Long-Term West Texas Export Special Study

ERCOT Transmission Planning

ESIG Fall Workshop

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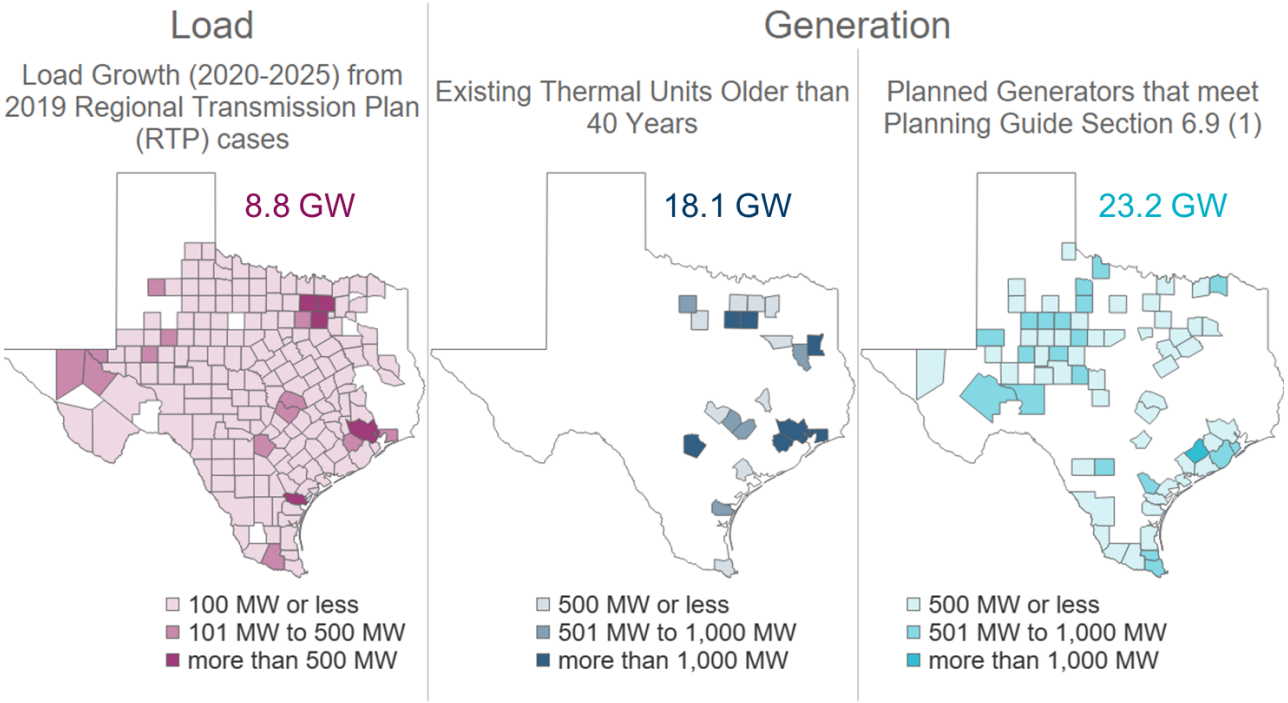
Outline

- Background
  - ERCOT system trends
  - Study case assumptions
- Key results from study year 2030
  - Base case findings
  - Performance of tested improvement options

ERCOT System Load and Generation Trends

- Increased transfers from renewable-rich regions to load centers, continued load growth, and the retirement of thermal generation closer to load centers all contribute to an increase in transmission constraints near load centers.
- The full benefit of new transfer paths to relieve stability-related export constraints cannot be realized without corresponding relief to local transmission constraints.
- Holistic solutions that address both stability constraints and downstream local transmission constraints are needed.

