Growth limits and growth impacts of renewable energy technologies.
NREL
Strategic Analysis Center

Background:

Certain renewable energy (RE) technologies—including solar photovoltaics (PV) and wind—have experienced rapid growth rates in the last decade. The Strategic Energy Analysis Center (SEAC) is developing a number of market penetration models for RE technologies including wind, Concentrating Solar Power (CSP) and solar PV. Currently, there is limited understanding of the potential limits to growth in these technologies. Specifically, it is unclear how fast these industries can grow given the limits of infrastructure development, construction, investment decision-making processes, material acquisition and supply, etc. Further, greater understanding the potential feedback of growth—within high growth scenarios (e.g. carbon constrained and other drivers) --into price increases or decreases is sought.

Goal:

We would like an extensive literature review of RE industries and some type of application of lessons learned to several RE industries with respect to the issue of growth of the industry. Ideally, the project team will evaluate and recommend enhancements to NREL-provided models that use historical industrial growth data to examine possible growth scenarios of wind and solar PV, considering a variety of constraints. Systems Dynamic Modeling, e.g. Stella, is a possible environment to look for relatively ease and transferability. The team will be requested to apply their findings to an NREL provided model, evaluate the outcomes, and make and implement approved recommendations to the model.

Some questions we are interested in include: How fast can and do industries grow in response to consumer demand? What limits industrial growth? What is the price impact of rapid growth? How do constraints to growth affect prices? How do industries grow in anticipation of demand? How accurately do industries forecast demand? What is the impact of missed forecasts? Are forecasts generally too optimistic or pessimistic?

Specific questions regarding renewable energy technologies are: What are some appropriate industries that are comparable to RE technologies? Can we apply lessons learned from other industries to historical and projected future growth of wind, solar PV, and possibly CSP and other technologies? Can a techno-economic model be developed to represent the growth of specific RE industries? Can this model include growth in anticipation of demand, price feedback impacts of rapid growth? If so, the project team should examine some high growth cases – what would be the impact of extreme growth cases provided by high growth scenarios from NREL models such as Wind Deployment System (WinDS) and Solar Deployment System (SolarDS).

Deliverables:
We anticipate the HMC clinic team will provide us with the results of the literature search; will research and test a techno-economic model to represent the growth of specific RE industries; provide recommendations for model enhancements; modify the model as appropriate; and provide model predictions of high-growth cases driven by various climate change scenarios.