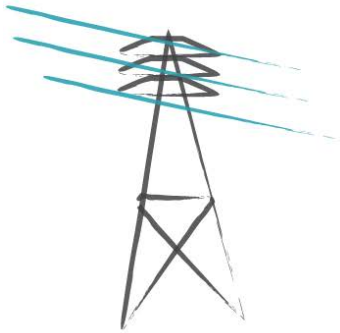


WECC

Load Model Improvements – a Case Study

Donald Glen Davies

Chief Senior Engineer

Data Management

- Complexity of load modeling
  - Each load has a different composition
  - Load magnitude and composition changes over a day, over a year, and over the years.
- Had to find ways to simplify data management processes
- Other entities will also need to find ways to simplify data management, may wish to consider some of WECC's methods

Load model addition to a new base case

- Developed a process we use to build composite load models for a given base case.
- Don’t need to worry about all the details for each case.

CLZONE – "Climate Zone"

Developed by WECC LMTF to categorize similar load patterns and types

WECC has approximately 60 climate zones, formed from combinations of climate areas, feeder types, and industrial load types.

CLZONE – Climate Areas

NWC – Northwest coast
NWV – Northwest valley
NWI – Northwest inland
RMN – Rocky mountain
NCC – N. Calif. coast
NCV – N. Calif. valley
HID – High desert
SCC – S. Calif. coast
SCV – S. Calif. valley
DSW – Desert southwest

CLZONE – Climate Areas

WECC Climate Areas

ID	Climate Zone	Representative City
NWC	Northwest Coast	Seattle, Vancouver BC
NWV	Northwest Valley	Portland OR
NWI	Northwest Inland	Boise, Tri-Cities, Spokane
RMN	Rocky Mountain North	Calgary, Montana, Wyoming
NCC	Northern California Coast	Bay Area
NCV	Northern California Valley	Sacramento
NCI	Northern California Inland	Fresno
SCC	Southern California Coast	LA, San Diego
SCV	Southern California Valley	LA, San Diego
SCI	Southern California Inland	LA, San Diego
DSW	Desert Southwest	Phoenix, Riverside, Las Vegas
HID	High Desert	Salt Lake City, Albuquerque, Denver, Reno

CLZONE – Feeder Type

Feeder Type

ID	Feeder Type	Residential	Commercial	Industrial	Agricultural
RES	Residential	80%	20%	0%	0%
COM	Commercial	20%	80%	0%	0%
MIX	Mixed	40%	40%	20%	0%
RAG	Rural Agricultural	40%	40%	10%	10%

LID code is <3-character climate zone>_<3-character load class>
Or <7-character industrial load ID>

LID is a field located in the load table.