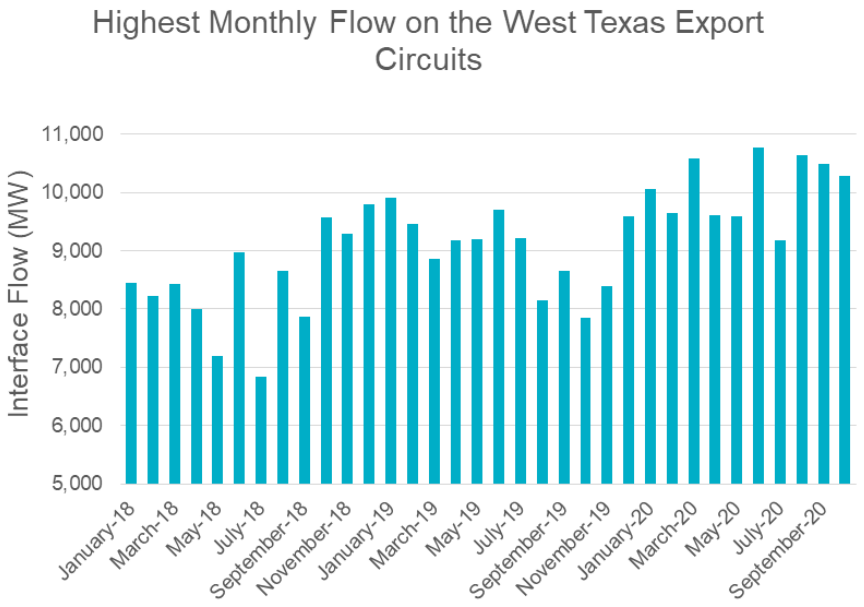


Existing thermal unit capacities are from the Final Winter 2020/21 SARA report and planned generation capacities are from the October 2020 GIS report. http://www.ercot.com/gridinfo/resource

West Texas Export Trends

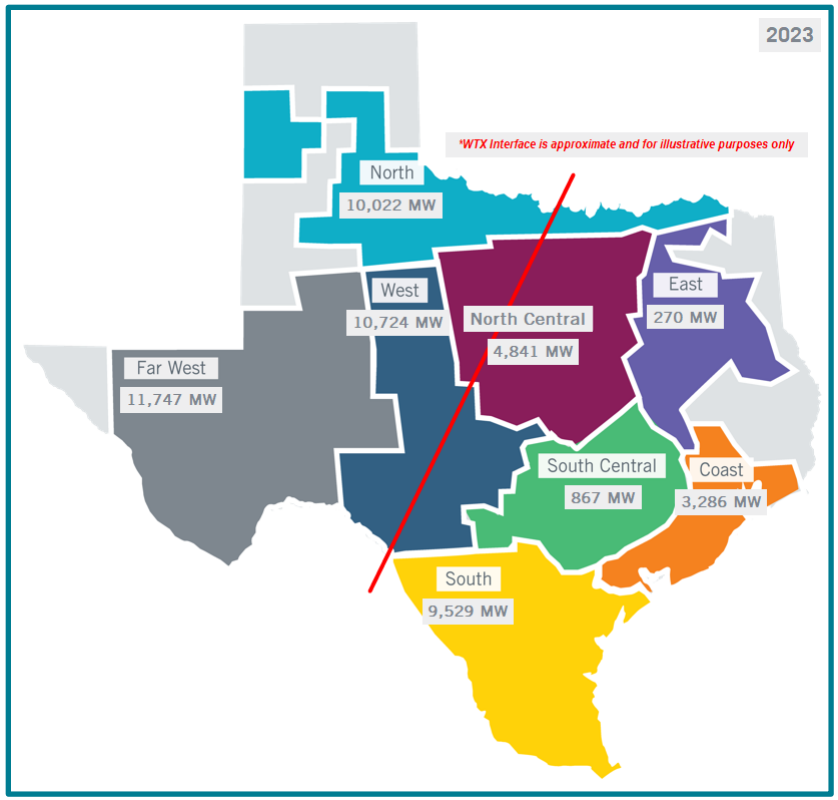
- West Texas (WTX) Export is a stability constraint whose interface flow is measured as the sum of the flow on 16 existing West/East 345-kV circuits

