State Energy Forecasting

An Overview of Methods

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Overview

- What is an energy forecast and why develop one?
- How does a state create a baseline forecast?
- What are issues a state should consider?
- Where can a state find out more information?

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What is a state energy forecast?

- A state energy forecast is a measurement and estimate of historic, current and projected patterns of energy supply and demand within a state.
- The baseline - or Business As Usual (BAU) - forecast illustrates what state energy use will look like in the absence of additional policies beyond what is already planned.
- It is a reference case against which to measure the energy impacts of policy initiatives or system shocks.

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Why Develop an Energy Forecast?

- States develop an energy forecast baseline and alternative scenarios to:
  - understand how energy within their jurisdiction was and is projected to be supplied and used;
  - estimate energy-related greenhouse gas and air pollution emissions;
  - set specific targets with respect to energy usage, such as renewable energy or energy efficiency targets;
    - identify specific sectors that could be targeted with policies and programs; and/or
    - analyze actions and measures that could help achieve targets and goals.

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How Does a State Create a Baseline Forecast?

- There are six steps involved in creating a baseline forecast –
  1. Define objectives and constraints of the forecast.
  2. Compile historical energy consumption and generation data into a baseline profile.
  3. Choose method to forecast the energy baseline.
  4. Develop or review assumptions.
  5. Apply the method.
  6. Evaluate forecast output.

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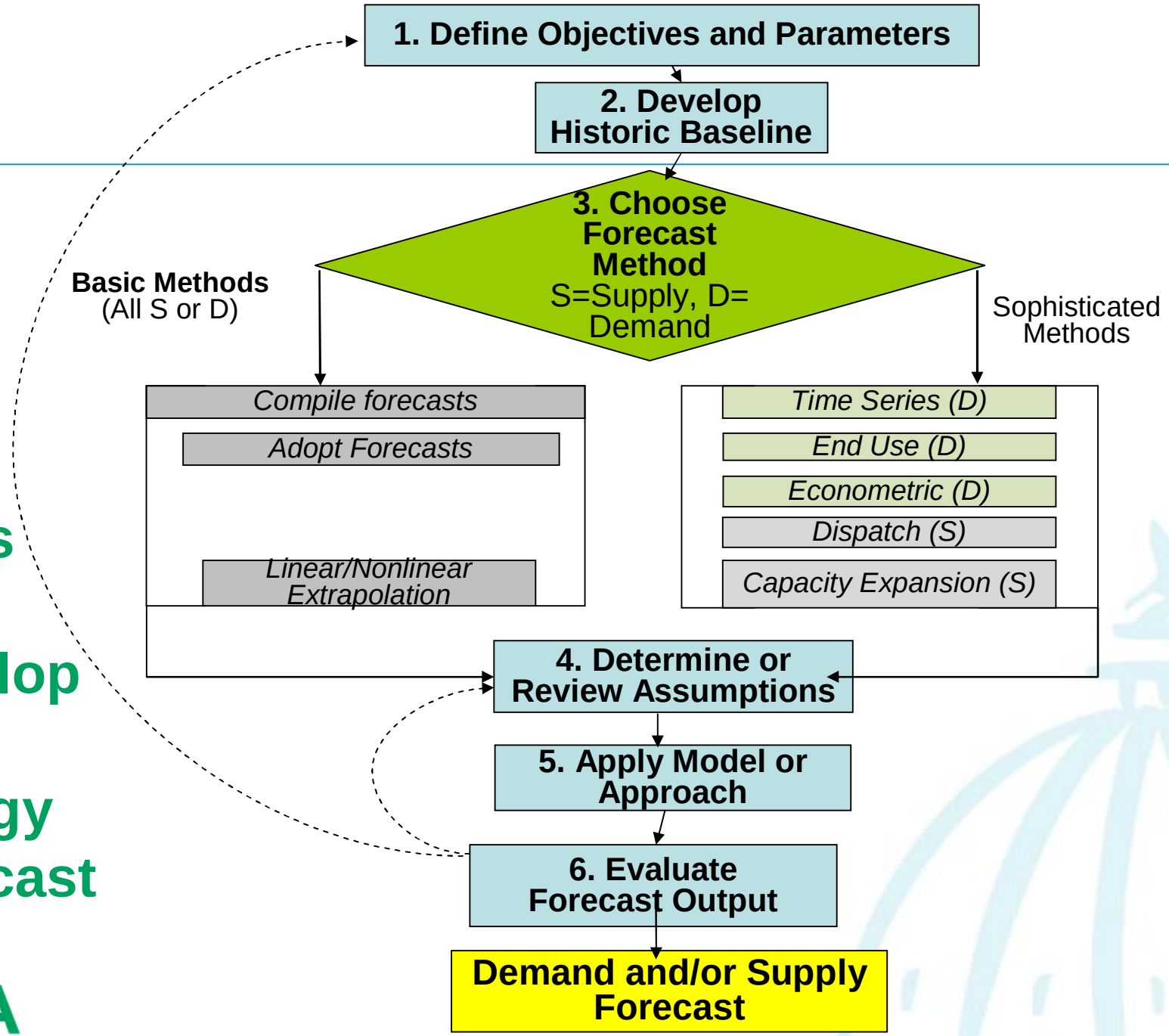
Steps to Develop an Energy Forecast



Step 1: Define Forecast Objectives and Parameters

- Identify the use(s) and purpose(s) of the forecast
  - e.g. to obtain a general energy profile or conduct a detailed analysis
- Factors to consider:
  - short-term vs. long-term;
  - bottom-up vs. top-down;
  - level of rigor necessary;
  - availability of financial, labor and time resources to complete the forecast; and
  - amount of energy data readily available.

