Transmission Access Charge Wholesale Billing Determinant Initiative: *Some Insights from a Simple Market Equilibrium Model*

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Bottom Line

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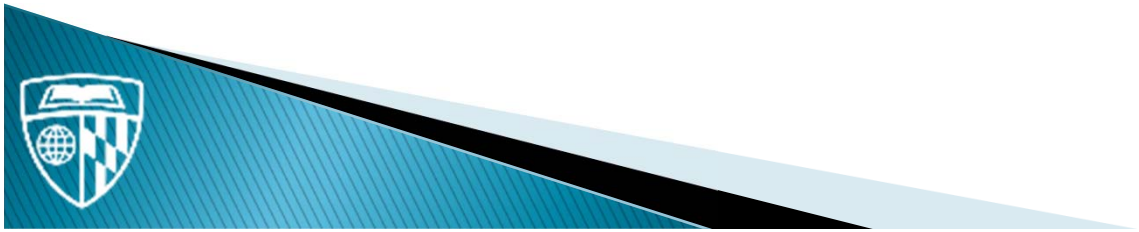
Basing TAC on "Transmission Energy Downflow" rather than "Customer Energy Downflow" will likely:

- *Increase front-of-meter DG* (FOMDG) at expense of bulk power generation on EHV grid
- *Increase retail $/kWh rates*, probably giving a small boost to behind-the-meter DG (BTMDG)
- *Increase overall supply costs*, if bulk gen cheaper than FOMDG
- *Lower market efficiency* unless there are significant network cost savings

The extent of EHV and perhaps distribution cost savings from expanded FOMDG/decreased bulk generation are crucial



Model Setup

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EHV System:
Cost = $F_{EHV}(S_B)$

$S_B = D-S_R-S_D$

Distribution System:
Cost = $F_D(D-S_R)$

$S_B+S_D=D-S_R$

Retail Customer

EHV-Distribution Interface

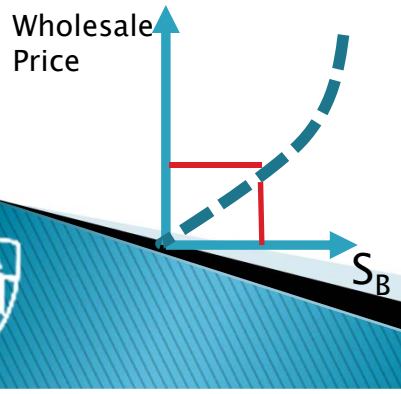
Meter

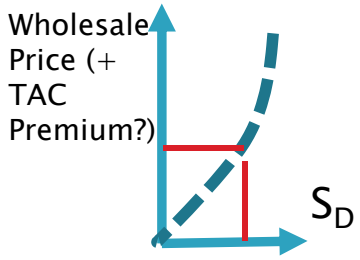
Bulk Generation S_B
Supply Function:
$S_B = \alpha_B P_B^{\varepsilon B}$

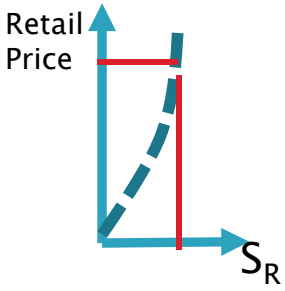
DG (Front of Meter)
Supply Function:
$S_D = \alpha_D P_D^{\varepsilon D}$

