



California ISO
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Technical Bulletin

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Explanation of Impact of Placer-Flint Congestion

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1. Introduction

During the first few days of operating the new CAISO markets, congestion was observed in the Day-Ahead Market on the Placer-Flint line as a result of planned transmission work that affected congestion prices across the rest of the system. The following explains how a constraint like Placer-Flint can produce such a wide-spread pricing impact on the system.

2. Detailed discussion

There are two transmission lines (corridors) between the area behind the constraint made up of the Placer, Drum, Summit area and the rest of the system. However, relative to the impedance of the two lines connecting the Placer area to the rest of the system, the rest of the system is nearly a single electrical point with relative low impedance between the points where two lines connect at Rio-Oso and the Gold Hill (refer to Figure 1). As a result, the Power Transfer Distribution Factors (PTDFs) of locations in the rest of the CAISO Balancing Authority Area are similar relative to the distributed reference.

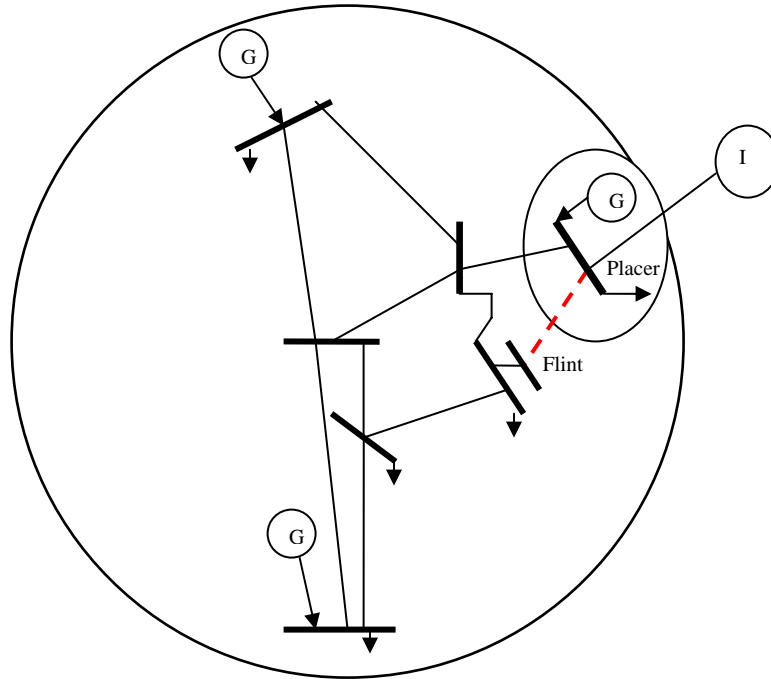


Figure 1:
Illustration of Placer-Flint Congestion Case

In these cases where Placer-Flint congestion became binding in the Integrated Forward Market (IFM), a dynamic distributed generation reference was used. The determination of the distribution of generation is dynamically determined based on price of generation and available capacity of generation. In these cases, the distribution of the reference resulted in distribution of approximately 64% of the reference to resources behind the Placer-Flint constraint. With the high concentration of reference behind the constraint, resources in the balance of the system had very similar effectiveness to relieve the constraint of between 0.26 - 0.33. These effectiveness levels are well within the 2% (0.02) effectiveness thresholds. This phenomenon can be illustrated by use of the simple three bus example provided in Figure 2.

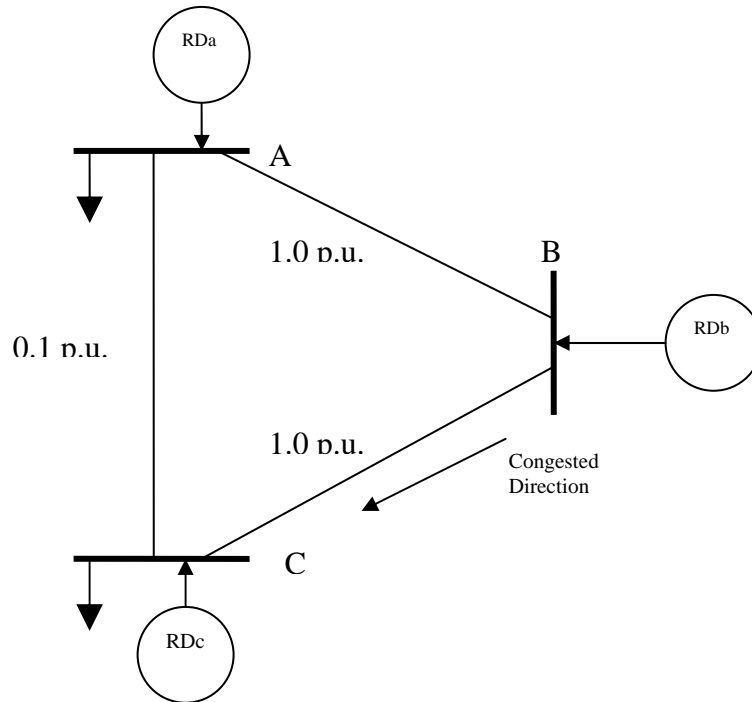


Figure 2: 3-Bus Example

$PTDF_{bc,j}$: Power Transfer Distribution Factor for flows on constraint from b-c for injection at bus j relative to reference location

X_{ij} : Impedance of branch from bus i to j

RD_i : Reference Bus Distribution at bus injection i

$$PTDF_{bc,c} = -RD_b \times (X_{ab} + X_{ac}) / (X_{ab} + X_{bc} + X_{ac}) - RD_a \times X_{ac} / (X_{ab} + X_{bc} + X_{ac}) - RD_c \times 0$$

$$PTDF_{bc,a} = -RD_b \times X_{ab} / (X_{ab} + X_{bc} + X_{ac}) + RD_c \times X_{ac} / (X_{ab} + X_{bc} + X_{ac}) - RD_a \times 0$$

Given

$$X_{ab} = X_{bc} = 1.0 \text{ p.u.}, X_{ac} = 0.1 \text{ p.u.}, RD_b = 64\%, RD_a = 18\%, RD_c = 18\%$$

$$PTDF_{bc,c} = -RD_b \times (X_{ab} + X_{ac}) / (X_{ab} + X_{bc} + X_{ac}) - RD_a \times X_{ac} / (X_{ab} + X_{bc} + X_{ac}) - RD_c \times 0$$

$$PTDF_{bc,c} = -0.64 \times 1.1 / 2.1 - 0.18 \times 0.1 / 2.1 - 0$$

$$PTDF_{bc,c} = -0.344$$

$$PTDF_{bc,a} = -RD_b \times X_{ab} / (X_{ab} + X_{bc} + X_{ac}) + RD_c \times X_{ac} / (X_{ab} + X_{bc} + X_{ac}) - RD_a \times 0$$

$$PTDF_{bc,a} = -0.64 \times 1.0 / 2.1 + 0.18 \times 0.1 / 2.1 - 0$$

$$PTDF_{bc,a} = -0.296$$