Congestion Cost Savings Test Discussion

Presentation to ERCOT PLWG

For Discussion Purposes Only

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Agenda

- Study Objective & Approach
- Identification of Cost Test Options
- Recommended Cost Test for ERCOT & Comparison to Alternatives

Study Objective & Approach

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Study Objective

+ Study Background: Legislation passed in SB1281 prompted PUCT's November 2022 amendments to Public Utility Commission (PUC) Rule 25.101

- Directed ERCOT to develop a "consumer benefits test" for evaluating whether to approve a transmission upgrade as economically beneficial for the ERCOT power system
  - Also referred to as a "congestion cost savings test" the consumer test would provide a supplemental evaluation to a "production cost savings test" which evaluates societal savings; a line with sufficient production cost savings can pass regardless of the outcome of the consumer benefits test

+ ERCOT engaged E3 as its consultant to:

- **(1) identify a set of viable options for ERCOT to use as a congestion cost test, and**
- **(2) recommend which option E3 believes is best for ERCOT**
- **Note:** This scope is focused on "economic energy benefit calculation methodology", which is how to calculate the impact of a new transmission line on the energy cost for ERCOT customers; this scope does not include a range of other factors that may impact the estimated benefits of a transmission line, such as:
  - "multi-value" approaches that evaluate different types of savings beyond energy costs, including tax credit treatment
  - the financial calculation of transmission project cost and the relevant benefit-cost ratio threshold
  - determining scenarios or study years beyond those in the current approach

Study Approach

+ **E3's assessment consists of four major steps for identifying a recommended congestion cost test option for ERCOT**
  - **Compile options**
    - E3 researched economic transmission evaluation approaches throughout North America, as well as Australia and Europe, and discussed with planners in those jurisdictions to identify the range of options currently used to evaluate transmission economic benefits
  - **Analyze & compare**:
    - E3 categorized the options identified in the survey and compared the key aspects and implications of each option
  - **Assess applicability to ERCOT**:
    - E3 identified the ways that each option would or would not fit with the ERCOT market rules and structure
  - **Recommend best option for ERCOT**:
    - After comparing each option against key criteria, E3 recommended the best option for implementation

Identification of Cost Test Options

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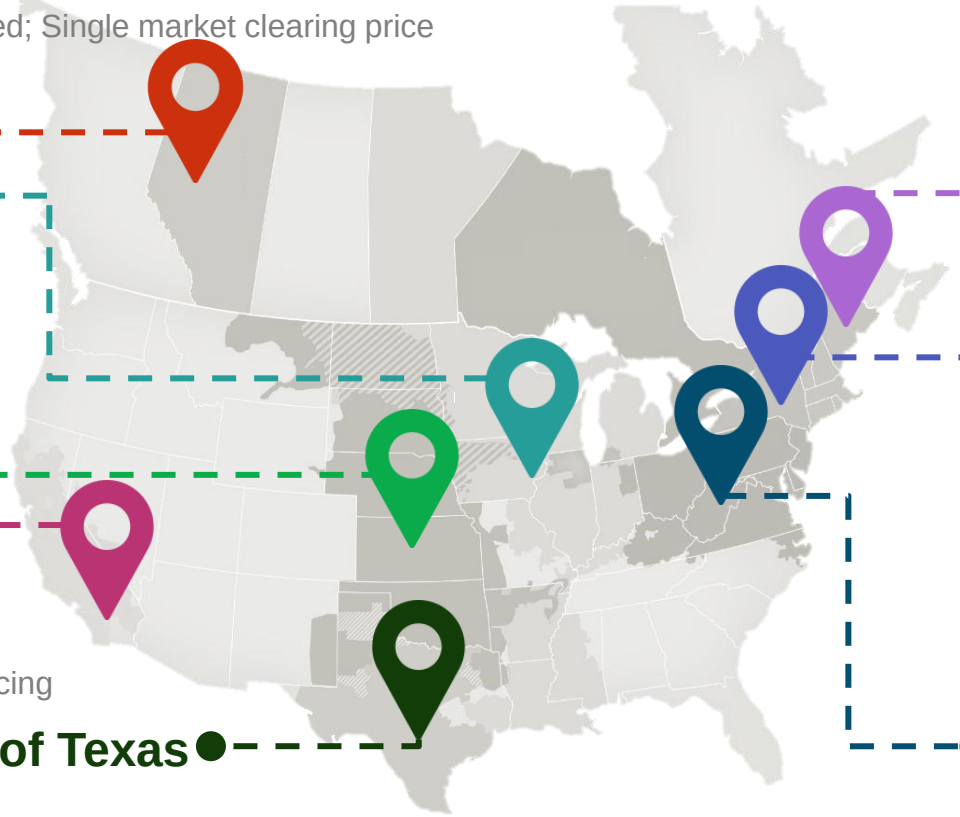
Jurisdictions Analyzed (North America)



