2022 RTP Economic Study Update

Priya Ramasubbu, Sadegh Modarresi, Pengwei Du

June 13, 2023

Background

- Amended PUCT Substantive Rules §25.101(b)(3)(A)(i)
  - The levelized ERCOT-wide annual ***production cost savings*** attributable to the proposed project are equal to or greater than the first-year annual revenue requirement (13.2%) of the proposed project
  - The levelized ERCOT-wide annual ***congestion cost savings**** attributable to the proposed project is equal to or greater than the average of the first three years annual revenue requirement (12.9%) of the proposed project
  - ERCOT may recommend, and the commission may approve, a transmission line in the ERCOT region that pass either a congestion cost savings test or a production cost savings test
- ERCOT presented financial assumptions at the February 2023 RPG meeting

*ERCOT is in the process of the development of a new congestion cost savings test. As directed by the PUCT Rule, a generator revenue reduction test is used before the congestion cost savings test is available.

Summary

- ERCOT updated the 2022 RTP economic cases (2024 and 2027) and evaluated economics of 14 transmission projects using both the production cost savings test and the generator revenue reduction test

- ERCOT will continue to evaluate the economic performance of those transmission projects in the 2023 RTP economic study

Top Congested Constraints from 2024 and 2027 Study Years

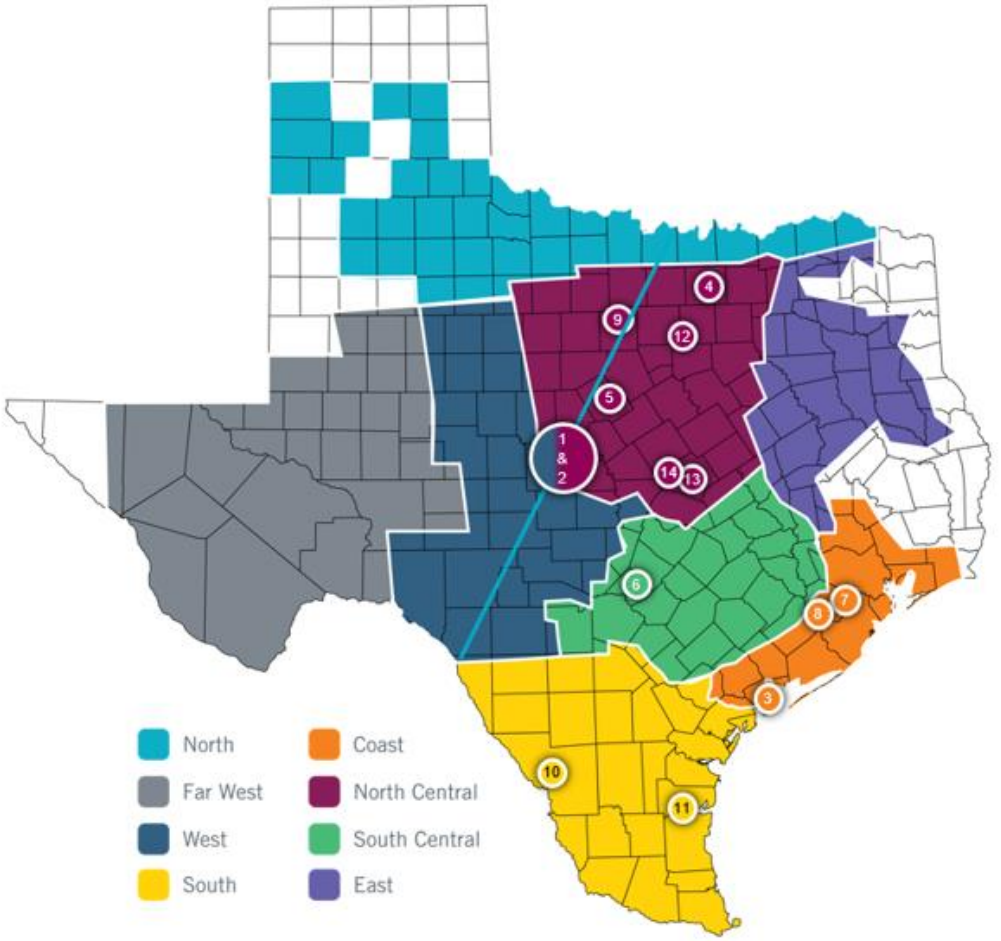
		Congestion Rent* (M$)	
Index	Constraint	2024	2027
1	Odessa EHV Switch to Rexall 138-kV line	336.0	-
2	West Texas Export Interface	104.1	72.0
3	Lewisville Switch to Dunham 345-kV line	63.9	73.4
4	North Edinburg to Lobo Interface	61.9	-
5	Nelson Sharpe to Rio Hondo Interface	42.1	-
6	South Texas Project to WA Parish 345-kV line	20.0	40.7
7	Lake Creek to Lake Hall Switch 345-kV line	12.5	31.3
8	Benbrook Switch to Decordova 345-kV line	15.2	26.1
9	Loyola Sub 138/69-kV transformer	8.6	26.0
10	Temple Switch to Tin Roof POD 138-kV line	22.9	24.9
11	Rocksprings to New Barksdale 69-kV line	22.5	0.8
12	George West Switching Station to Sigmor 138-kV line	20.7	0.1
13	Waco Northeast Tap to Waco North 138-kV line	5.3	19.1
14	Killeen Switch to Harker Heights South 138-kV line	8.7	16.8
15	Calaveras to Pawnee 345-kV line	16.1	2.8

*Congestion rent indicates areas of the system where economic transmission projects may be beneficial. It is not an indication of whether a project to reduce specific congestion would or would not meet the ERCOT economic planning criteria

