Projecting Emissions Inventories for Air Quality Modeling of Future Years

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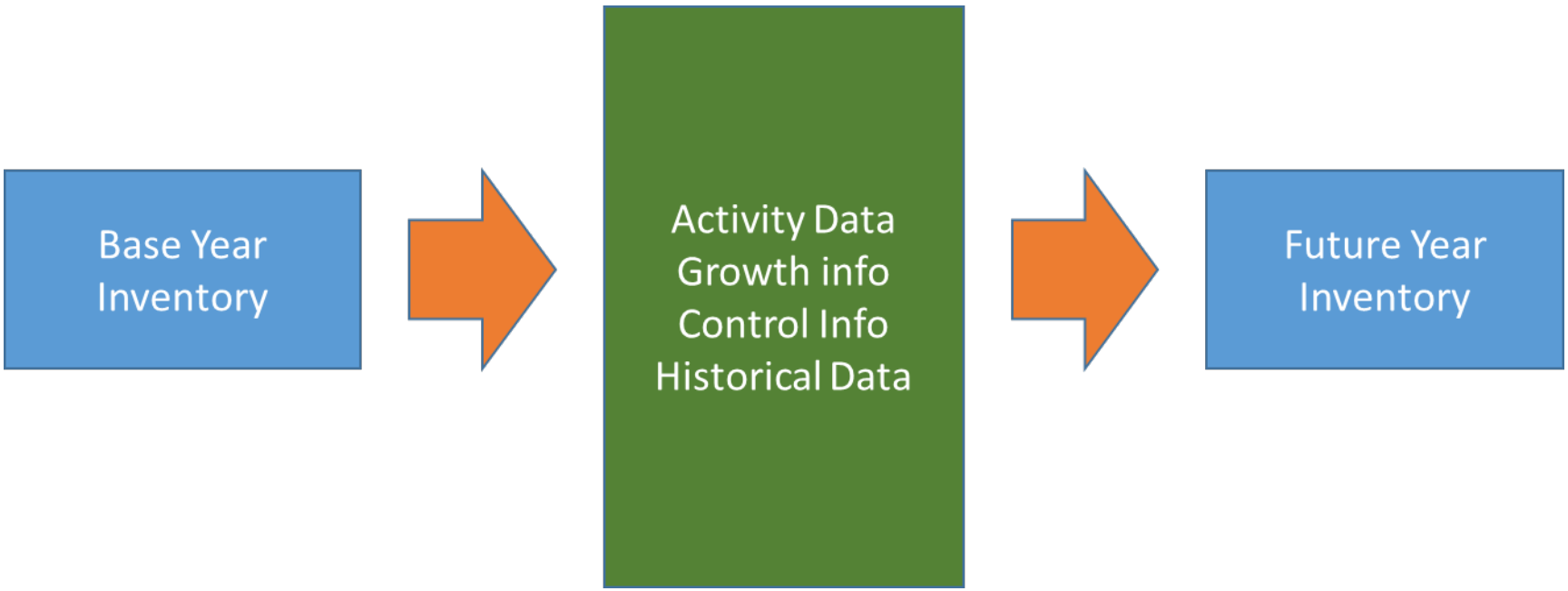
Course Outline and Schedule

- 1:30 Introduction to projections
- 1:45 EGU projections
- 2:00 Onroad mobile source projections
- 2:30 Control Strategy Tool overview
- 3:00 Break
- 3:15 Agricultural and fugitive dust projections
- 3:30 Oil and gas projections
- 4:00 Residential wood, commercial marine vessel, and aviation projections
- 4:30 Wrap up and final questions