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Step 2. Develop an Historic Baseline

- Historic baseline includes:
  - Energy consumption (demand) data by sector and fuel and
  - Energy generation (supply) data by fuel

- Data sources include:
  - utilities,
  - public utility commissions,
  - state energy offices,
  - departments of transportation,
  - independent system operators (ISOs),
  - EPA's Emissions & Generation Resource Integrated Database (eGRID) model,
  - DOE's Energy Information Administration (EIA) and
  - North American Electric Reliability Corporation (NERC) among others.

- For more information, see the State Clean Energy-Environment Technical Forum Backgrounder, *Using State Energy Data, May 22, 2008*: http://www.keystone.org/Public_Policy/2007_8DOCS_CLEANENERGY/05_22_2008Background_State%20Energy%20Data.pdf

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Step 3: Choose Forecast Method: Basic or Sophisticated

- Basic Methods for Supply and demand Forecasts include:
  1. Compilation of individual forecasts by others
  2. Adoption of a complete forecast used by others
  3. Linear and/or Nonlinear Extrapolation of Baseline

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Comparison of Basic Methods for Forecasting Energy Demand and Supply

Methods	Advantages	Disadvantages	When to use
Compilation of individual forecasts by others	Easy to gather	May not be compatible; proprietary concerns; possible short horizons; may or may not provide information on construction requirements, fuel use, emissions, and costs.	High level, preliminary and quick analysis
Adoption of a complete forecast used by others	Easiest method	May not have the long-term outlook	High level, preliminary and quick analysis
Linear and/or Nonlinear Extrapolation of Baseline	Quick	May not capture impact of significant changes (e.g., plant retirements)	High level with simple escalation factors from history
	More robust data analysis	Possible errors in formulas, inaccurate representation of demand and supply	Knowledge in generation dispatch modeling by type of plant

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Step 3: Choose Forecast Method: Sophisticated Methods for Demand

- Sophisticated Methods for Demand
  - Time series models
    - Forecasts future events based on known past events and patterns
    - Examples: SAS Forecast Server, SAS Analytics, EViews
  - End use models
    - Develops load profiles for consumer types based on historical demand, surveys
    - Example: MetrixLT™
  - Econometric models
    - Complex and robust analysis which includes population, economics, energy relationships, structural changes
    - Examples: MetrixND®, REMI

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Step 3: Choose Forecast Method: Sophisticated Methods for Supply

- Sophisticated methods for Supply
  - Electricity Dispatch Models
    - Determines how existing electricity system will meet projected demand
    - Examples: PROSYM, GE-MAPS, PROMOD
  - Capacity Expansion or Planning Models
    - Determines how energy system will change & capacity will be built in response to meet demand
    - Examples: NEMS, IPM®, ENERGY 2020, LEAP, Strategist, Aurora, Plexos

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Step 4: Determine Assumptions and Review Data

- Future projections of energy demand and supply depend on assumptions about population and economic variables
  - Population, energy prices, productivity, gross state product, and the labor force.
  - Sources include:
    - US Census Population Estimates Program (http://www.census.gov/popest/estimates.php).
    - Bureau of Economic Analysis (http://www.bea.gov/),
    - Bureau of Labor and Statistics (http://www.bls.gov/) and
    - the U.S. Census Economic Census (http://www.census.gov/econ/census02/). Energy and fuel price data are available from EIA (http://www.eia.doe.gov/oiaf/forecasting.html). They also may be available from PUCs and ISOs although proprietary data may limit the amount available.
- May already be embedded in others' forecasts and/or sophisticated models
- Review data for gaps, inconsistencies, etc.

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Steps 5 and 6: Apply & Evaluate

- Step 5: Apply method or model

- Step 6: Evaluate Forecast Output
  - Ensure that it makes sense and meets original objectives
  - May need to revisit assumptions and re-run

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Some Issues and Considerations

- Data lags exist
- Transparency is key
  - Forecasts, in particular, should very clearly state what is and is not included regarding assumptions about what will take place without any new initiatives.
  - Consider stakeholder review of assumptions
- When facing staffing and budget constraints, consider using existing forecasts as much as possible

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For More Information

- See the State Clean Energy-Environment Technical Forum Backgrounder, *State Energy Forecasting,* June 19, 2008
  - http://www.keystone.org/Public_Policy/2007_8DOCS_CLEANENERGY/06_19_08Background_Forecasting.pdf
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