DG (Behind Meter)
Supply Function:
$S_R = \alpha_R P_R^{\varepsilon R}$

Consumption
D







Some Assumptions

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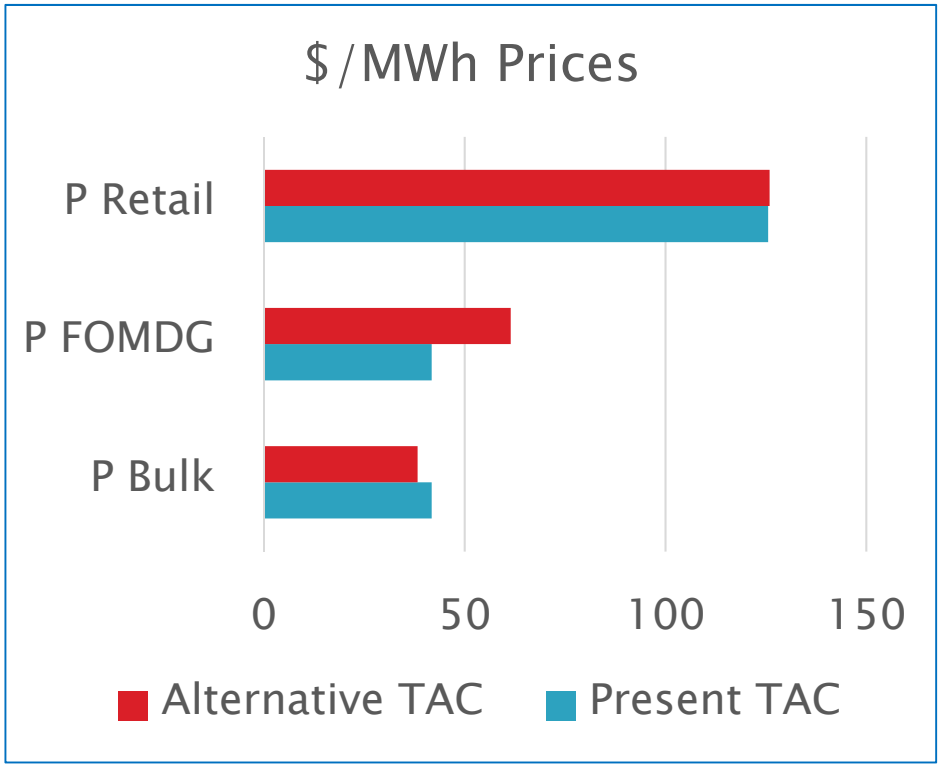
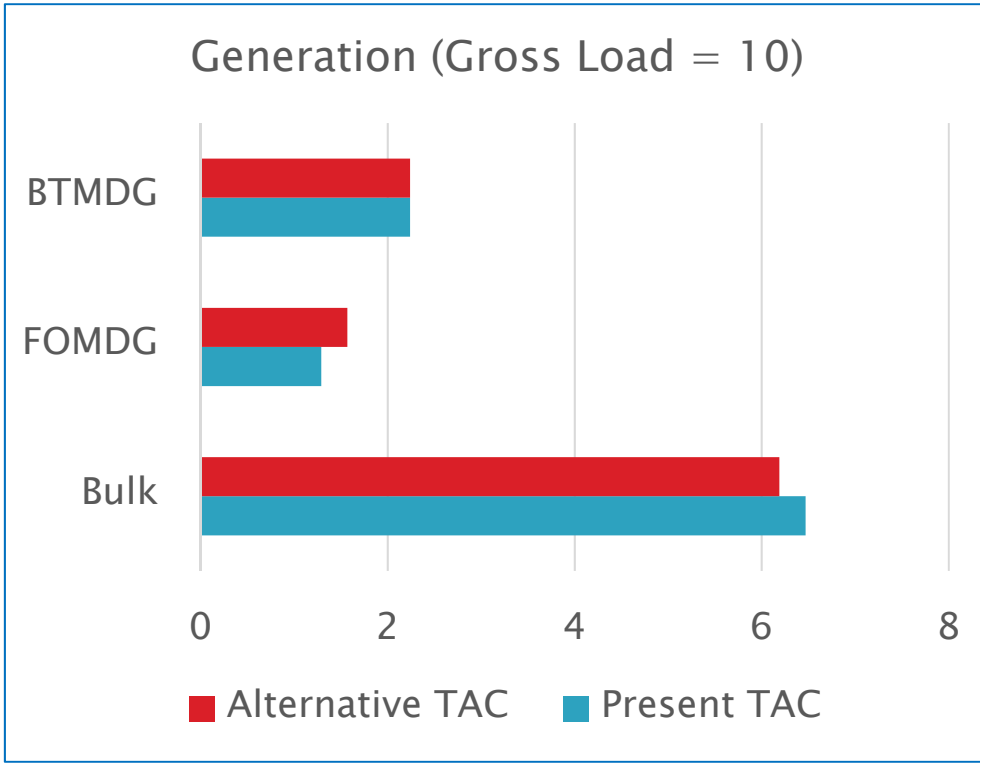
- Simulation of long-run supply using a single representative hour
  - Supply curves that describe how bulk supply and FOMDG react to the locational marginal prices they face;
  - A supply curve for BTMDG that represents the response of consumers to changed retail prices
  - Elasticities of supply = +0.5
- Retail competition such that:
  - All retail consumers pay the same price of supply plus bulk network costs (the TAC) & distribution network costs,
  - The entire financial benefit of exempting load served by FOMDG from TAC is realized by the FOMDG
- Network costs (EHV) are paid through TAC, and either are fixed or increase if bulk generation increases. Paid by:
  - Consumer energy downflow in the present TAC system
  - Transmission energy downflow under the proposal
- Distribution costs are paid by volumetric (per kWh) charges. Either fixed or depends on consumer downflow. No losses
- Parameter values are hypothetical