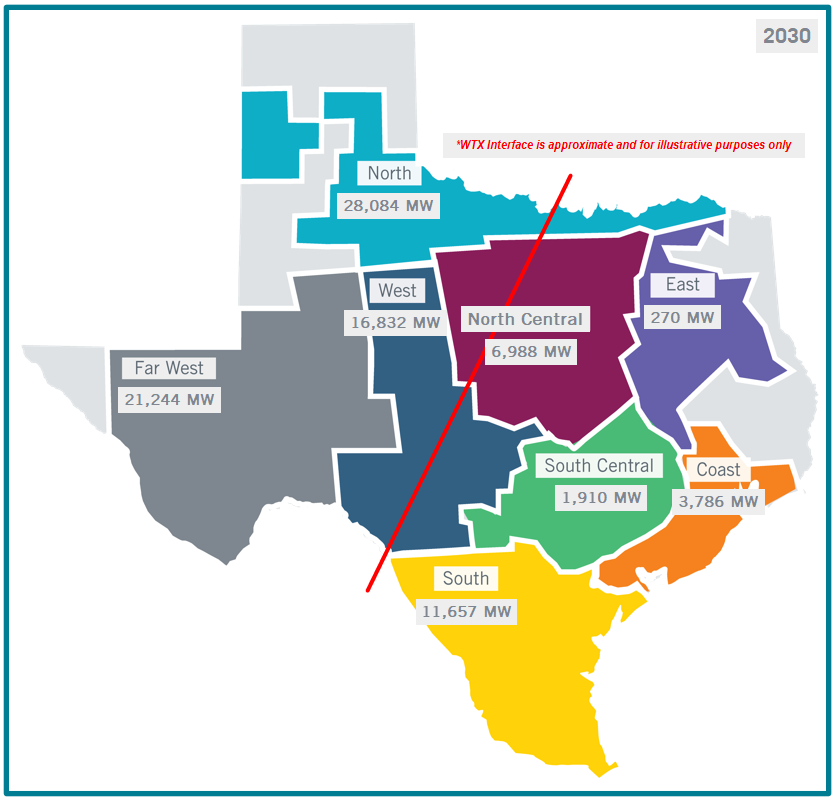
For illustrative purposes



- ERCOT initiated the West Texas Export Special Study in late 2020 to develop a roadmap of transmission improvements that will allow more power transfers from West Texas to ERCOT load centers.
- It is the first-of-its-kind study within ERCOT combining both dynamics and economics.

IBR Capacity and Load in the Study Cases



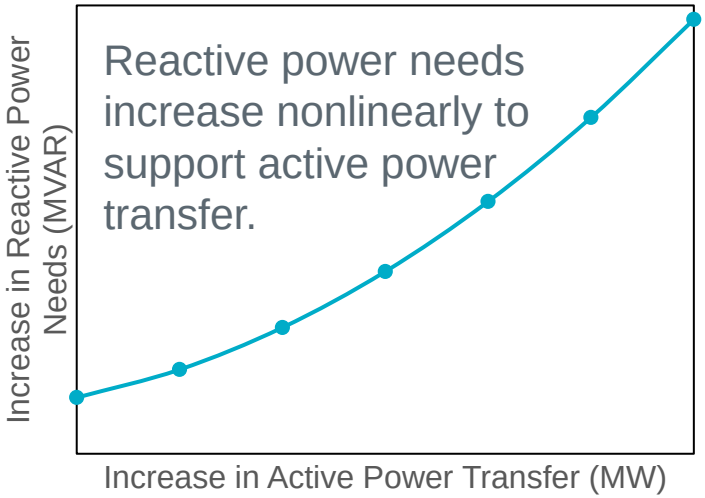


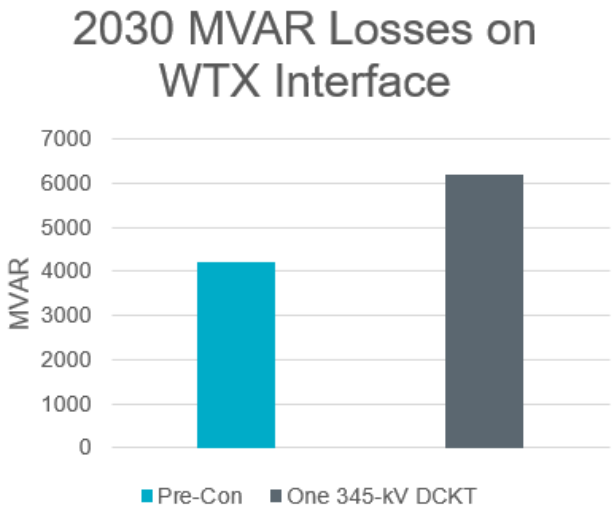
Scenarios	IBR Capacity(1)	System Load(3) in the Reliability Cases
2023	~ 53.3 GW(2)	~42 GW
2030	~ 92.8 GW	~48 GW

