92
	ELCENTRO_2_N001	909,074.4	0.26	$2,380,069	-$103,727	-1.64	0.30

ZGlobal recognizes that the overall system congestion prices might have been different had there been 1010 MW of capacity imported from Coachella and the dollar figures calculated are for illustrating the potential magnitude of difference if the same 1010 MW were connected at the more northern areas of IID. As explained earlier, the constraints impacting CAISO's deliverability studies are all in the transmission corridors connecting IID to SDG&E areas. Further, SCE and IID have planned transmission upgrades that will support IID-SCE transfers of up to 1400 MW. So given the 2015 congestion prices, and the power flow analysis that ISO-connected resources have higher impact on the constraints, it is reasonable to assume that additional capacity imported at Coachella would not have significantly been different than estimated above.

Assessment Summary

CAISO may be missing opportunities to maximize efficiency of interconnected transmission grid with its current deliverability assessment study approach. Initial power flow analysis illustrates that use of a locational-based study approach can be used to increase total deliverability of resources connecting to both ISO and IID transmission systems for the benefit of all potential users of the interconnected grid.

Recent Congestion Cost analysis suggest that recent ISO-connected generation could be paying higher costs when compared with costs to deliver from IID located resources. It is estimated that deliveries from ISO-connections are paying up to 57% higher congestion costs than deliveries from IID via Coachella and up to 10% higher congestion cost than deliveries from El Centro.