Rows highlighted in green indicate constraints selected for project evaluation

Projects Selected for Evaluation

Index	Description
Project 1	West Texas Export Option 1 (4AC)*
Project 2	West Texas Export Option 2 (3AC+HVDC)*
Project 3	STP – WAP CKT 39 345-kV line upgrade*
Project 4	Lewisville Switch – Dunham 345-kV line upgrade*
Project 5	Comanche Switch – Comanche Tap – Shiloh – Hasse – Dublin 138-kV line upgrade**
Project 6	Bergheim 345/138-kV transformer upgrade**
Project 7	Upgrade of WAP – Bellaire CKT 50 and Smithers – Bellaire CKT 98, 345-kV double circuit**
Project 8	Upgrade of WAP – Obrien 345-kV double circuit**
Project 9	Barton Chapel Wind Farm – Oran Sub 138-kV line**
Project 10	North Laredo Switch to Piloncillo 138-kV Rebuild**
Project 11	Loyola Sub 138/69-kV transformer*
Project 12	Benbrook Switch to Decordova 345-kV line*
Project 13	Temple Switch to Tin Roof POD 138-kV line*
Project 14	Killeen Switch to Harker Heights South 138-kV line*



*Project selection based on congestion pattern observed in the 2022 RTP study for years 2024 and 2027

**Project recommended for evaluation by respective TSP

PCS and GRR Test Results

Index	Description	Study Year	Estimated Circuit Miles	Levelized PCS/Cost Ratio (%)[1][3]	Levelized GRR/Cost Ratio (%)[2][3]
Project 4	Lewisville Switch – Dunham 345-kV line upgrade	2024/2027	13	***14.1***	-
Project 7	Upgrade of WAP – Bellaire CKT 50 and Smithers – Bellaire CKT 98, 345-kV double circuits	2024/2027	25	-	***17.7***
Project 13	Temple Switch to Tin Roof POD 138-kV line + Second circuit	2024/2027	16	-	***40.6***
Project 14	Killeen Switch to Harker Heights South 138-kV line + Downstream Upgrades	2024/2027	16	-	***21.9***

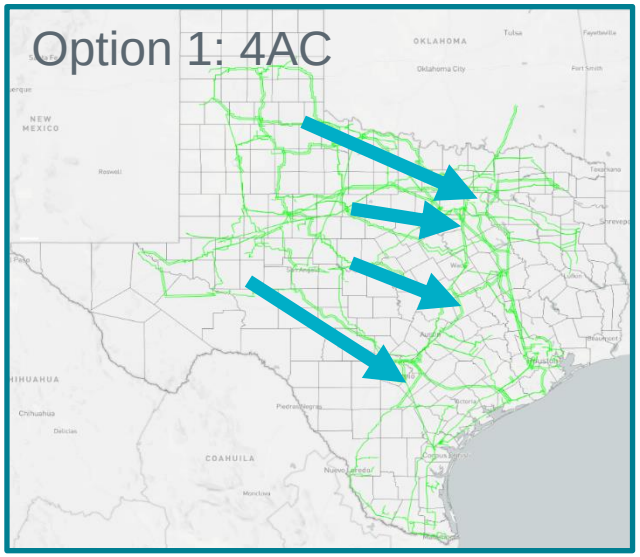
A proposed transmission system upgrade is economically viable if 1) it satisfies a production cost savings (PCS) test or 2) it satisfies generator revenue reduction (GRR) test requirement if it does not adversely impact the overall societal benefit

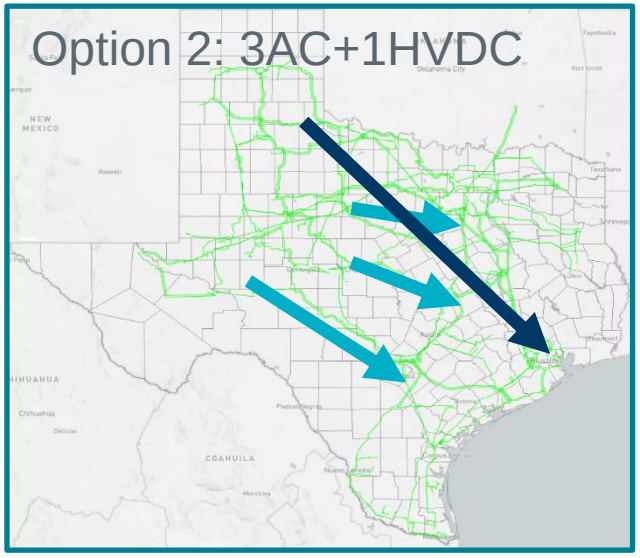
[1] The levelized production cost savings (PCS) to cost ratio was derived using generic cost estimates for the transmission project.
[2] The levelized generator revenue reduction (GRR) to cost ratio was derived using generic cost estimates for the transmission project.
[3] The levelized PCS/GRR was calculated based on the study results for 2024 and 2027.

West Texas (WTX) Export

Preamble

- West Texas (WTX) export stability limit in the base case is measured as the sum of the flow on the existing sixteen 345-kV circuits
- 90% of the calculated stability limit is applied in the economic assessment, which is consistent with the Transmission and Security Operating Procedure
- Both option 1 and option 2 as proposed in Long-Term West Texas Export Study Report were evaluated
- Simulation was performed for the 2027 study year
- Generator revenue increase was observed for both options
- Positive production cost saving was observed for both options
- The benefit to cost ratio in the production cost savings test are 1.7% and 1.3% for the option 1 and option 2 respectively