Future Year Projections

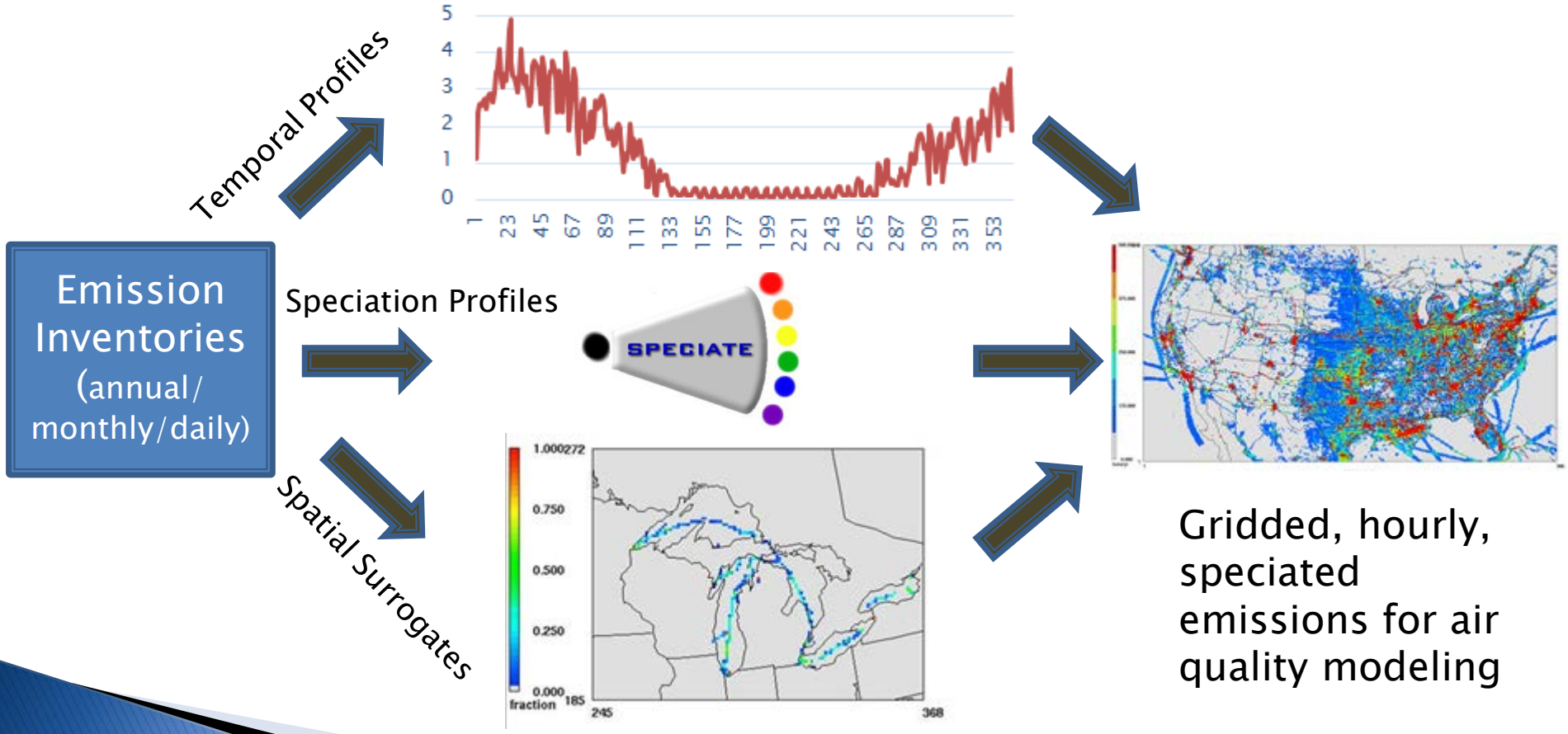
- Overview
  - Inventories and ancillary data
  - Sets of future years: strive for consistency in methods
- Projection techniques
  - Replace the sector inventory or section thereof
  - Have a set of sources that factors are applied to – to account for activity change and controls
  - Model-based categories/sectors
- Estimate changes between base and future years
  - Activity changes
  - Rules / technology changes in intervening years
  - Closures
  - Interpolation / extrapolation often difficult

Future Year Projections



Emissions Modeling Process

- Steps needed to convert emissions inventories into the resolution and formats needed by air quality models



Review: Emissions Modeling Platform Sectors

- Emission inventories are broken down into "sectors" used to prepare AQM-ready emissions for different parts of the inventory
- Each sector has unique processing or inventory characteristics and starts with lowercase letter
- Specific sectors vary by modeling platform but cover all sources in the inventory
- Point source sectors keep their specific latitude-longitude locations throughout the process
- Nonpoint sectors are allocated to grid cells using spatial surrogates
- **EPA processes emissions separately for each sector then merges the ground-level emissions together at the end**

Why Develop Projected Emission Inventories?