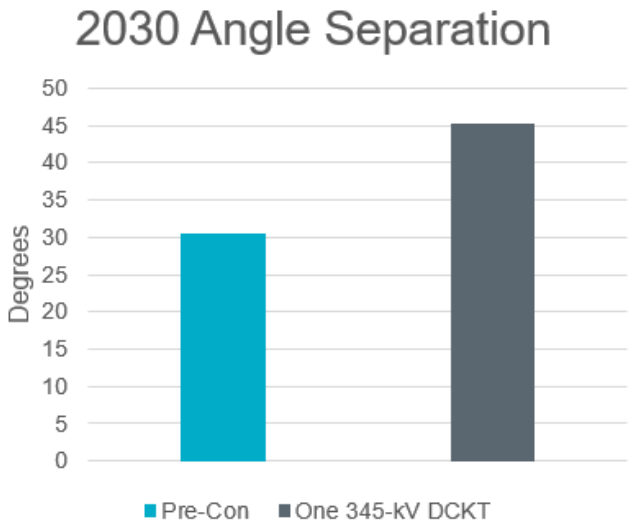
(1). Maps show IBR capacity by Weather Zone (2). As of 12/31/2020 (3). Economic cases use 8760 hourly load profiles

Y2030 Reliability Assessment – Base Case

- Long distance power transfer led to
  - Significant increase of reactive power consumption under normal and outage conditions
  - Significant angle separation on major transfer corridors under normal and outage conditions
  - Both stressed conditions would lead to dynamic instability prior to reaching thermal overload



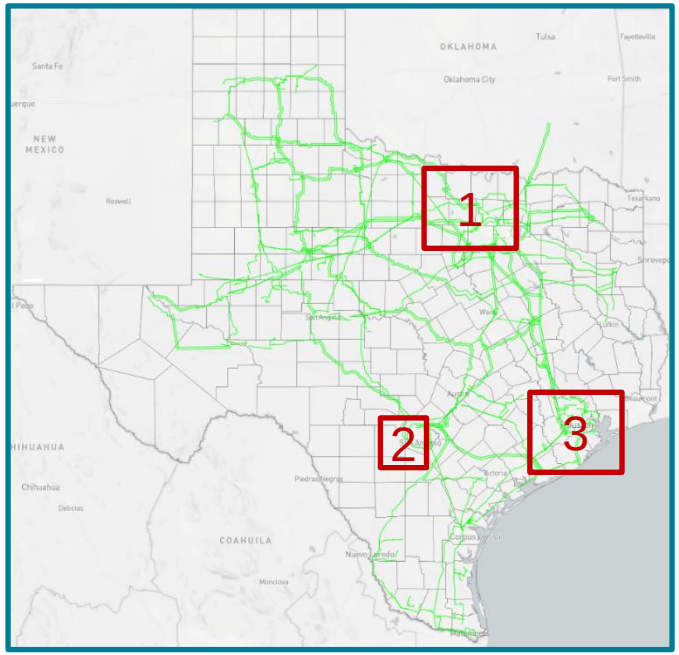




Y2030 Economic Assessment – Base Case

- 88% of total system IBR curtailment is behind the WTX interface.

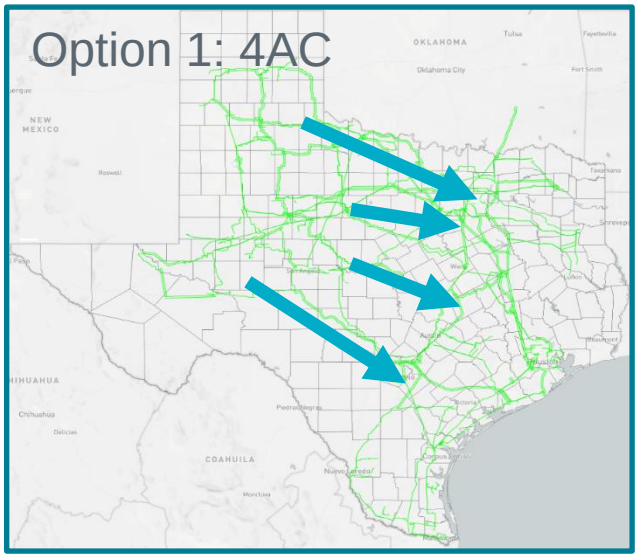
- Significant congestion is observed in the following areas in the Y2030 base case:
  1. Northwest DFW area
  2. Western San Antonio
  3. North Houston (Houston Import)