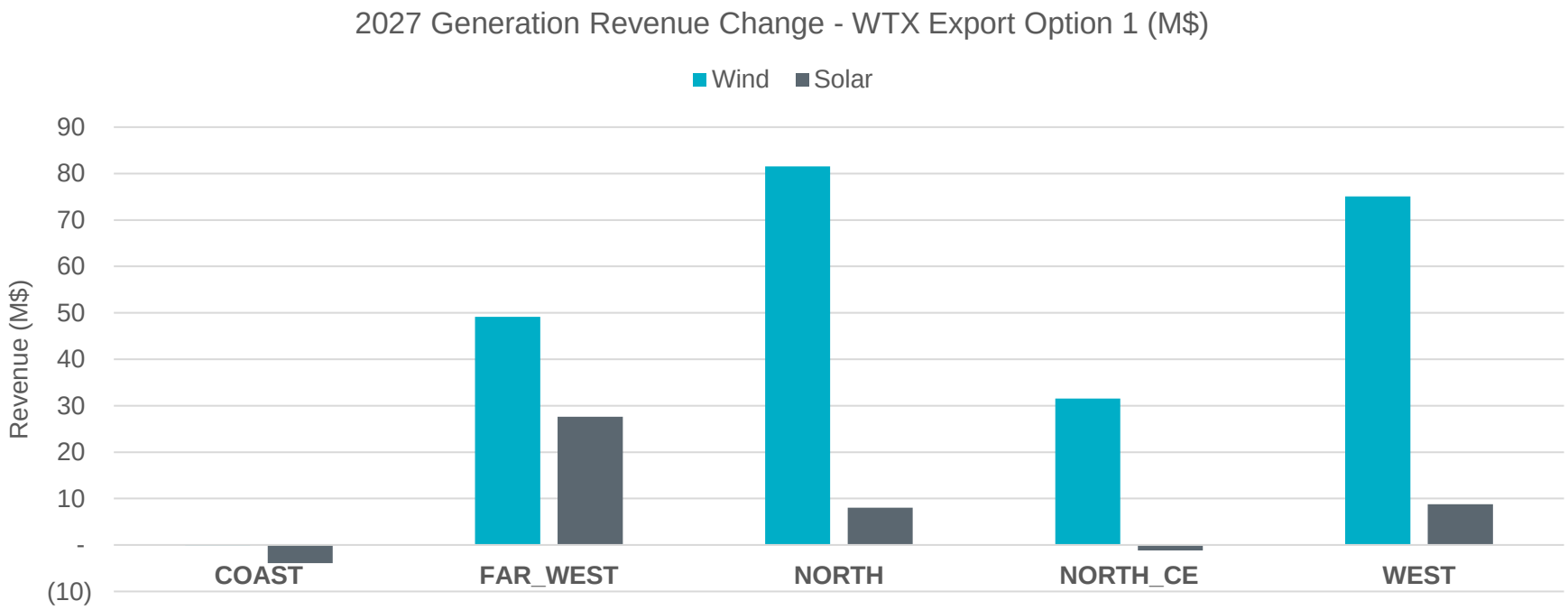




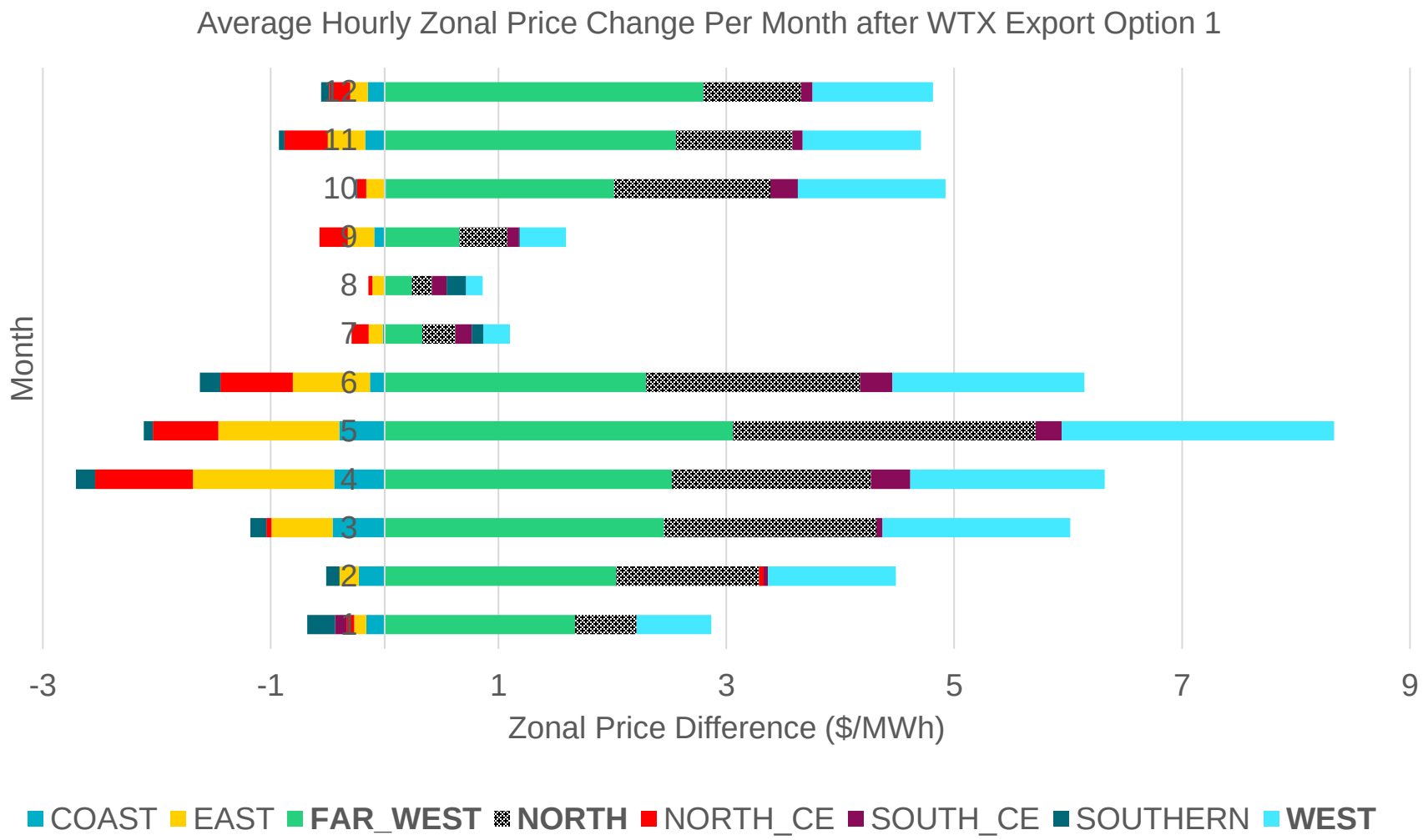
For illustrative purposes

WTX Export Option 1

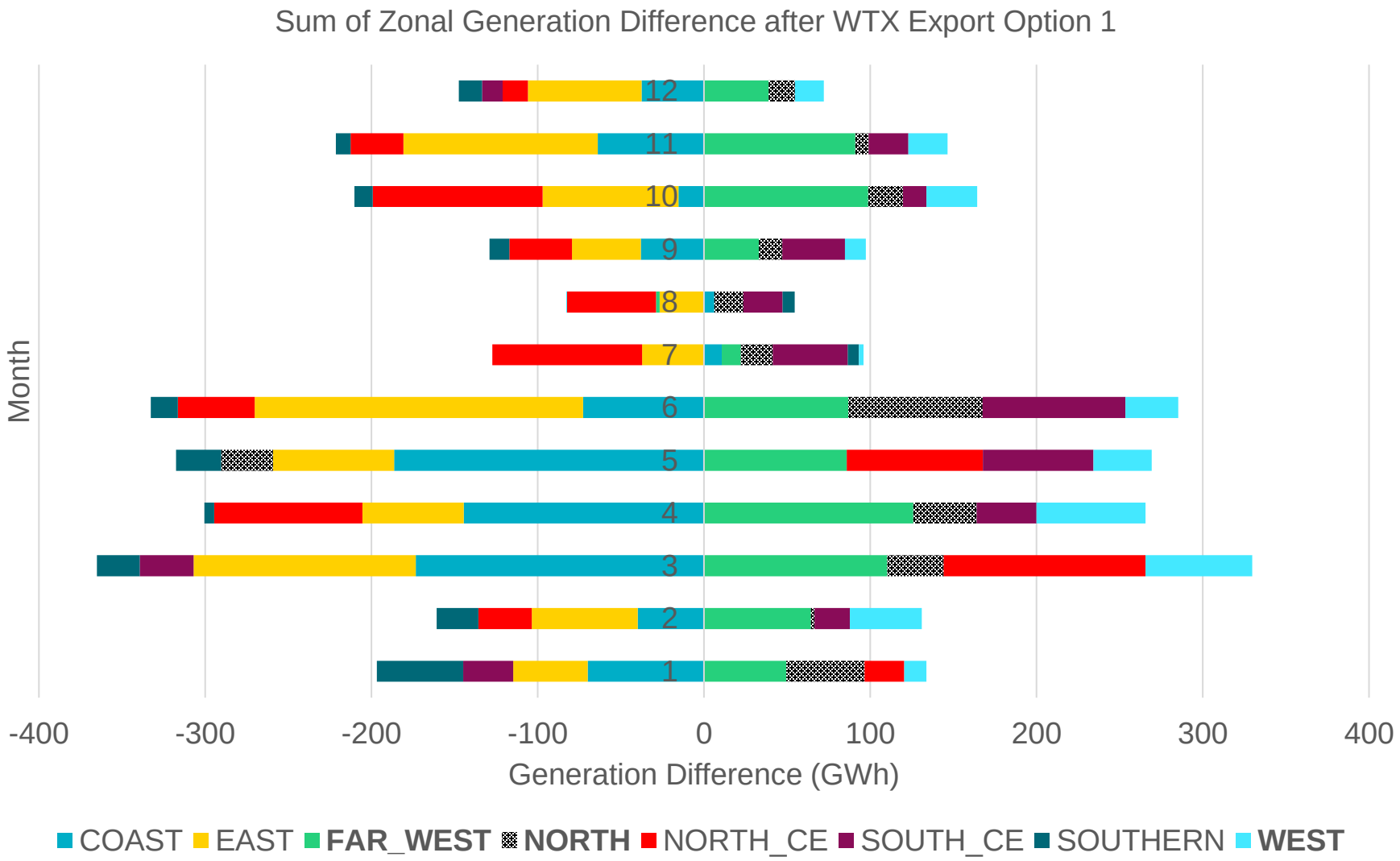
- Generation revenue is increased by $268M in study year 2027
  - Generation revenue increase is mainly observed in renewable-rich areas (**Far West, North, West**)
  - Generation revenue increases are due to both locational marginal price (LMP) increase and curtailment reduction in **West, Far West, and North**
- Although the project results in ~**$47M production cost saving in 2027**, the benefit to cost ratio is less than the first-year revenue requirement due to large estimated capital cost ($2,738M)