- Near-term projections
  - The full NEI is developed every three years (2011, 2014, 2017, …)
  - We frequently do air quality modeling for years other than NEI years
- Mid-term future projections (e.g., through 2028)
  - We need to evaluate policy options and impacts of changing emissions and use the results in a relative sense
  - EPA develops Regulatory Impact Analyses (RIAs) for regulations
    - Describe the potential social benefits and social costs of regulations
  - **Interstate transport:** The Clean Air Act's "good neighbor" provision requires EPA and states to address interstate transport of air pollution that affects downwind states' ability to attain and maintain National Ambient Air Quality Standards (NAAQS)
    - Each state in its State Implementation Plan (SIP) must prohibit emissions that will **significantly contribute** to nonattainment of a NAAQS, or interfere with maintenance of a NAAQS, in a downwind state.
    - EPA is required to backstop state actions by promulgating Federal Implementation Plans (FIPs) in the event of no submittal or disapproval
  - Other types of analyses

Developing Projections (1/2)

- Future year emission inventories are developed in different ways, depending on the **base-year modeling platform** and each sector in the platform
- Factors to consider include:
  - Confidence in base year inventory data
  - Historical data available since base year
  - What sources of information are available for each sector
    - Databases (e.g. Annual Energy Outlook (AEO))
    - Models (e.g. Integrated Planning Model (IPM) for EGUs)

Developing Projections (2/2)

- More factors to consider
  - How can these sources of information be used for estimating emissions?
  - Spatial and time resolution of information
  - For all sectors, federal rules that go into effect in the intervening years are considered
  - Stationary sources are also adjusted to account for consent decrees, planned shutdowns, etc.
  - Base year-specific point source and non-point fires and biogenics are used for future years

Review: Purpose and Contents of a Modeling Platform

- A modeling platform provides a comprehensive air quality modeling system that uses the most recent technically sound data and state-of-the-science tools available
- Modeling platforms are used to support EPA regulations and other analyses
- Major components of a modeling platform:
  - Meteorological models (WRF) and met. data
  - Boundary conditions (GEOS-Chem)
  - **Emissions**: base year (NEI)+NonUS, future year projections
  - Air quality models (CMAQ, CAMx)
  - **Other**: ancillary data for emissions modeling, projections data, emissions modeling tools (SMOKE, etc) and scripts