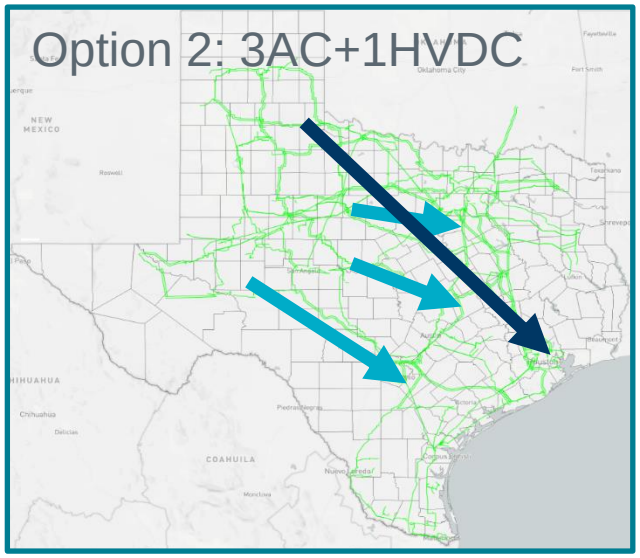


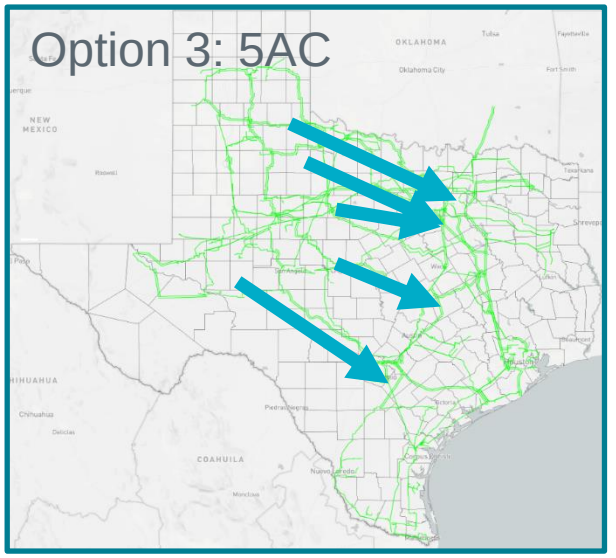
Considerations in Identifying System Improvements

- Stability issues and needs
- Thermal constraints and congestion
- Generally, the options to address stability may not be the best ones for thermal related congestion since the cause of stability and thermal issues are not always the same.
  - Stability: more relevant to impedance and controls
  - Thermal: more relevant to thermal rating
- Both AC only and HVDC+AC hybrid options have been tested for Y2030 improvements

