



Economic Planning- TEAM Overview and Review of Documentation Update

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TEAM documentation update Stakeholder Conference Call
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Introduction

- Transmission Economic Assessment Methodology (TEAM) was approved by 2005
- Review and update TEAM document based on ISO's evolved practice
 - A documentation update – not a methodology review
 - Remove obsolete contents, and clarify and update components to reflect practices
- Structure of this presentation
 - Overview of TEAM
 - TEAM document update - Principles
 - TEAM document update - Implementations

TEAM overview

- TEAM proposed principles for economic planning and outlined a framework to implement these principles
 - Benefit assessment
 - Network representation
 - Market prices
 - Uncertainty
 - Resource alternatives
- TEAM original document focused on energy benefit assessment based on production cost simulation
 - Additional benefits were discussed, but lacked details of implementation due to data and modeling limitations at the time when TEAM was introduced

Motivation of reviewing and updating TEAM document

- Changes happened since TEAM was approved in 2005
 - Power market keeps evolving in California
 - Renewable penetration increases
 - Number of transmission projects were studied
 - Study tools advanced

Key points in ISO's practices of using TEAM

- Assessing economic benefits for rate-based projects
- All benefits are assessed from ISO “ratepayer’s” perspective
 - Energy benefit
 - Capacity benefit
 - Transmission loss saving benefit
 - Other benefits if applicable
- Market and grid modeling
 - EIM modeling and benefit
 - Ancillary services
 - Transmission constraints (such as nomograms, SPS)
 - Outages and derates that may impact routine congestion
 - Uncertainties, e.g. hydro and load assumptions

TEAM DOCUMENT UPDATE – PRINCIPLES

Benefit assessment

- TEAM provides a standard for measuring transmission expansion benefits for consumers, producers, and transmission owners
- While the original methodology explored a range of perspectives, the “ratepayer” perspective has been relied upon consistently since the methodology was introduced
- Other options that had been considered initially and subsequently discarded were society and participant perspectives

Benefit assessment - economic criteria

- Calculate the net present value (NPV) of the benefit of transmission expansion
 - Social discount rate is used
- “Total cost” of a transmission expansion is the present value of the annual revenue requirement
- Benefit to cost ratio (BCR) needs to be greater than 1.0

Network model and market price

- Full network model has become the default as the production cost simulation tools advanced
 - Losses are calculated in production cost simulation
 - Transmission constraints and outages can be modeled
- Cost-based production cost simulation is used in economic planning study
 - Market power mitigations in ISO's market are more effective today than in 2005
 - Strategic bidding is not used in the ISO's current economic planning studies

Uncertainty

- Decisions on whether to build new transmission are complicated by risks and uncertainties about the future
- Sensitivity studies are needed to test the robustness of the economic assessment results
 - In the ISO's current practice, sensitivity cases by varying the most critical assumptions for the project under evaluation

Sensitivity analyses	Note and typical variation
Load - High	+6% above forecast
Load - Low	-6% below forecast
Hydro - High	if applicable and data available
Hydro - Low	if applicable and data available
Natural gas prices - High	+50%
Natural gas prices - Low	-25%
CA RPS portfolios	If data available
Other sensitivities per requested	n/a

- Stochastic models can be used

Resource alternatives

- Resource alternatives to transmission expansion is another principle that has been proposed in TEAM
- In current CAISO's transmission planning process, resource plans are used as input, e.g.
 - Renewable portfolios
 - DG/EE/DR
 - Energy storage
 - OTC retirement and replacement

TEAM DOCUMENT UPDATE – KEY IMPLEMENTATIONS

Benefit evaluation- production benefit

- Production benefit is assessed based on production cost simulation
 - Difference of net load payment between the cases pre and post project

- Generally,

Net load payment = ISO's Gross load payment – ISO's
Generator profit – ISO's Transmission revenue

Gross load payment = sum (Load × LMP)