Review: Recent Emission Modeling Platforms

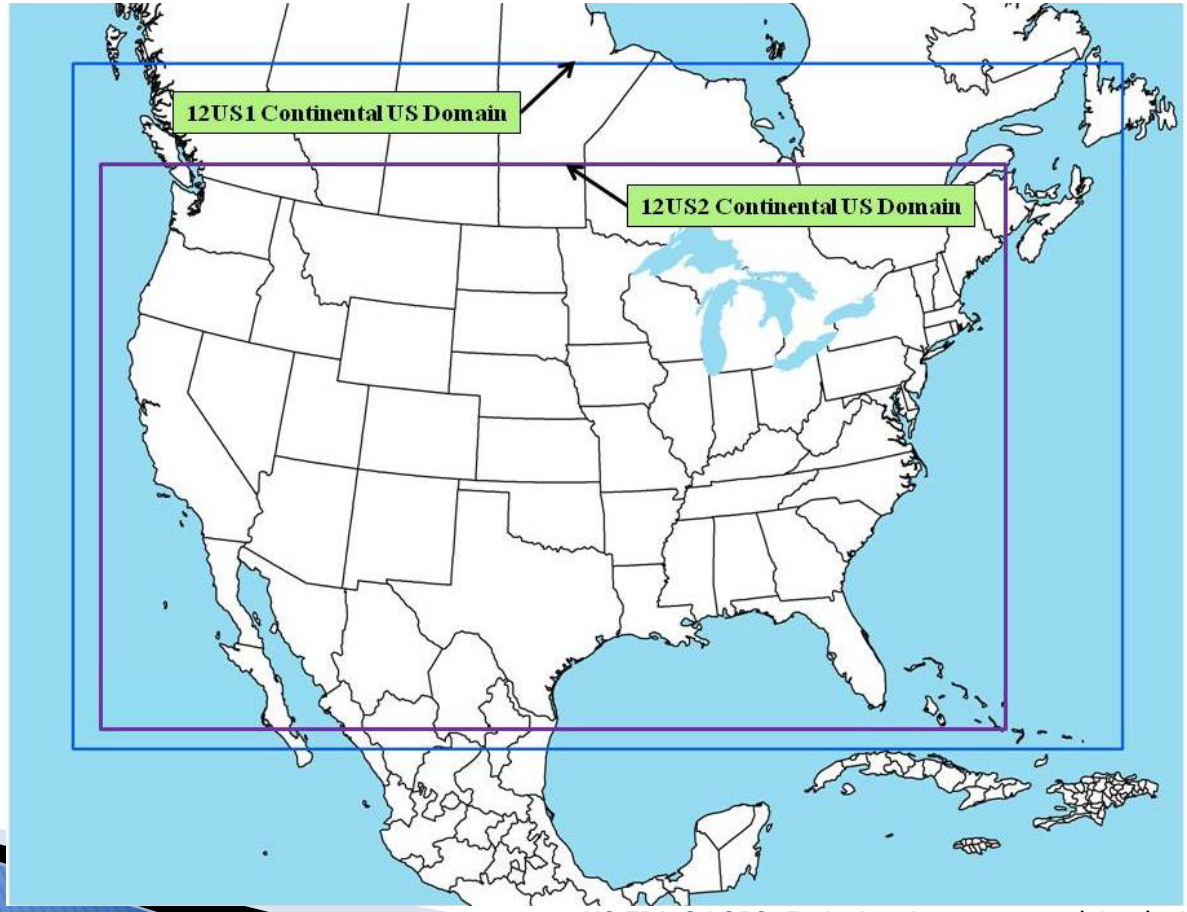
- 2011v6.3 platform is based on 2011NEIv2
  - First number (2011) is the base year being modeled
  - The number before the "." (6) corresponds to a specific NEI year (e.g., 6 means 2011 NEI was used)
  - The number after the "." (3) is an iteration of the platform (e.g., 3 is a third major iteration for 2011)
  - Emission modeling platforms have both base and future years that go with them (e.g., 2017, 2023)
- 2014v7.0 is the initial 2014 NATA modeling platform based on 2014NEIv1
- A "case" is a specific set of AQM-ready emissions inputs and has an abbreviation with its own naming scheme

Review: EPA's Emissions Modeling Case Abbreviations – Alphabet Soup!

- Modeling case abbreviations include:
  - the **year** represented in the modeling (e.g. 2011, 2016)
  - a letter representing the NEI base year (e.g., e, f)
  - a letter representing the iteration of the emissions (e.g., a, b)
  - a year and letter representing the meteorology (e.g., 11g, 14j)
  - optionally, the speciation used (e.g., cb6cmaq, sparc07t)
  - optionally, the version of the platform (v5=2008, v6 =2011)
  - optionally, a special note about the case (e.g., nata, cntl for a control case)
- Examples
  - **2023el_cb6v2_v6_11g**: 2023= year modeled, e= 2011 NEI base, l = twelfth 2011 case, cb6v2 = CB6 speciation, v6 = platform, 11g = WRF 3.5 for 2011
  - **2016fc_cb6camx_16j**: 2016 = year modeled, f = 2014 NEI, c = third 2014 platform emissions case, cb6cfamx = CB6 speciation, 16j = WRF 3.8 for 2016

EPA US 12km Modeling Platform Domains

- US domains / grids use consistent map projections (Lambert)
- Other domains also exist (e.g., 36km, 4km, hemispheric)
- **Many US domains include parts of Canada and/or Mexico**



