Abstract
Presently, models for industrial facilities are usually not available for the utility long-term planning study and operation study. The project is to develop models accurately representing different types of industrial facilities. Extensive literature review indicates that no such work has been done or attempted in the past. Templates are established for refinery facilities, three types of template models with different complication levels are built, Full model, Process Equivalent (PE) model, and Simplest Equivalent (SE) model. The template models are compared with the current utility practice, the guideline model. It is verified that template models shows significant improved accuracy than the guideline model. The sensitivity study is also performed for the template models for refinery facilities.

Template Full Model for a Coking Refinery Facility
1. The template full model adapts the radial system configuration.
2. Each refinery process is modeled as a substation, which includes static loads and induction motor loads, and some processes also have synchronous motor loads.
3. Induction motors are divided into three groups based on their voltage levels, 0.46 kV, 2.3 kV and 4 kV.

Template PE Model for a Coking Refinery Facility

Comparison of Three Template Models
The system responses during two events, a 3-phase fault at the 138 kV Utility Bus and the circuit breaker CB-4 switching, are simulated for three template models. Event 1: A three phase fault is applied to the 138 kV Utility Bus at 1.0 seconds, and cleared at 1.135 seconds. Event 2: A main circuit breaker, CB-4, is switched open at 1.0 seconds, and close at 1.15 seconds. Total simulation time for each event is 5 seconds.

Template SE Model for a Coking Refinery Facility

Current Industry Practice, Guideline Model
In order to demonstrate the accuracy of the facility-template method compared to the guideline method, which is the current utility practice for the facility modeling, a guideline model of the refinery facility is built using a 30% static load and a 70% induction motor load.

The system responses of the template full model, the PE equivalent model and the guideline model are compared during a circuit breaker switching event. The main circuit breaker, CB 4, is switched open at 1.0 seconds, and close at 1.15 seconds. Total simulation time of the event is 5 seconds.

Sensitivity Study for Template Models
A three phase fault is applied to the 138 kV Utility Bus for Cases 1 and 2 for the Template full model and PE model. The fault starts at 1.0 second and it is cleared at 1.135 second. Total simulation time for the event is 5 seconds.

Conclusions and Future Work
This work will provide electric utility companies an effective tool for long-term planning considering various industrial facilities with minimal information. The template models are verified to be adequate models for power studies using refinery facilities as an example. The future work will include 1). Finding the equivalent model for a group of synchronous motors to improve the established template models. 2). Developing template models for other types of industrial facilities.