WTX Export Option 1

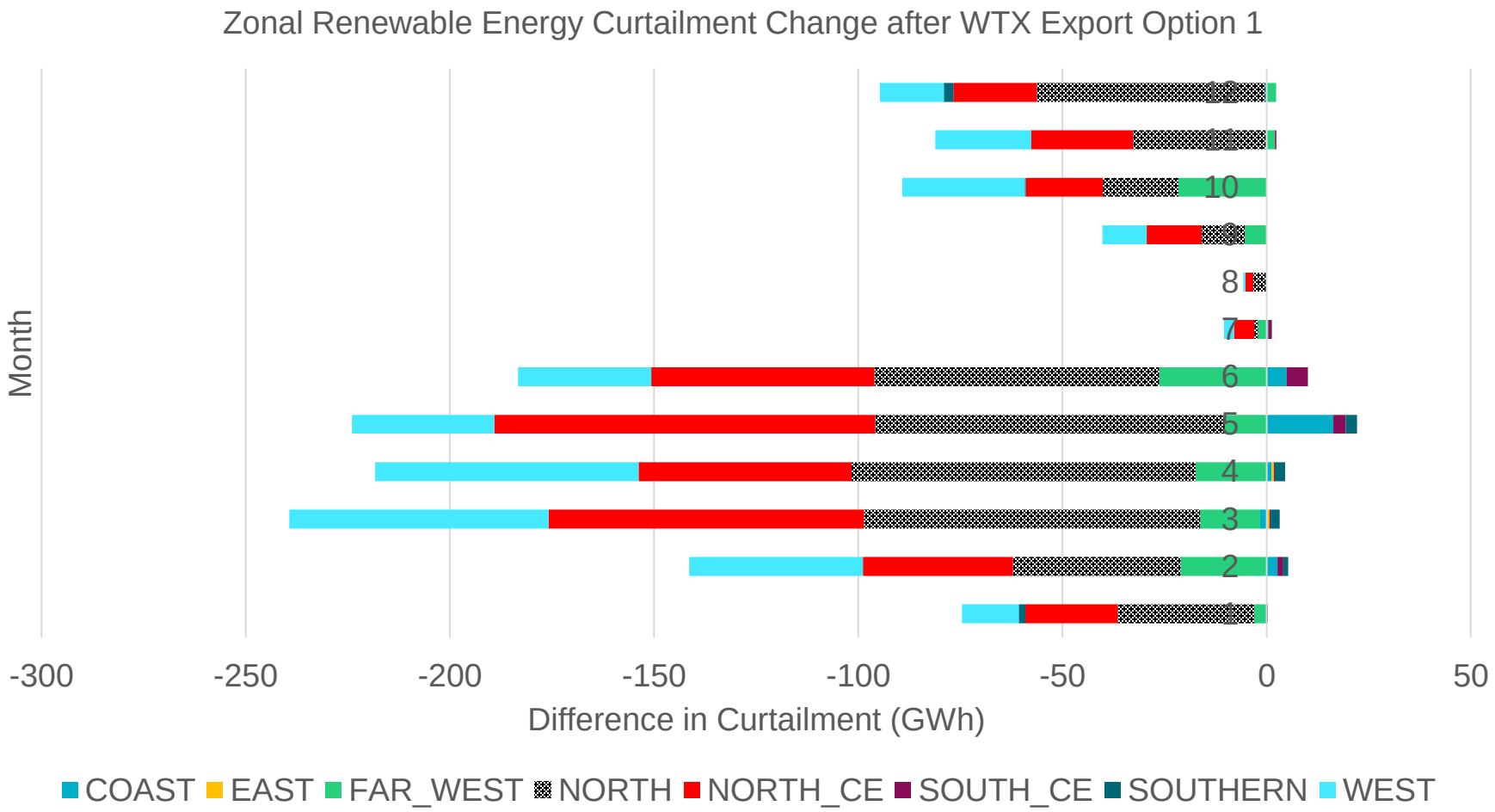


WTX Export Option 1 (Cont.)



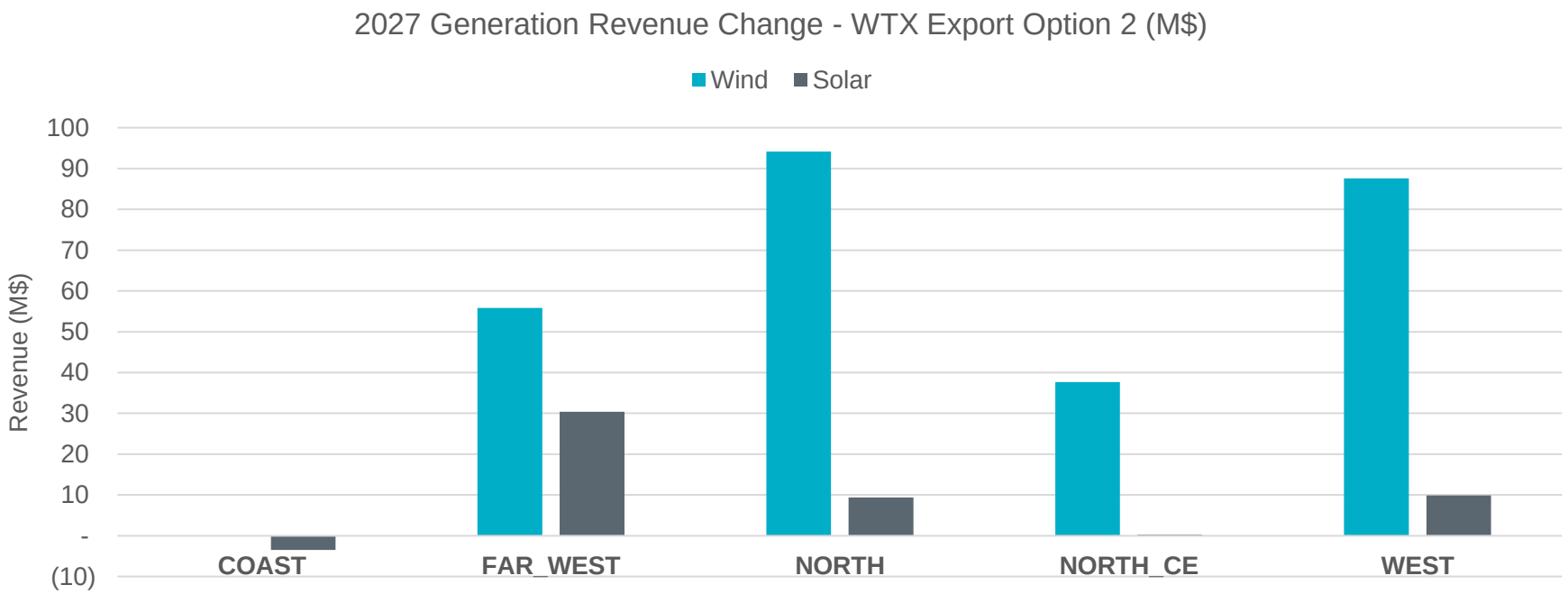
WTX Export Option 1 (Cont.)