Alberta Electric System Operator (AESO)
12 GW peak load
20% Wind, 6% Solar
16k Transmission mi
Deregulated; Single market clearing price

Midcontinent ISO
127 GW peak load
16% Wind, 1% Solar
68k Transmission mi
Deregulated with utility LSEs; nodal pricing

Southwest Power Pool
53 GW peak load
29% Wind, <1% Solar
72k Transmission mi
Deregulated with utility LSEs; nodal

California Independent System Operator
52 GW peak load
10% Wind, 20% Solar
26k Transmission mi
Deregulated with utility & CCA LSEs; nodal pricing

Electric Reliability Council of Texas
82.5 GW peak load
29% Wind, 11% Solar
53k Transmission mi
Deregulated retail & wholesale; nodal pricing

ISO New England
28 GW peak load
4% Wind, 3% Solar
9k Transmission mi
Deregulated; nodal pricing

New York ISO
31 GW peak load
2 GW Wind, 4 GW Solar
11k Transmission mi
Deregulated; nodal pricing

PJM Interconnection
128 GW peak load
5% Wind, 1% Solar
88k Transmission mi
Deregulated wholesale
nodal pricing with 21 sub-regions

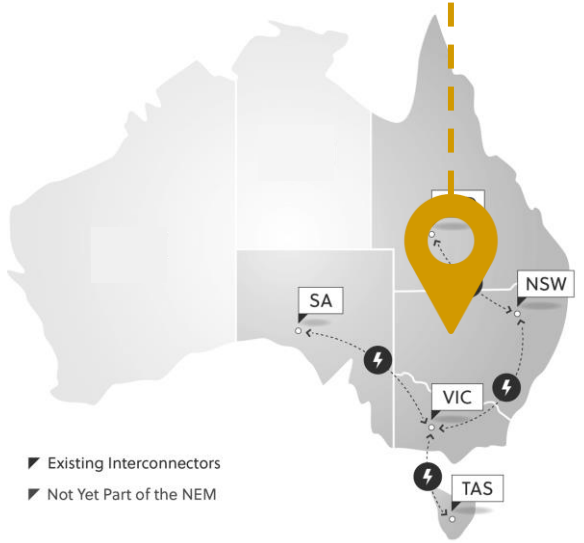
Jurisdictions Analyzed (EU and Australia)

EirGrid (Ireland)

12 GW
34% Wind, <1% Solar
6k Transmission mi
Deregulated
Economic Transmission Defined by regional planner at European Network of Transmission System Operators for Electricity (ENTSO-E)

Australian Energy Market Operator (AEMO) - NEM

34 GW
11% Wind, 10% Solar
24k Transmission mi
Deregulated; nodal prices



Summary of Economic Transmission Assessment Options

+ **All regions surveyed have a consistent study framework:**
  - Used a production simulation model to compare system benefits and costs between two cases:
    - A **base case** without the proposed transmission project
    - A **project case** which includes the proposed transmission upgrade
  - Economic savings are calculated as improvement to a **defined benefit metric** in the project case compared to the base case
  - All regions then take the calculated economic savings (from one or more study case years), and compare that to the project line cost over a defined period to calculate a benefit-to-cost ratio
  - Projects are recommended as economic if the benefit-to-cost ratio is greater than a selected threshold (such as 1.0)
+ **The regions differ in:**
  - What outputs of the simulation they use to calculate the benefit metric
  - What study scenarios, study years, and input assumptions are used
  - How the benefits over multiple years are calculated and compared to line cost (based on financial assumptions)
  - Whether other types benefits are included together with energy savings

Transmission Cost Test Alternatives

Generator Revenue Reduction Test

Sum for all generators:
(Gen MWh * LMP $)

- Used by ERCOT prior to 2012 and applied on interim basis for 2023 study cycle
- A Generator Revenue Reduction (GRR) Test calculates the change in the payment the system makes to generators
- Calculated based on the sum of energy produced by each generator * the locational price for that generator
- By using the generator locational price, this approach implicitly assumes that all transmission congestion value is returned to load customers (through the CRR market)
- A transmission line that reduces the prices at generator locations (by enabling more transmission connectivity to lower-cost generators in other locations) will produce savings under the GRR test

Transmission Cost Test Alternatives

Gross Load Cost Test

Sum across all busses: (Load MWh * LMP $)