Modeling Platform(s) with Projections

- 2011 NEI version 2 has been the primary component of the base-year modeling platform used for future-year projections
- Recently available platforms with projections:
  - Original 2011v6.3 platform supported the Final Cross-State Air Pollution Rule (CSAPR) Update and included cases 2011ek and 2017ek, and 2017ek_cntl
  - Cases 2011el and 2023el were added for a preliminary analysis of ozone transport with respect to the 2015 National Ambient Air Quality Standard (NAAQS) for ozone
  - https://www.epa.gov/air-emissions-modeling/2011-version-63-platform
- Working towards projections based on 2014 NEI
  - Gathering data sources and information
  - Need short-term (historical) projections to year 2016

Projection Techniques

- Inventory projection techniques differ for different modeling platform sectors
  - Some done using the Control Strategy Tool (CoST) within the Emissions Modeling Framework (EMF)
  - Others are taken as outputs from models
- Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system is used to prepare the emissions for air quality models (e.g. CMAQ, CAMx)

Projections overview: Sectors projected based on NEI emissions

Sector(s)	Data sources and techniques used
Agricultural NH3 (ag)	USDA animal population growth estimates, livestock only.
Fugitive dust (afdust)	County-level VMT and population Annual Energy Outlook (AEO)-based projections to unpaved/paved roads. Note: Canadian fugitive dust (othafdust) not projected.
Residential Wood Combustion (rwc)	2015 Wood heaters New Source Performance Standards (NSPS) with growth and appliance change-outs/retirement assumptions.
Class 1&2 CMV + trains (cmv, rail)	Locomotive and Marine (RIA-based) rule growth and controls; California data scaled from CARB inventories.
Class 3 CMV (cmv, othpt*)	Regional-based growth factors + ECA-IMO engine and fuel controls, extending from ports (state), to near-offshore (EEZ) to global; California scaled from CARB data.
Oil and Gas (pt_oilgas, np_oilgas)	AEO production, consumption fuel-based growth. Various NSPS impacts + local information.
Remaining non-EGUs (ptnonipm, nonpt)	AEO production, consumption fuel-based growth. Various NSPS impacts + local information. Numerous additional growth/control/closure information

Projections overview: Sectors not projected from NEI base year emissions

Sector(s)	Data sources and techniques used
EGUs (ptipm)	IPM 5.16 w/ 2011 CEMs-based temporalization
Onroad mobile (onroad)	MOVES 2014a w/ projected activity, fuels, inspection and maintenance, controls, speciation; California magnitude from CARB but temporalized based on SMOKE-MOVES
Nonroad mobile (nonroad)	NMIM/NONROAD (now within MOVES) projected inventories, except for California data provided by CARB
Canada/Mexico (othar, othpt, othon)	Canada: nonroad and onroad emissions projected using US trends (by SCC) Mexico: Future-year inventories projected from 2008 base year inventory
Biogenics & Fires (beis, agfire, ptfire)	No projections, same as base year

Future-year Ancillary Data

- Most ancillary (i.e., non-inventory) data stays the same in the base and future year modeling
- Meteorology is held constant
- Spatial surrogates are constant
- Temporal profiles are constant for most sectors (except for EGUs)
- Speciation profiles are constant for many sources
  - Updated in future year for mobile sources

Future Year Projections: Recent updates

- IPM version 5.16 used for 2023el case
  - Uses Annual Energy Outlook (AEO) 2016
  - NEEDS database updated from comments
  - New cross reference with more matches
- Incorporated data from Federal Register and other comments plus new growth data for many non-EGU industrial sources
- Oil and gas sector: methods being updated
- Onroad uses MOVES2014a
  - AEO2016 used for VMT, fuel splits, etc.
- Projections for Mexico developed by ERG