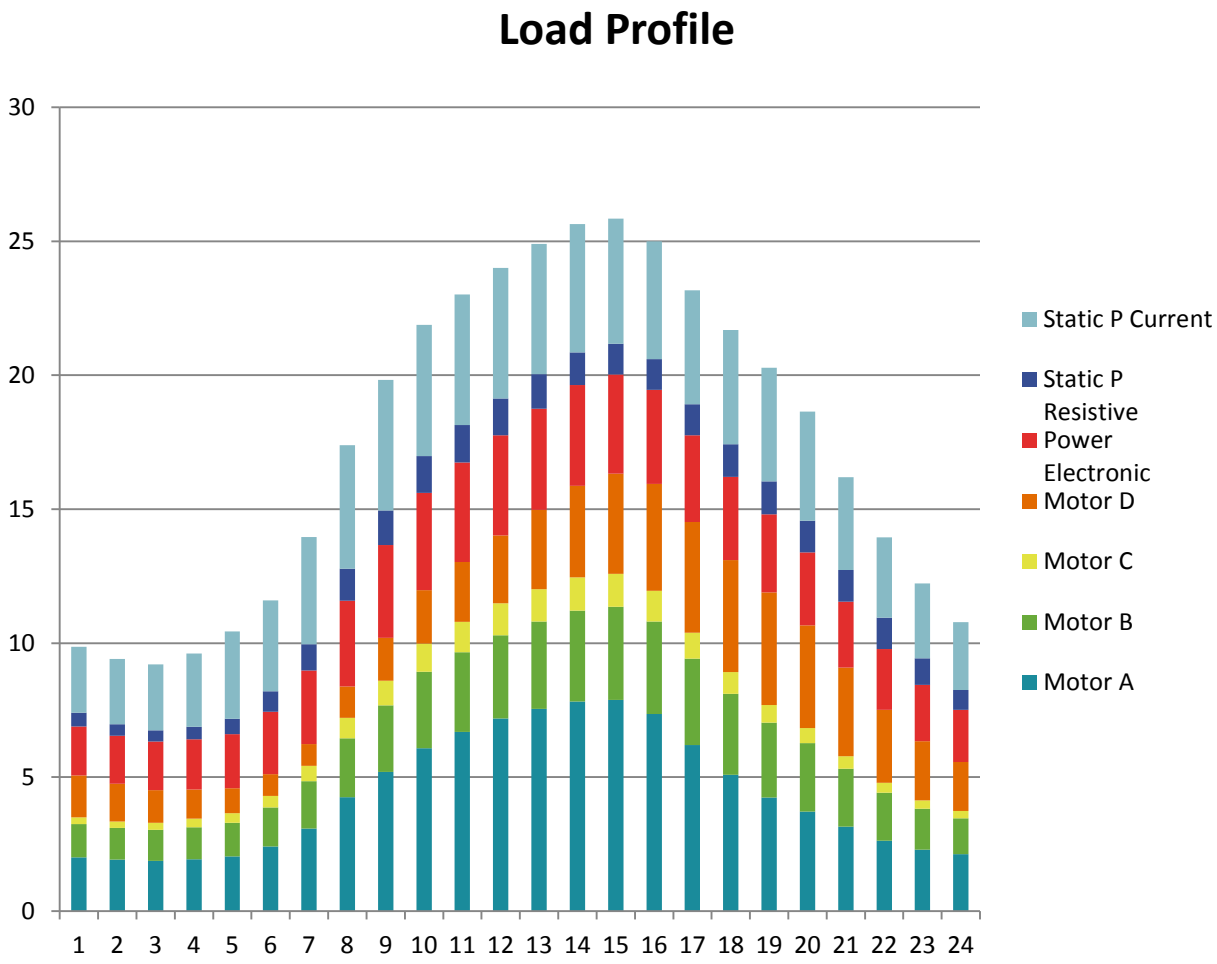
For example:
Commercial load downtown Phoenix with high concentration of commercial loads would be indentified as "DSW_COM"
Rural agricultural load in Moses Lake, WA would be identified as "NWI_RAG"