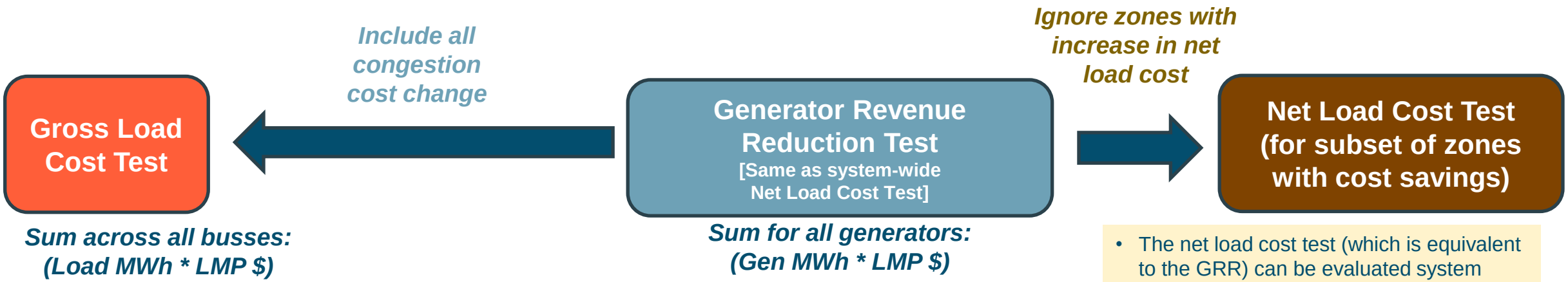
- A Gross Load Cost Test calculates the change in the energy cost charged to customers (loads)
- Calculated based on the sum of energy used in each location * the locational price for those loads
- A transmission line that reduces prices at load locations will create savings in the Gross Load Cost test

Generator Revenue Reduction Test
[Same as system-wide Net Load Cost Test]

Sum for all generators: (Gen MWh * LMP $)

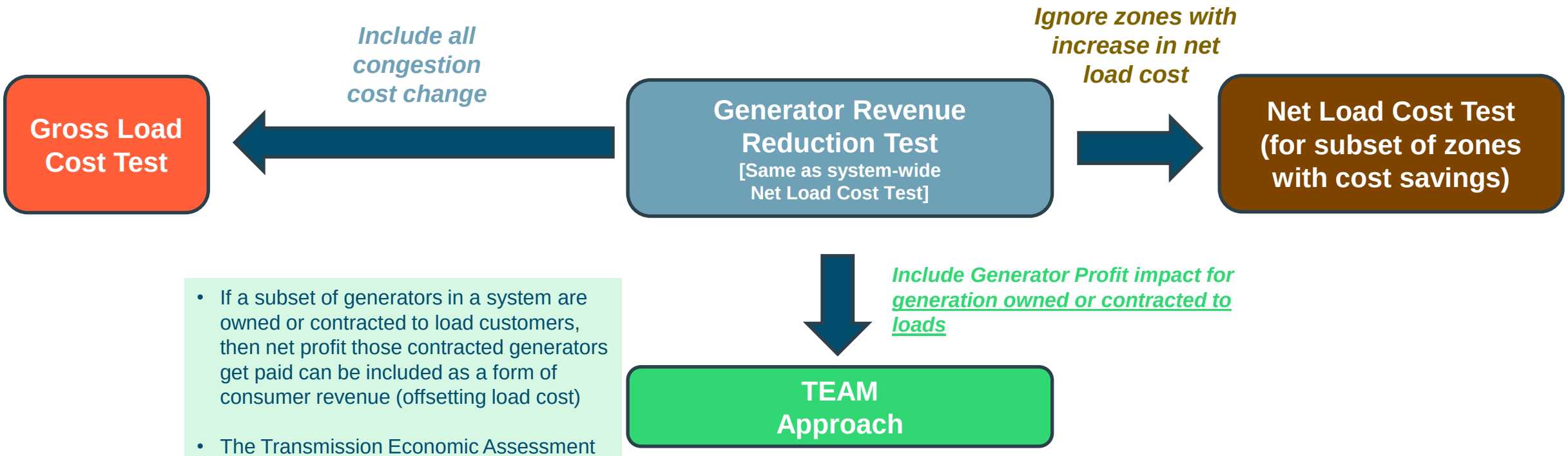
***Note: The Generator Revenue Reduction test will be mathematically equivalent to an ERCOT-wide net load cost test by calculating the gross load cost impact and subtracting the sum of congestion cost change (real power losses create a small additional difference)**