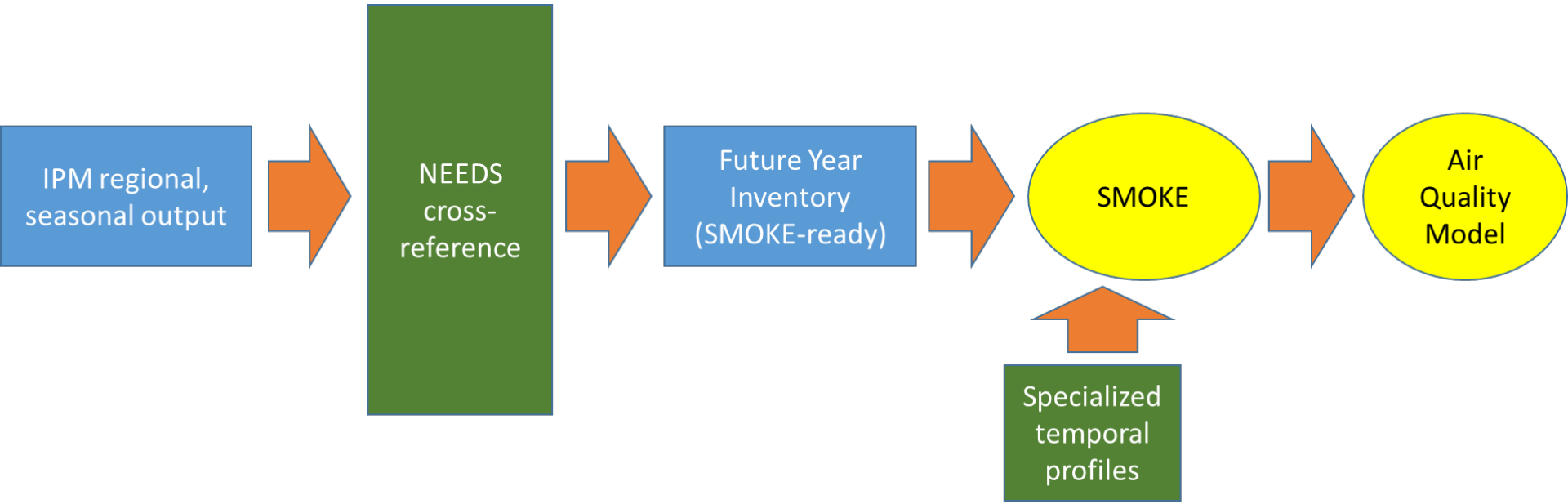
Other Non-EGU Projections Updates

- Growth for non-EGU industrial sources
  - Comments from RPOs and states: impacts most non-EGU source categories beyond oil and gas, including aircraft, residential wood combustion (RWC), portable fuel containers (PFCs)
- Updated facility/unit closures based on comments and NEI 2015 submissions
- Upstream mobile source emissions impacts
  - Stationary impacts of mobile rules (e.g. changes to refineries and pipelines due to increase of ethanol blends)
  - Simplified the approach; fewer source categories included
  - OTAQ provided scalars for additional years