- Annual renewable energy curtailment is reduced by 1,350 GWh in comparison to the base case

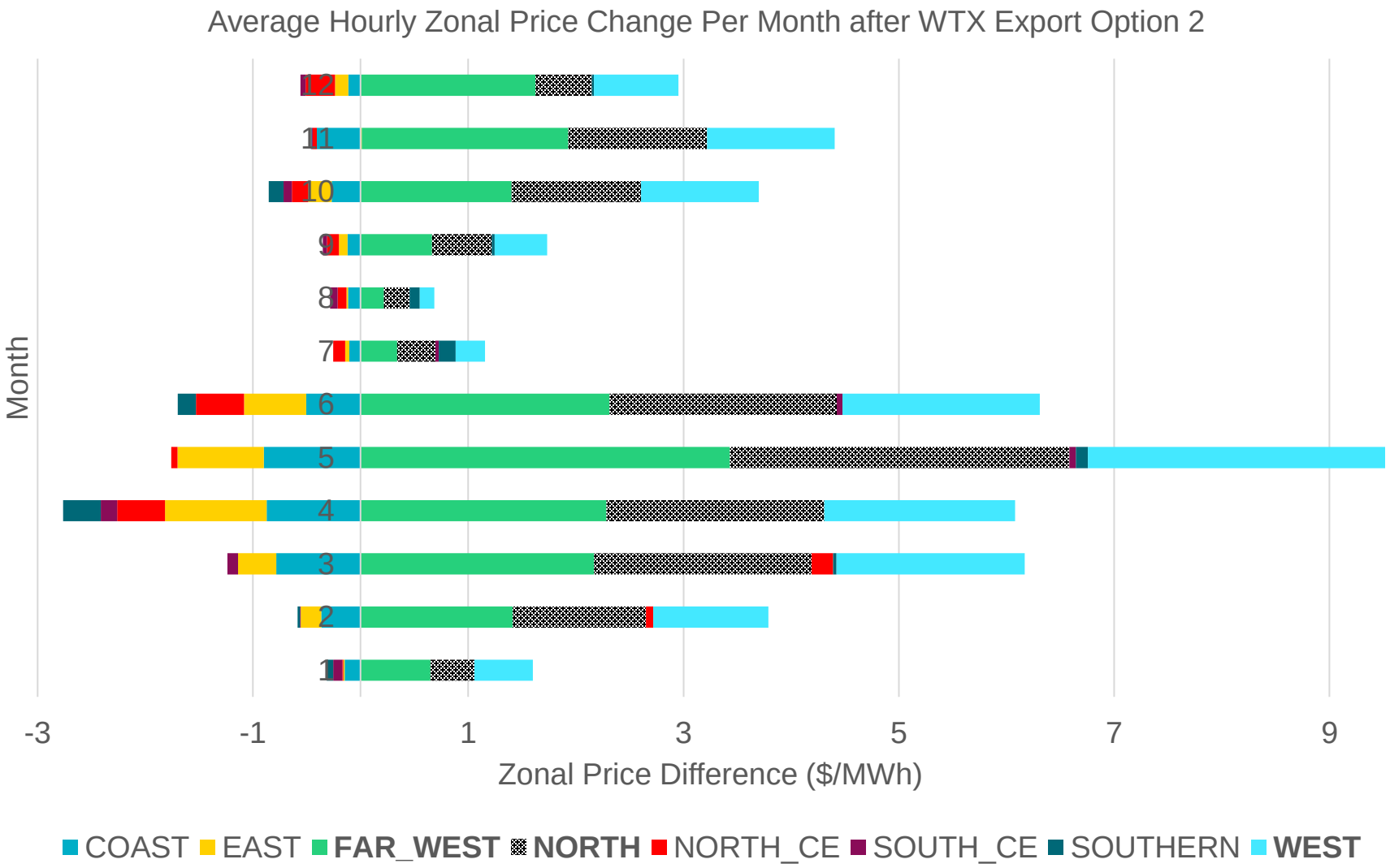


WTX Export Option 2

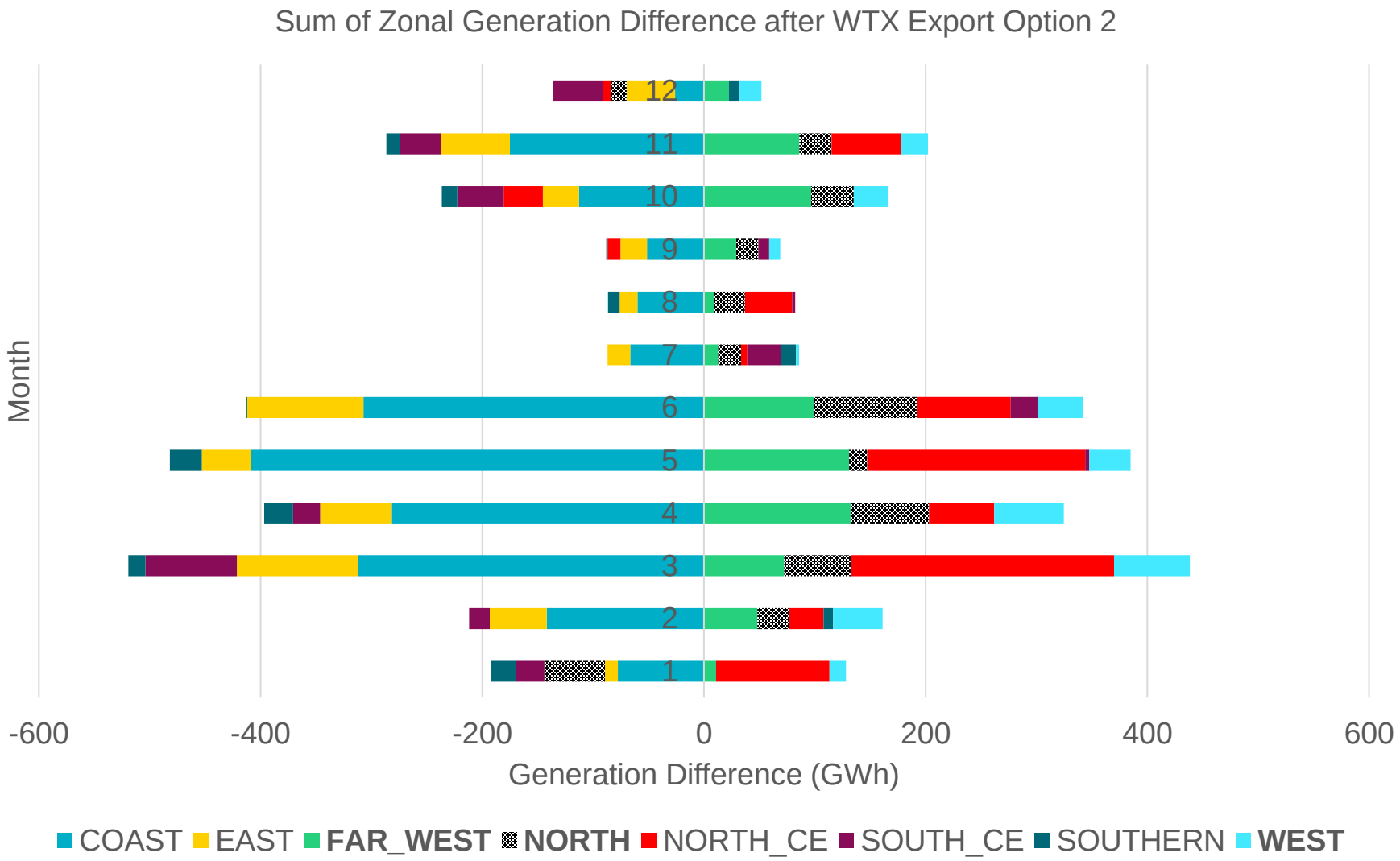
- Generation revenue is increased by $303M in study year 2027
  - Generation revenue increase is mainly observed in renewable-rich areas (**Far West, North, West**)
  - Generation revenue increases are due to both LMP increase and curtailment reduction in **West, Far West, and North**
- Although the project result in ~**$66M production cost saving**, the benefit to cost ratio is less than the first-year revenue requirement due to large estimated capital cost ($5,203M)



WTX Export Option 2 (Cont.)