Transmission Cost Test Alternatives



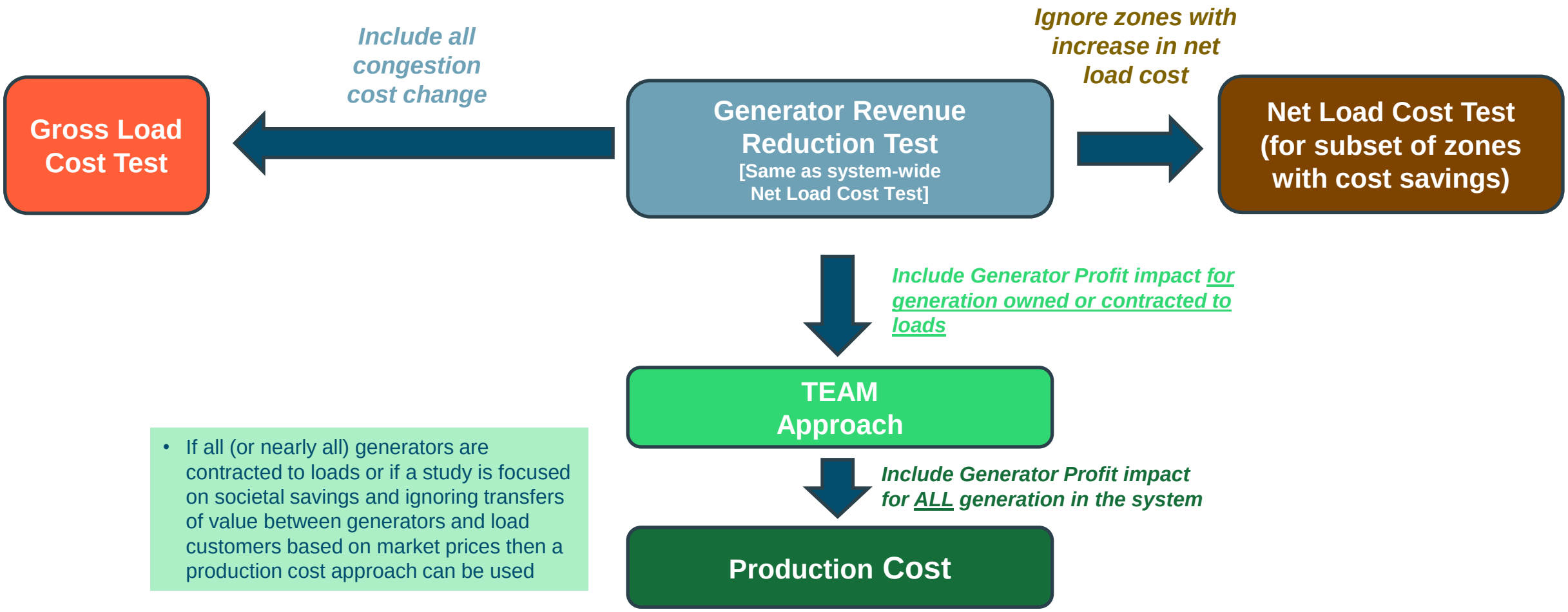
- The net load cost test (which is equivalent to the GRR) can be evaluated system wide or for a subset of zones in which cost are reduced when the transmission line is added, to reflect impact only in zones that benefit from the new line
- If focused on only zones with benefits, zones with increased cost to loads can be ignored

Transmission Cost Test Alternatives



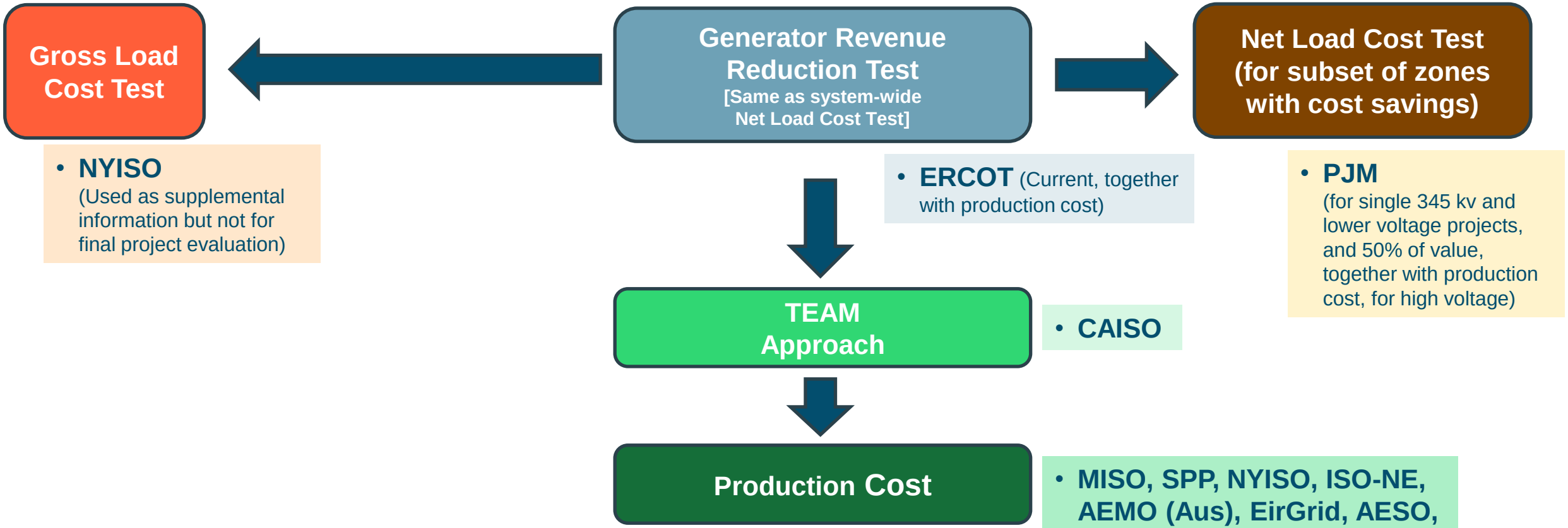
- If a subset of generators in a system are owned or contracted to load customers, then net profit those contracted generators get paid can be included as a form of consumer revenue (offsetting load cost)
- The Transmission Economic Assessment Methodology (TEAM) approach used by CAISO starts with a net load cost test, but includes the profit (revenue less production cost on units owned by or contracted to loads)