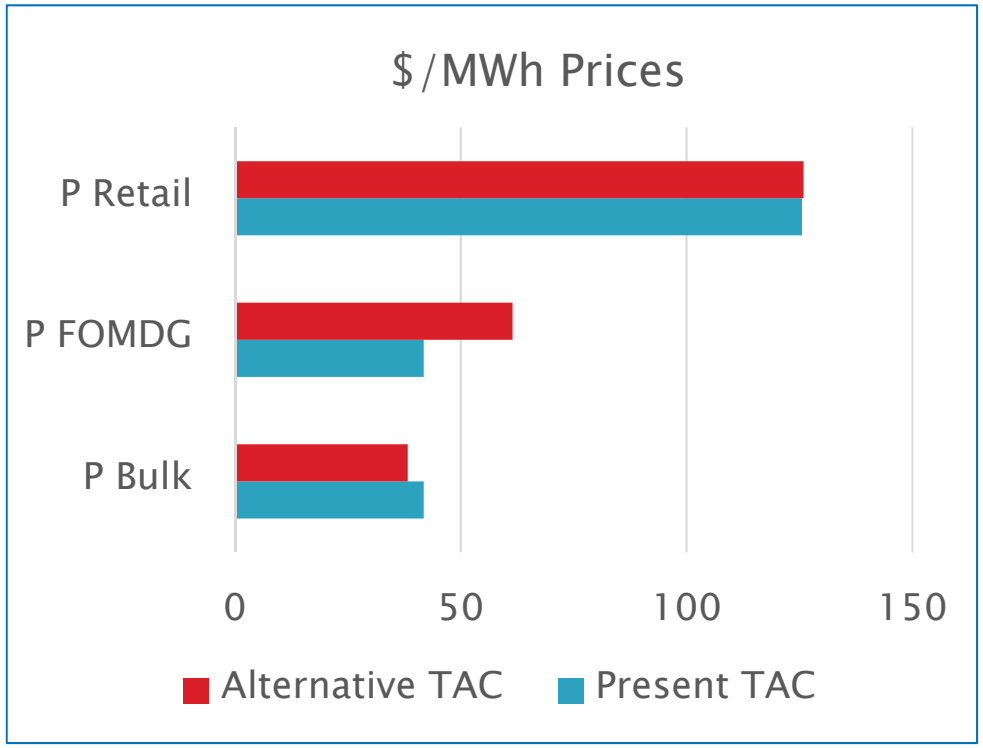
Case 1: *Fixed* Network (EHV & Distribution) Costs

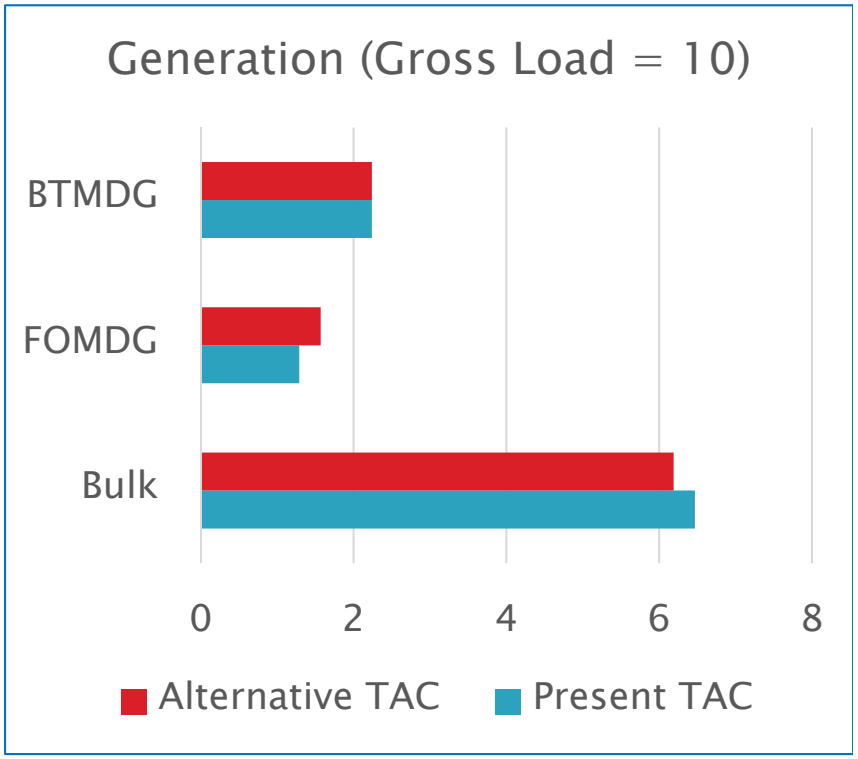




- Total cost
  - Present TAC: 100%
  - Alternative TAC: 100.5%
    - Increases due to shift of generation to bulk system

Case 2: *Variable* Network (EHV & Distribution) Costs (Proportional to Flow)





- Total cost
  - Present TAC: 100%
  - Alternative TAC: 99.6%
    - Decrease due to reduced transmission revenue requirement, partially offset by more expensive generation

Sensitivities

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- Doesn't matter much
  - Decreasing elasticity of supply for bulk supply or BTMDG to +0.25
  - Cutting fixed EHV or distribution network costs in half
  - Making distribution costs proportional to consumer downflow rather than fixed

- Matters a lot
  - Whether EHV grid costs are fixed or proportional to transmission downflow
    - If EHV LRMCs are ~half of average cost, inefficiency of shift to generation and cost savings in EHV network roughly cancel
  - Elasticity of supply for FOMDG