CLZONE – Industrial Loads

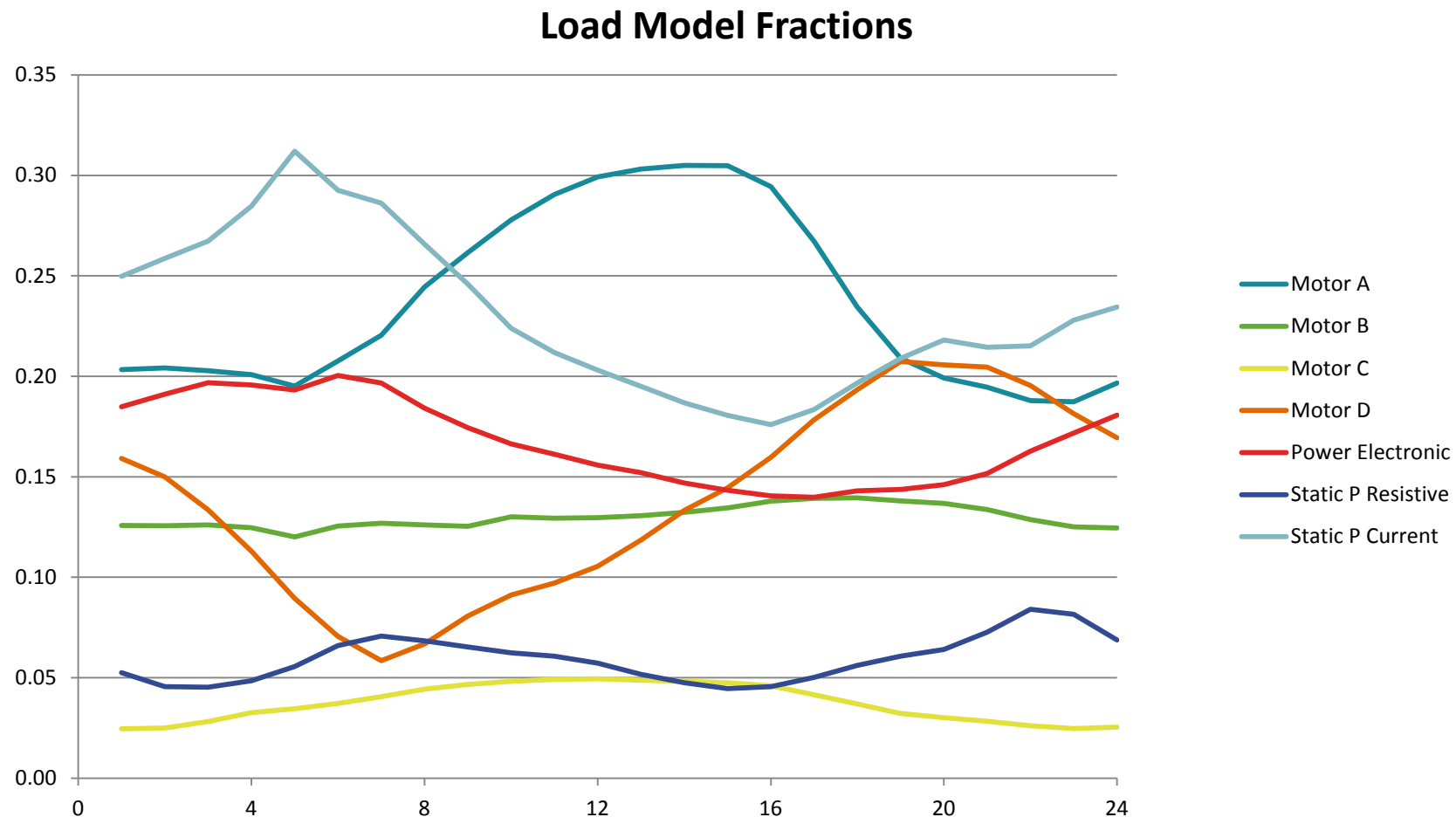
Industrial Loads

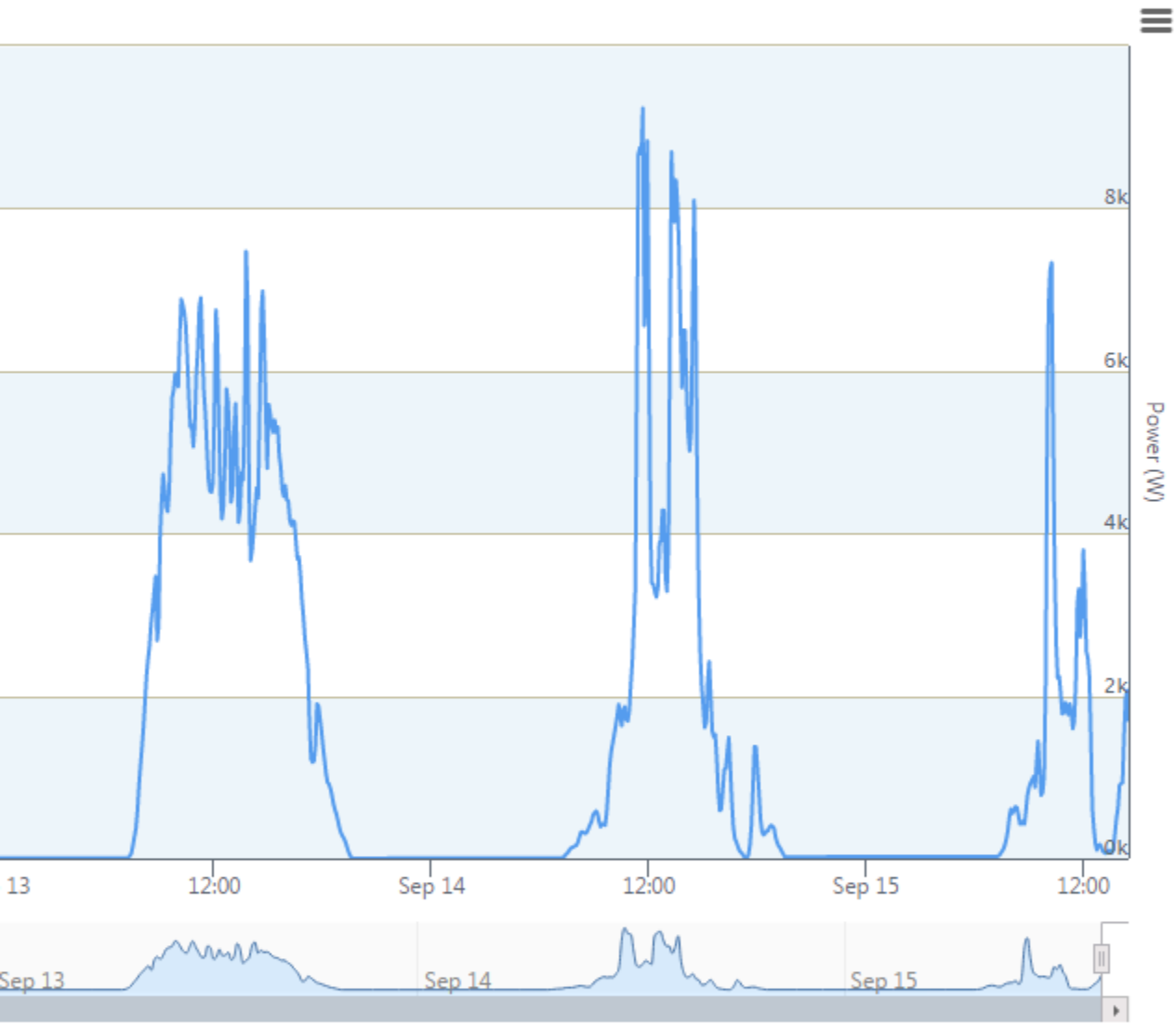
ID	Feeder Type
IND_PCH	Petro-Chemical Plant
IND_PML	Paper Mill
IND_ASM	Aluminum Smelter
IND_SML	Steel Mill
IND_SCD	Semiconductor Plant
IND_SRF	Server Farm
IND_OTH	Industrial – Other
PPA	Power Plant Auxiliary

