Please note that copies of study design, data reporting excel template and third-round schedule can be found on the <u>Stanford EMF website</u>. Teams should choose Reference scenario. It can be patterned after AEO2018 or AEO2019. AEO 2019 changes from AEO2018 are on slides 25-43: <u>https://www.eia.gov/outlooks/aeo/ppt/aeo2019.pptx</u>.

EMF 34 Core Scenarios (after October 16-17 Meeting)			
Scenario	**Description**	**Notes**	**Motivation/Hypotheses to be tested**
1. Reference – Modeler's choice	Modeler's own choice of Reference Case • Outputs to be reported in accordance with defined sets of units and unit conversion rules • <u>Note:</u> Please report variable values for 2015 regardless of whether these are treated as historical data or projections in your model. This will help facilitate comparisons	Use common units as well as agreed upon unit conversion rules to compare results across models	Reference against which side cases to be compared. Reference results may be consulted to diagnose differences in side case deltas.
2. Low Oil Price	Modelled after Low Oil Price case from AEO2018 • Brent assumed lowered via higher oil supply and lower oil demand outside North America, no supply or demand changes within North America • Henry Hub prices only incrementally different from Reference case.	• Delta (%) calculated based on AEO2018 Reference and Low Oil Price cases • Delta (%) applied to Modeler's Reference oil prices	Oil production declines when oil prices are permanently lower than reference levels and consumption of petroleum products increases. These changes may not happen at the same time nor in the same places, resulting in shifting patterns of petroleum trade across North America.
3. High Gas Supply	High gas supply, modelled as a lower production cost case • Costs of producing gas decrease by 20% by 2020 and by 30% by 2050. • Costs are decreased gradually to meet the target reductions in 2020 and 2050.	Conceptually patterned after AEO 2018 High oil/gas resource/ technology (HRT) case where both the resource is larger and technological progress diminishes production costs and leads to larger output.	Electric power & economy become more gas intensive when gas costs are lower. With more gas production across North America, both greater North-to-South trade flows and greater LNG exports.

4. High Macro Growth	Increased energy demand via macro pull • GDP growth rate is increased by 20% vis a vis Modeler's Reference in each case • Growth in other countries and outside North America held at Reference case levels unless predicted otherwise by the model Four sub-cases are defined: 4.1 High North America Macro Growth: Canada, Mexico, and US macro growth rate ALL are increased by 20% vis a vis Modeler's Reference 4.2 High Canada Macro Growth: Only Canadian macro growth rate is increased by 20% vis a vis Modeler's Reference 4.3 High Mexico Macro Growth: Only Mexico macro growth rate is increased by 20% vis a vis Modeler's Reference 4.4 High U.S. Macro Growth: Only U.S. macro growth rate is increased by 20% vis a vis Modeler's Reference		Stronger economic growth in a country causes energy imports to increase more than energy exports. If all of North America grows faster, impacts on intra-continental trade is limited; if one country grows faster than the others, trade patterns might change.
5. High Intermittent Renewables Penetration	Increased penetration of solar and wind technologies through cost reductions • Penetration of wind and solar generation to increase by 20% by 2030 and 30% by 2050 vis-à-vis the Modelers Reference Case.	Increased penetration to be modeled as a reduction in direct and implicit costs of renewables.	Electric power displaces fossil fuels and nuclear for renewables. Canadian hydro generation is reduced.

6. Cross-border Energy Infrastructure	Case focuses on understanding the impact of energy infrastructure. Three sub-cases are defined: 6.1 First case increases the capacity of electricity transmission by 20% vis-à-vis the Modelers Reference Case from Round One starting 2020; 6.2 Second case decreases the total capacity of crude transportation (pipeline + rail) by 20% vis-à-vis the Modelers Reference Case from Round One, starting 2020; 6.3 Third case decreases the cost of transporting natural gas by 20% vis-à-vis the Modelers Reference Case from Round One, starting 2020.	• For all three sub cases, in models with exogenous builds increase total available capacity by 20%. • For endogenous builds, it is modeler's choice on how to implement the 20%.	Greater cross-border power capacity expands power trade and increases renewable and hydro generation. Greater cross-border crude capacity expands oil trade within North America and decreases non-North-American imports. Lower-cost cross-border natural gas capacity expands gas trade within North America and increases North American LNG exports.
7. Carbon Policy	Case focuses on the impact of carbon policy. • Carbon policy is modeled as a carbon tax of US $35/tonne starting 2022 and increasing at 5% per year until the last model year • All other countries outside of North America also impose the same carbon tax Two sub-cases are defined: 7.1 Case 1 models the carbon policy adopted in all three countries (US, Canada, Mexico). 7.2 Second case models the carbon policy adopted in only Canada and Mexico but not in the US	• Tax applied on all combustion related CO_2 emissions • Tax is in real 2015 dollars • Lump sum recycling to households to ensure tax neutrality for the governments	7.1: Carbon policy displaces fossil fuels in all three countries 7.2: Carbon policy displaces fossil fuel use in Canada and Mexico but increases fossil fuel use in the US