Generator profit = Gen. revenue – Gen. cost

Transmission revenue = Congestion cost + Wheeling cost

Benefit evaluation- ownership definition in production benefit calculations

- Ownership is used to indicate which transmission's revenue and generator's profit will be counted to offset ratepayer's payment
 - Defined as ISO owned in the ISO's production cost model
- "Owned facilities" operated to the ISO ratepayer advantage include
 - PTO owned transmissions
 - Generators owned by the utilities serving ISO's load
 - Wind and Solar under contract with an ISO load serving entity to meet the state renewable energy goal
 - Other generators under contracts of which the information is available for public may be reviewed for consideration
 - Type of contract
 - Length of contract

Benefit evaluation – capacity benefit

- **Local area capacity benefit**
 - Potential reduction in local capacity requirement
 - Normally assessed through LCR-type studies
- **System capacity benefit**
 - Potential increase in import capability between regions
 - Potential capacity deficit in the importing region
 - Difference of marginal capacity costs between regions
 - Normally assessed through power flow and stability studies
- **Deliverability benefit**
 - Potential increase in generator deliverability to the region under study
 - Potential capacity deficit in the region under study
- **Full assessment will be on case by case basis**

Benefit evaluation – transmission loss saving benefit

- Energy saving
 - Embedded in the production cost simulation results
- Peak saving
 - Can be translated to capacity benefit
 - Based on power flow study
- Generator deliverability increase
 - Can be translated to capacity benefit
- Full assessment will be on case by case basis

Other benefits

- **Public policy**
 - A project may affect renewable portfolio calculation in accessing remote or out of state generation
 - Benefits may come from avoiding over-build
- **Renewable integration**
 - Reduce over-supply and curtailment
 - Transmission congestion-related
 - Market design to allow sharing energy between areas
 - A/S requirements could be reduced, depending on transmission congestion and market design for being materialized
- **Avoided cost of other projects**
 - If a reliability or policy project can be avoided because of the project under study
- **Full assessment will be on case by case basis**

Cost calculation (revenue requirement)

- For general screening, per unit cost on the ISO website is used to estimate the capital cost, and the present value of the annual revenue requirement is estimated as 1.45 times of the capital
- If a project needs to go through the solicitation process, the cost will be the actual revenue requirement of the project as the project sponsor proposed
- For an ISO proposed project, the revenue requirement is estimated using the model and assumptions that are consistent with the CAISO Transmission Access Charge (TAC) model

Market and grid modeling – Energy Imbalance Market (EIM)

- EIM affects the generation dispatch hence the flow pattern on the interfaces
- In the congestion studies of the ISO's previous planning cycle, EIM was considered by taking a discount on the hurdle rates among EIM entities
 - The discount was the ratio between the energy transactions through EIM and in the whole market

Market and grid modeling – EIM (cont.)

- It is not recommended to consider the full effect of EIM in project justification for an ISO internal project financially
 - Mainly due to the relative ease for entities to exit EIM and the long life of transmission assets
- For an inter-regional project using with EIM or without EIM model as the base will be case by case
 - Depending on the arrangement of cost sharing of the project between planning regions

Market and grid modeling - others

- Ancillary services (A/S) are co-optimized with energy
 - Regulation up/down, Load following up/down, spinning/non-spinning
 - Frequency response is modeled as an A/S
- Transmission constraints in addition to facility ratings
 - Contingencies and SPS, critical and credible to local or system
 - Mostly N-1 or N-2 identified in LCR and reliability assessments
 - Nomograms, such as COI, Path 15, Path 26
 - Scheduled outages and derates
 - Only consider that may produce routine congestion

Summary of TEAM document updates

- The framework of TEAM remains the same
- Implementation has been updated to reflect the changes on market and grid operation, and planning processes
- ISO “ratepayer’s” perspective is the perspective relied upon for benefit calculations, as the ratepayers are ultimately funding the development through rates
- Assessment of benefits in addition to energy benefit have been added to the TEAM framework
- Production cost model has been enhanced to reflect market and grid operation

Next steps

- Stakeholder comments on the updates by August 24, 2017
- Revised and final updated TEAM document by September 30, 2017

Questions/Comments?