Daily Load Shape Example



Daily Load Shape Example





42 Microinverters
1 Envoy Ethernet
Taylorsville, UT

59°F

System Normal

Full System

Energy | Status

Today
10.5 kWh

Peak Power: **7.33** kW at 10:15 AM
Latest Power: **1.70** kW at 2:30 PM

Past 7 Days
335 kWh

Month To Date
797 kWh

Lifetime
19.8 MWh

Routine Process to add Load model to each base case

1) Transmission Planner (or whoever prepares load data) populates a “Climate Zone” field for each load in their power flow data submittal. They typically do this once, use for all future cases.

2) WECC runs a spreadsheet tool to look up the climate zone definitions for a given power flow case based upon the hour of day and season represented. Spreadsheet dumps a calculated sheet with feeder information, proportion of various motor types in each climate zone to a csv file.

Spreadsheet Tool

Enter Day (1=normal summer, 2=hot summer,3=cool summer,4=shoulder,5=winter)	Enter Hour (Pacific Time)
5	5

Significant effort went into the data in the spreadsheet tool, but that was preparatory . That work does not have to be redone for each case, or by each utility.

The tool computes how much of each motor type, etc. for each climate zone based upon hour of day and type of day.

Routine Process to add Load model to each base case

3) WECC uses an epcl program (WECC uses PSLF to build cases) that reads the completed power flow case to dump a csv file with needed information including load magnitude, voltage and climate zone for each load bus.

4) WECC runs a tool from PNNL to create the composite load model part of the dynamics data file. The tool reads three files:

- CSV from spreadsheet tool (step 2)
- CSV output from epcl (step 3)
- CSV with predefined motor definitions

The tool can output cmpld model data for PSLF or PSS/E dynamics files

Implementation Process

- Several rounds of implementation, then trial, then refinement
  - 2 years of studies by individual utility volunteers with the composite load model
  - Additional adjustments were required, especially to the protection model
  - Finally approved for initial inclusion in base cases with a phased approach
    - The new model provides a better match to system events

Implementation Process

- Phased implementation
  - Currently disabled AC stalling – Phase 1
  - Work continues to better understand AC stalling
  - Hope to continue improving the model – Phase 2

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