Transmission Cost Test Alternatives



- If all (or nearly all) generators are contracted to loads or if a study is focused on societal savings and ignoring transfers of value between generators and load customers based on market prices then a production cost approach can be used

Transmission Cost Test Alternatives: Where Applied by Jurisdiction



Recommended Cost Test for ERCOT & Comparison to Alternatives

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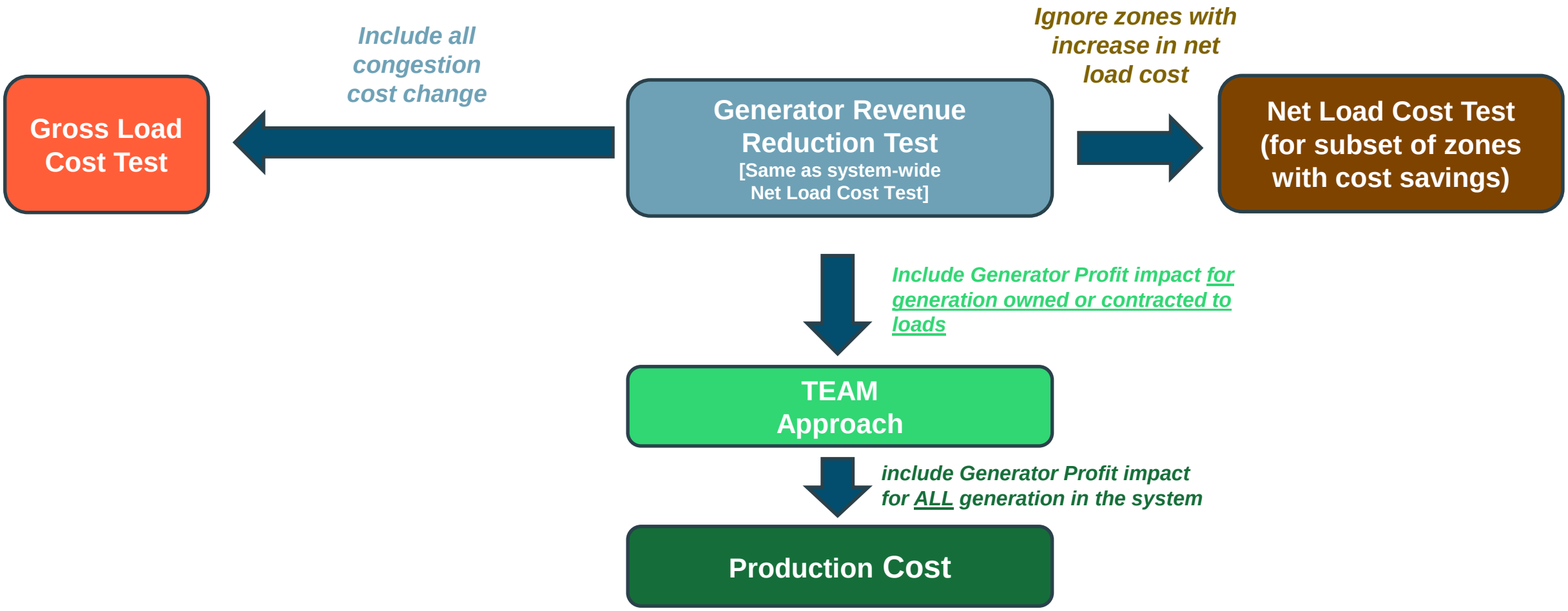
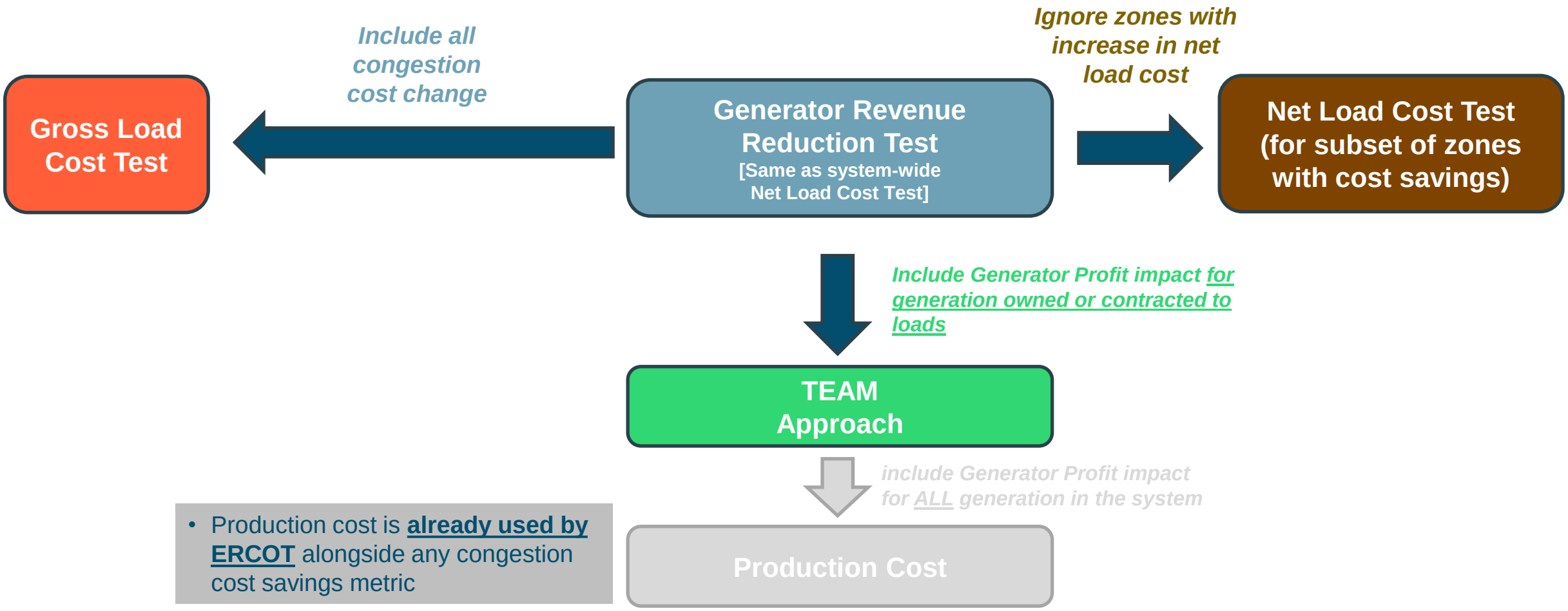
Evaluation Criteria for Cost Test Fit for ERCOT Market