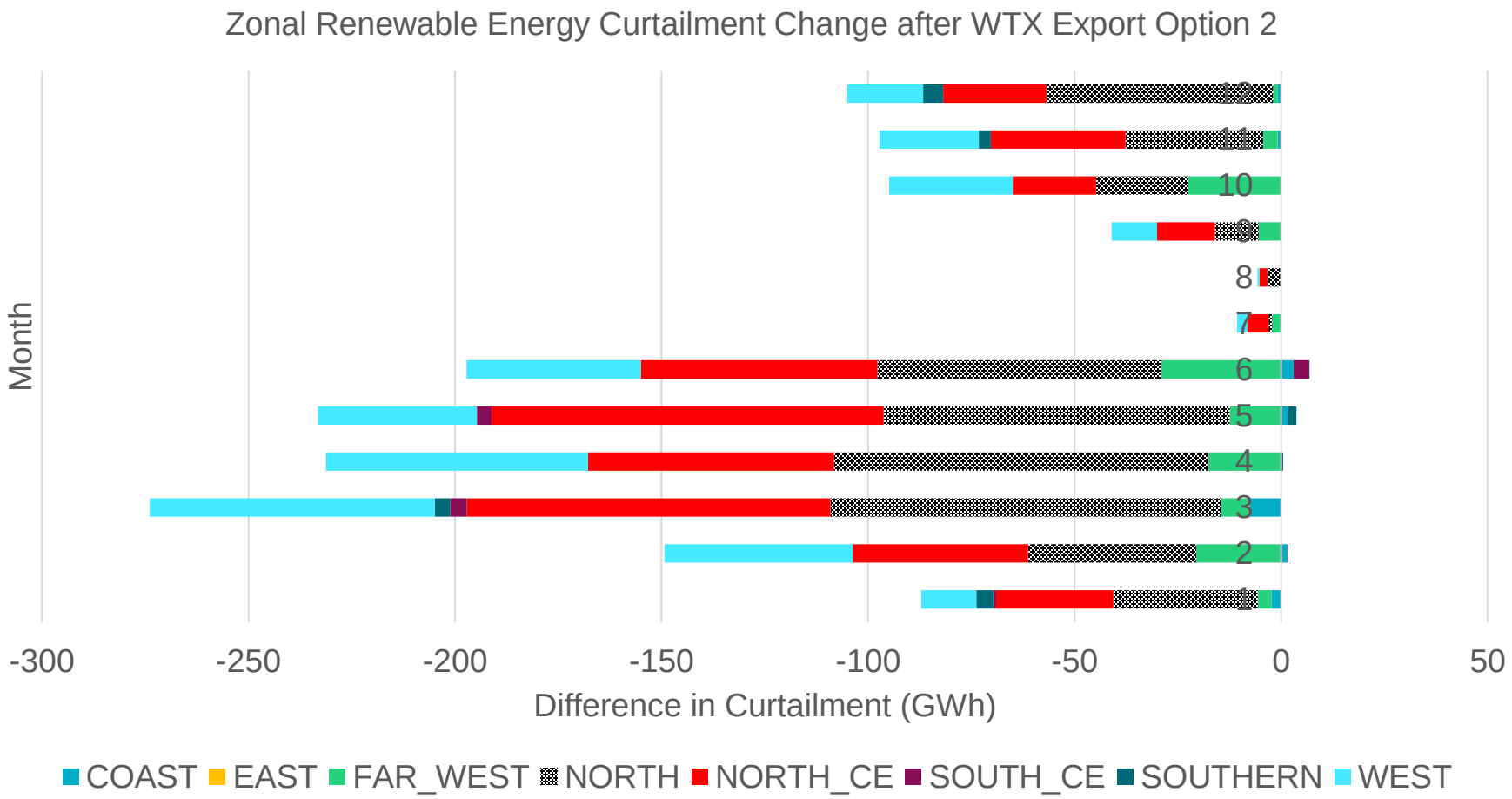


WTX Export Option 2 (Cont.)



WTX Export Option 2 (Cont.)

- Annual renewable energy curtailment is reduced by 1,513 GWh in comparison to the base case



Next Steps

- ERCOT evaluated the cost benefits of 14 transmission projects for 2022 RTP economic study based on the generic cost estimation
  - Per the RPG review process, the economic performance of these projects should be evaluated using the capital cost from TSPs
- ERCOT will post an addendum to 2022 RTP report summarizing the study results
- ERCOT will continue to evaluate the economic performance of the transmission projects in the 2023 RTP economic study and 2024 LTSA, using both production cost savings test and generator revenue reduction test, until the congestion cost savings test is developed and adopted

Questions

- Pengwei Du (Pengwei.du@ercot.com)
- Ping Yan (Ping.yan@ercot.com)

Project Descriptions

Index	Project Title	Description
Project 1	West Texas Export Option 1 (4AC)	- Add Bakersfield (76002) – Howard (5068) 345-kV double circuit - Add Brown (1444) – Bell (3687) 345-kV double circuit - Add Clear Crossing (60515) – Watermill (2427) 345-kV double circuit - Add Tesla (60501) – Royse (2478) 345-kV double circuit
Project 2	West Texas Export Option 2 (3AC+HVDC)	- Add Bakersfield (76002) – Howard (5068) 345-kV double circuit - Add Brown (1444) – Bell (3687) 345-kV double circuit - Add Clear Crossing (60515) – Watermill (2427) 345-kV double circuit - Add Tesla (60501) – King (40900) HVDC line
Project 3	STP – WAP CKT 39 345-kV line upgrade	- Upgrade South Texas Project (5915) – WA Parish (44000) 345-kV line
Project 4	Lewisville Switch – Dunham 345-kV line upgrade	- Upgrade Lewisville Switch (646) – Dunham (21851) 345-kV line
Project 5	Comanche Switch – Comanche Tap – Shiloh – Hasse – Dublin 138-kV line upgrade	- Upgrade Comanche Switch (Oncor) (1441) – Comanche Tap (1650) – Shiloh (290) – Hasse (1649) – Dublin (1636) 138-kV line
Project 6	Bergheim transformer + Downstream Upgrades	- Upgrade Bergheim (7770-7170) 345/138-kV transformer - Upgrade Bergheim (7170) – Antler (7171) – Highway 46 (7177) 138-kV line - Upgrade Bergheim (7170) – Fair Oaks (7169) – Fair Oaks Ranch (5470) 138-kV line