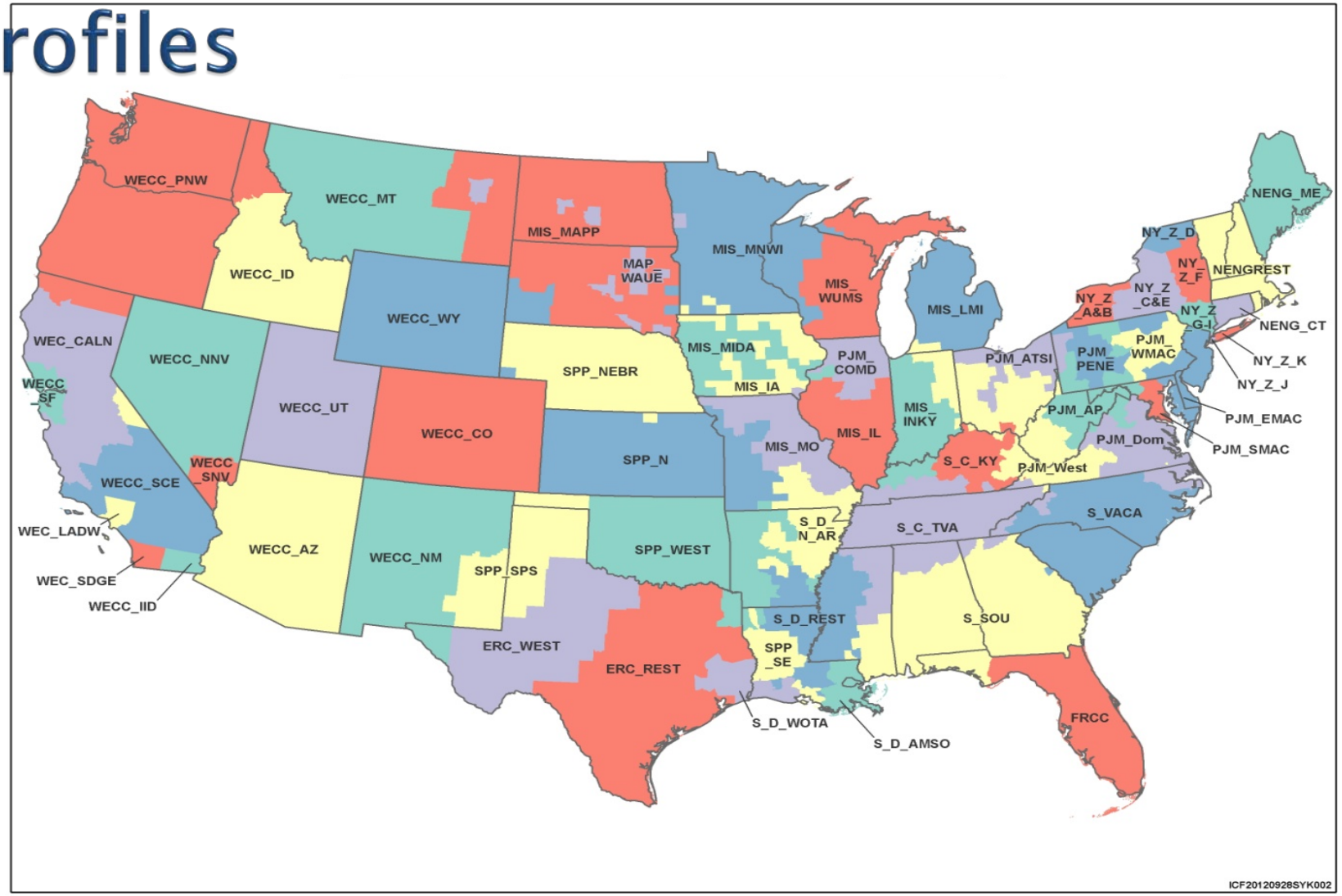
EGU Projections

- EGUs are identified in the NEI point inventory by filling in the IPM_YN column of the flat file
  - Populated from a set of alternate IDs stored in EIS
  - Sometimes there are not 1-1 matches between NEI and NEEDS database used by IPM (some manual)
- IPM reflects impacts of rules in intervening years
- IPM produces outputs for specific future years
  - 2020, 2023, 2025, 2028, 2030, 2035, 2040, 2045
  - Years not directly produced by IPM are typically mapped to years that it does produce
- IPM 5.16 base case available here: https://www.epa.gov/airmarkets/clean-air-markets-power-sector-modeling