- **E3 worked with ERCOT to define a set of relevant criteria against which to compare different congestion cost test options**
- **<u>Top Criteria</u>: Clear link to ERCOT load customer savings – this requires test to be compatible with key features of the ERCOT market including:**
  - Deregulated wholesale and retail market with independent generation, transmission, and load serving entities
  - Assignment of ERCOT transmission costs to loads on a system-wide basis
  - Auction of congestion revenue rights to mix of generators, financial entities, and loads
- **<u>Additional Criteria</u>:**
  - Implementable in reasonable time within ERCOT planning process framework
  - Provides additional perspective complementary to Production Cost Test that is already being used

Transmission Cost Test Alternatives: Identifying Best Options for ERCOT

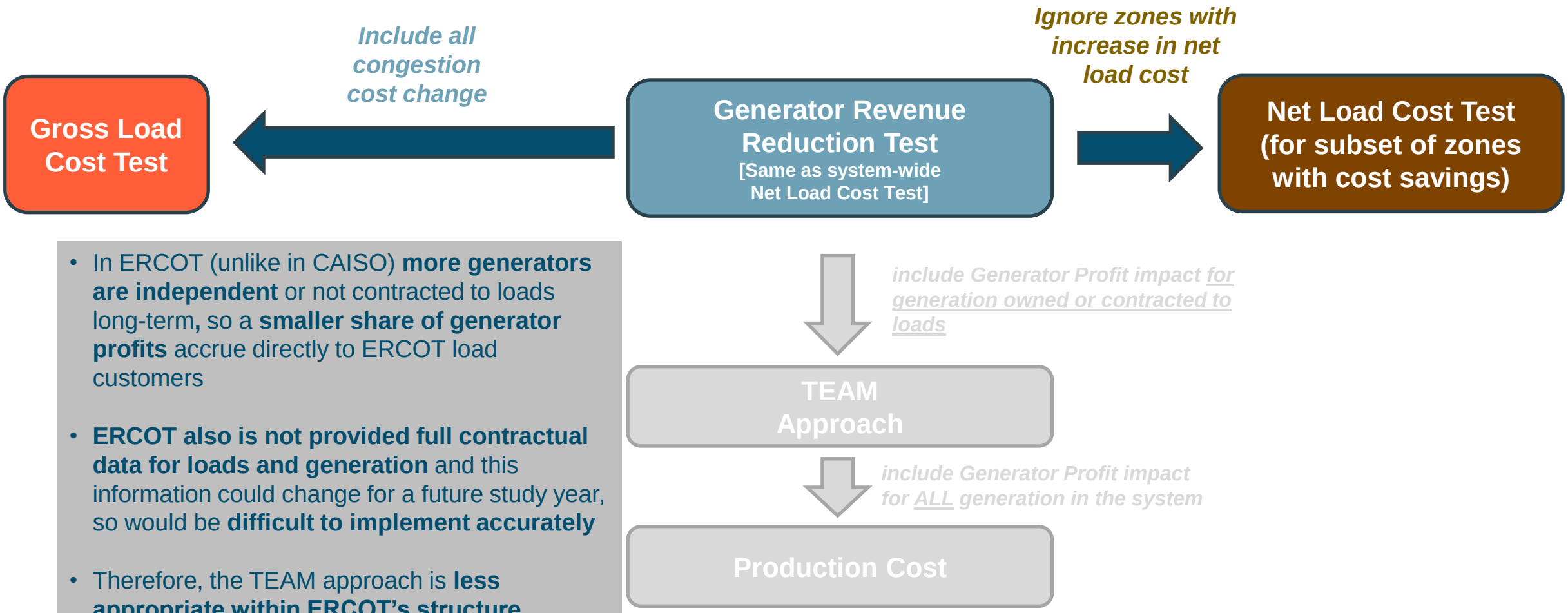


Transmission Cost Test Alternatives: Identifying Best Options for ERCOT



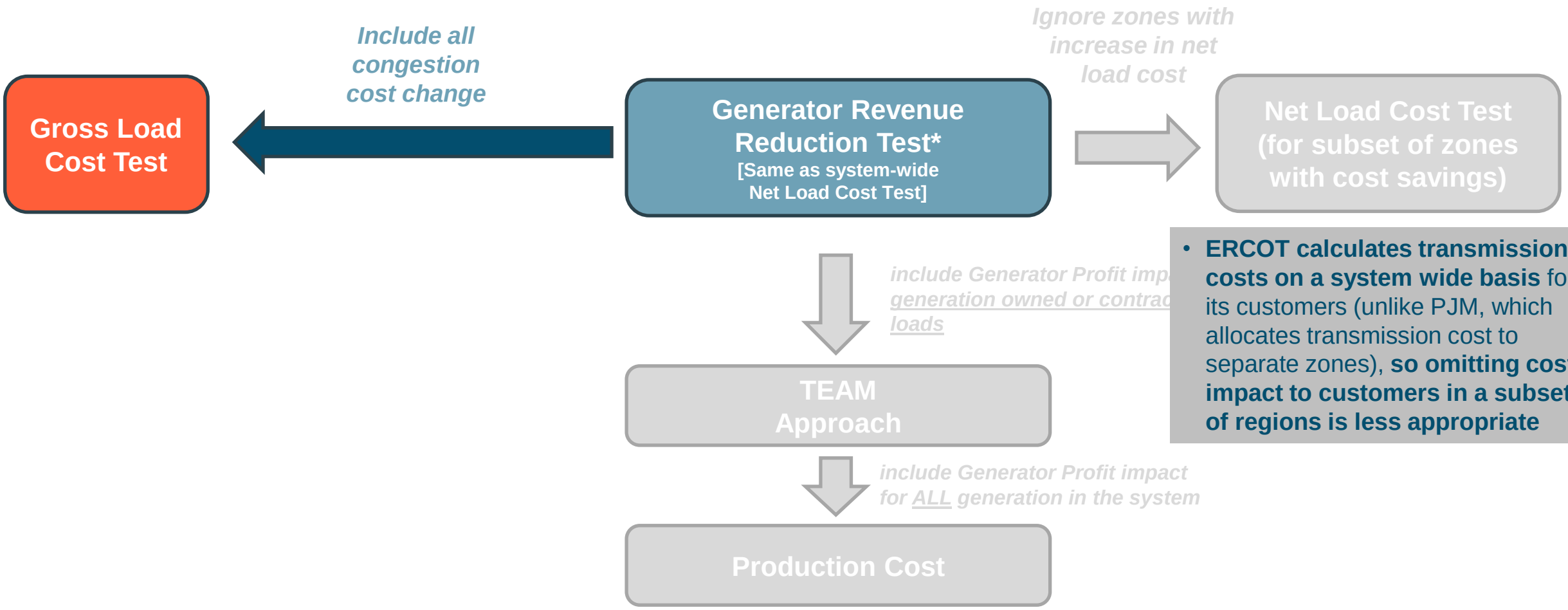
- Production cost is **already used by ERCOT** alongside any congestion cost savings metric