Project 7	Upgrade of WAP – Bellaire CKT 50 and Smithers – Bellaire CKT 98, 345-kV double circuits	- Upgrade WA Parish (44000) – Bellaire (47000) ckt 50 and Smithers (44650) – Bellaire (47000) ckt 98, 345-kV double circuit

Project Descriptions

Index	Project Title	Description
Project 8	Upgrade of WAP – Obrien 345-kV double circuits	- Upgrade of WA Parish (44000) – Obrien (44500) 345-kV double circuit
Project 9	Barton Chapel Wind Farm – Oran Sub 138-kV upgrade	- Upgrade Oran Sub (1571) – Barton Chapel Wind Farm (1599) 138-kV line
Project 10	North Laredo Switch – Piloncillo 138-kV Rebuild	- Rebuild North Laredo Switch (88909) – Piloncillo (80481) 138-kV line
Project 11	Loyola Sub 138/69-kV transformer + Downstream Upgrades	- Upgrade Loyola (5648-5650) 138/69-kV transformer - Upgrade Ricardo Sub (5645) – Riviera Sub (5646) – Loyola Sub (5650) 69-kV line
Project 12	Benbrook Switch – Decordova 345-kV line upgrade	- Upgrade Benbrook Switch (1873) – Decordova (1890) 345-kV line
Project 13	Temple Switch to Tin Roof POD 138-kV line + Second circuit	- Expand Tinroof substation (loops in the 345-kV double circuit line from Temple SS (3414) to Bell County East Switch (3687)) and add two 345/138-kV transformers - Upgrade the Temple Switch (3415) to Temple Southeast (3612) 138-kV line - Upgrade the Temple Switch (3415) to Tin Roof Pod (3485) 138-kV line - Upgrade the Temple Switch (3415) to Temple (3607) 138-kV line - Upgrade the Scott and White POI (3602) to Temple Southeast (3612) 138-kV line - Upgrade the Scott and White POI (3602) to Temple South (3611) 138-kV line - Upgrade the Temple North (13608) to Temple Elm Creek (13662) 138-kV line - Upgrade the Temple North (3608) to Temple Elm Creek (13662) 138-kV line - Add new second 138-kV circuit from Temple Switch (3415) to Tin Roof Pod (3485)
Project 14	Killeen Switch to Harker Heights South 138-kV line + Downstream Upgrades	- Upgrade Killeen Switch (3423) – Harker Heights South (3633) – Belton Southwest (13610) 138-kV line