Tested System Improvements for WTX Transfer



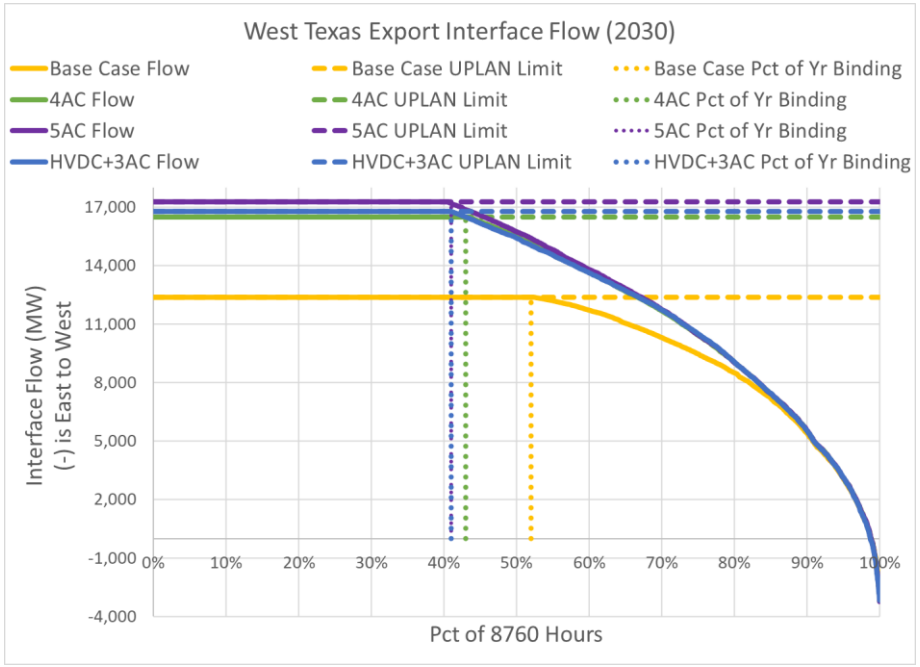


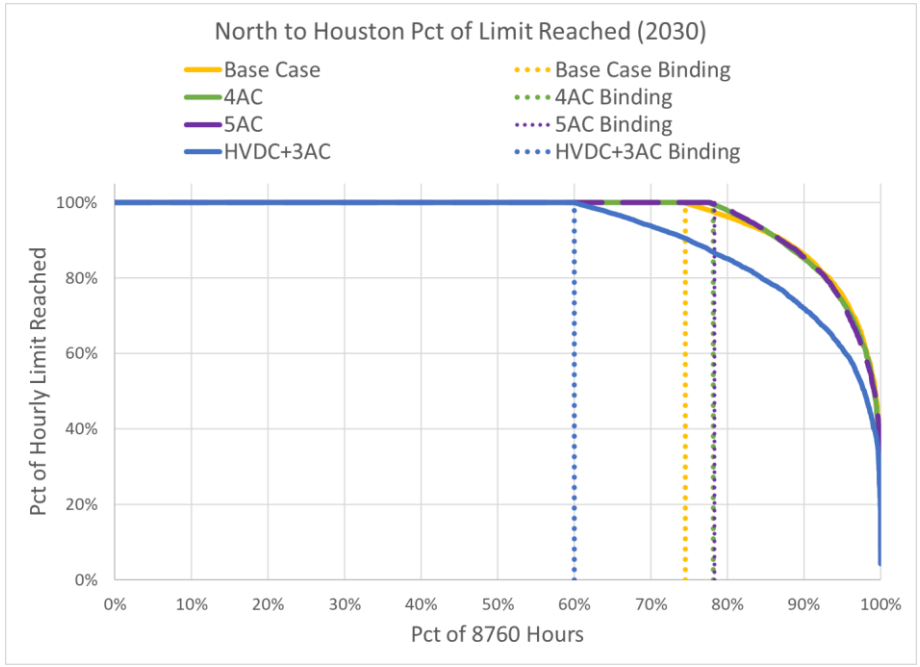


Option[1]	Description	Estimated Circuit Miles[4]	Estimated WTX Transfer Capability in VSAT (GW)
	Base Case		13.8
1	4AC[2]	~1,027	18.3
2	3AC and 1HVDC[3]	~721 (AC) and ~545 (HVDC)	18.6
3	5AC	~1,292	19.2

(1). Arrows represent general locations; specific locations are still under review
(2). A low impedance 345-kV double circuit line is assumed in this assessment
(3). A ~1.5GW VSC-HVDC is assumed in this assessment
(4). Miles represent DCKT AC and HVDC lines

Y2030 Economic Assessment with Improvement Options





- All three tested options improve the WTX transfer capability and Option 2 (1HVDC+3AC) also improves North to Houston Import capability.
- **Based on the Y2030 results, WTX export is expected to remain a significant constraint even with system improvements.**

Preliminary Results with System Improvements for the Y2030 Condition

- **Further improvement of WTX transfer capability may be limited by thermal constraints inside and outside WTX.**

Comparison	Option 1 (4 AC)	Option 2 (1HVDC+3AC)	Option 3 (5AC)
Estimated WTX Transfer Capability in VSAT (GW)	18.3	18.6	19.2
Estimated Production Cost Savings ($M)	670	808	774
Congestion in DFW	Decreased	Decreased	Decreased
Congestion in Western S.A.	Resolved	Resolved	Resolved
Congestion on Houston Import	Increased	Decreased	Increased
Congestion behind WTX interface(1)	Increased	Increased	Increased

(1). Local thermal constraints within WTX

Thank you! Questions?

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