Transmission Cost Test Alternatives: Identifying Best Options for ERCOT



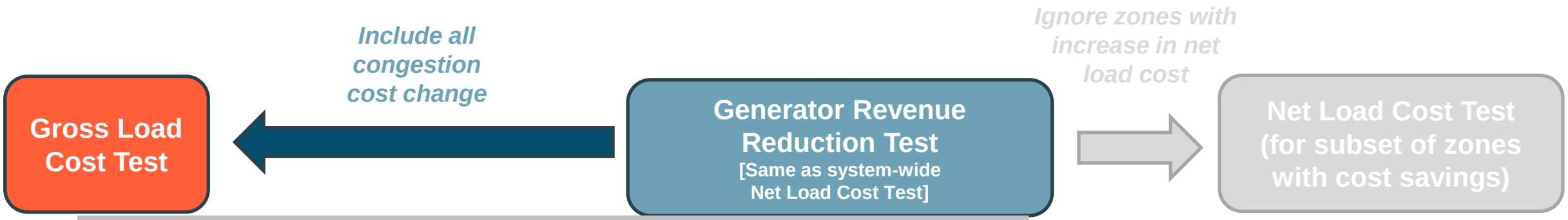
- In ERCOT (unlike in CAISO) **more generators are independent** or not contracted to loads long-term**,** so a **smaller share of generator profits** accrue directly to ERCOT load customers
- **ERCOT also is not provided full contractual data for loads and generation** and this information could change for a future study year, so would be **difficult to implement accurately**
- Therefore, the TEAM approach is **less appropriate within ERCOT's structure**

Transmission Cost Test Alternatives: Identifying Best Options for ERCOT



- **ERCOT calculates transmission costs on a system wide basis** for its customers (unlike PJM, which allocates transmission cost to separate zones), **so omitting cost impact to customers in a subset of regions is less appropriate**

Transmission Cost Test Alternatives: Identifying Best Options for ERCOT



- ERCOT's congestion revenue and auction process includes a **wide mix of participants including non-loads**; 3rd parties purchase some of the rights, and auction proceeds represent a portion, but not all of the congestion cost that accrues
- **ERCOT does not have sufficient data to isolate the impact of CRR auction revenue that accrues to load customers** so cannot identify the exact portion of CRR revenue to attribute to consumers, particularly for a future study year
- The GRR would risk over-accounting for loads' hedging of congestion in ERCOT, and **not fully capturing potential value of new transmission to ERCOT consumers**
- The **Gross Load Cost Test, which more conservatively accounts for the impact of congestion auction revenue to loads, is therefore the best option for ERCOT**

Comparison of Recommended Test to Alternative Options in ERCOT

- + Recommended option represents the best fit with current ERCOT market structure and rules
- + Should be implementable in ERCOT planning approach with limited additional modification
- + Provides additional, complementary information to what is already captured by ERCOT's production cost test

*Recommended Test

Criteria:	Generator Revenue Reduction Test	Gross Load Cost Test*	Zone-specific Net load Cost Test	TEAM Approach
1. Consistent with deregulated ERCOT market structure with independent generation and loads	Yes	Yes	Yes	No
2. Consistent with allocation of transmission costs to all ERCOT load customers rather than on a sub-zonal basis	Yes	Yes	No	Yes
3. Reflects the net impact of CRR and CRR auction revenue for load customers (limited by data availability)	Partial	Partial	Partial	Partial
4. Supports projects that reduces system-wide congestion cost	Partial	Yes	Partial	Partial
5. Provides additional information beyond production cost	Yes	Yes	Yes	Limited
6. Implementable in ERCOT's current framework	Yes	Yes	With Modifications	Yes

Summary of Recommended Test

- **E3 recommends ERCOT implement a System-Wide Gross Load Cost Test as the best option for the rules and structure of the ERCOT market**
- **This cost test directly estimates the impact of new transmission on energy costs to ERCOT consumers by calculating how it changes wholesale market prices paid at ERCOT customer locations**
  - If a new line enables prices to go down where customers are located, the reduction in annual cost will be reflected as a consumer benefit, and compared to the cost of building the transmission project
- **This approach will:**
  - Have a clear link to ERCOT customer savings, recognizing key features of the ERCOT market
  - Support projects that reduce system-wide transmission congestion in ERCOT
  - Provide a complementary perspective on transmission value to the production cost test
  - Be straightforward to implement using ERCOT's existing study approach and software

Thank You

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