Future year EGU Processing



Map of IPM Output Regions – also used for Average Non-CEMS profiles



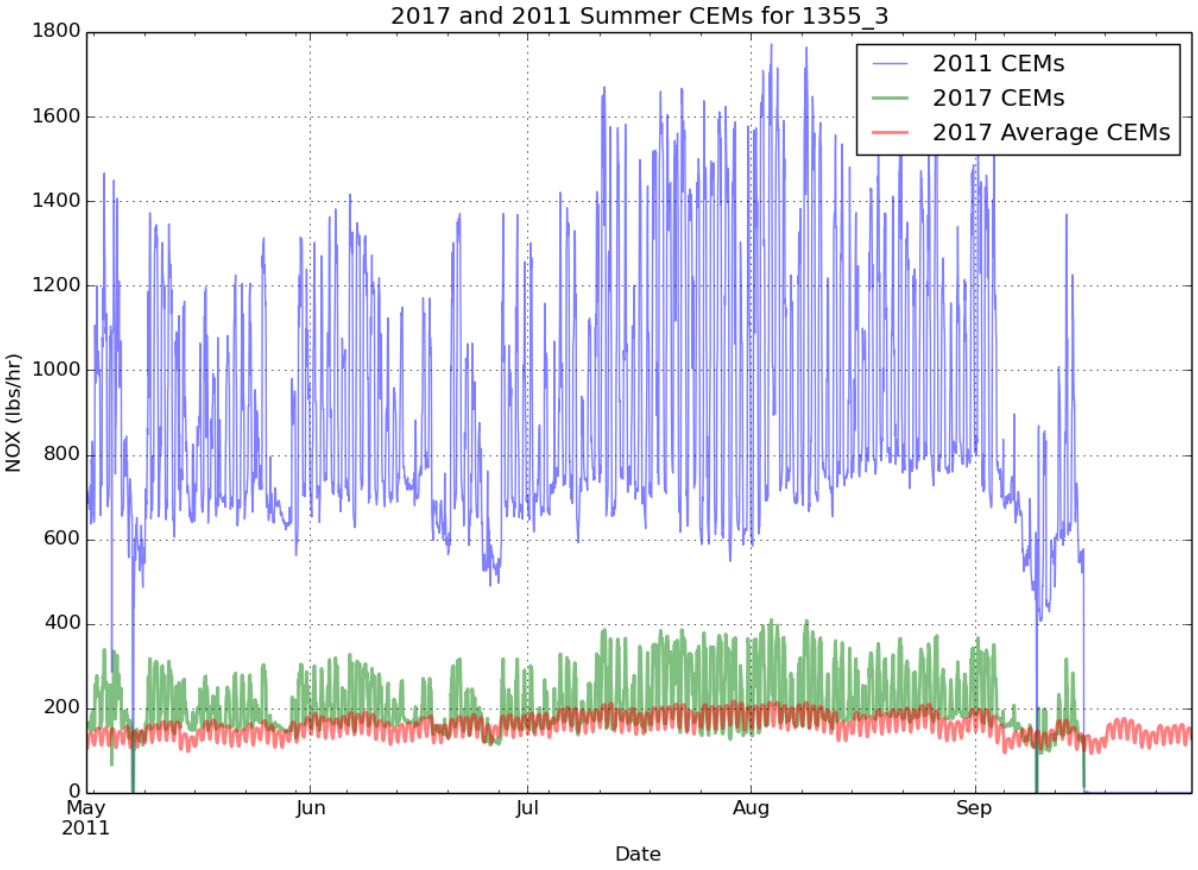
Flat Files Created from IPM Outputs

- IPM regional, seasonal outputs are converted to a Flat File format that can be input to SMOKE in multiple postprocessing steps
  1. For a specific model output year, parse results to unit-level for each season (Pollutants = NO_x, SO_2, Hg, CO_2)
  2. SMOKE-ready Flat file is created from parsed file
     - Cross reference from National Electric Energy Data System (NEEDS) to NEI units is used to assign IDs, locations, stack parameters (improved with state review)
     - PM emissions are created based on emission factors, fuel, and controls
- The base year EGU inventory is fully replaced by the flat file inventory output from IPM
  - IPM results have not used in air quality modeling for municipal waste combustors, nuclear, wind, solar

EGU Temporal Allocation for Future Years

- For sources that exist in both base and future years, allocate seasonal emissions to base year (2011 or 2014) hourly temporal pattern by pollutant
  - Compute hourly ratio for each hour of season in base year and multiply that ratio by the seasonal total to get the future year hourly emissions
- Units not matched to base year units are temporalized using fuel- and pollutant-specific regional average profiles to allocate emissions to month, then day, then hour
  - Method is also used for new units, units with no base year emissions, units that change fuels from base to future, and units with large predicted increases in emissions

Example Temporal Plots: base year, unit-specific, regional

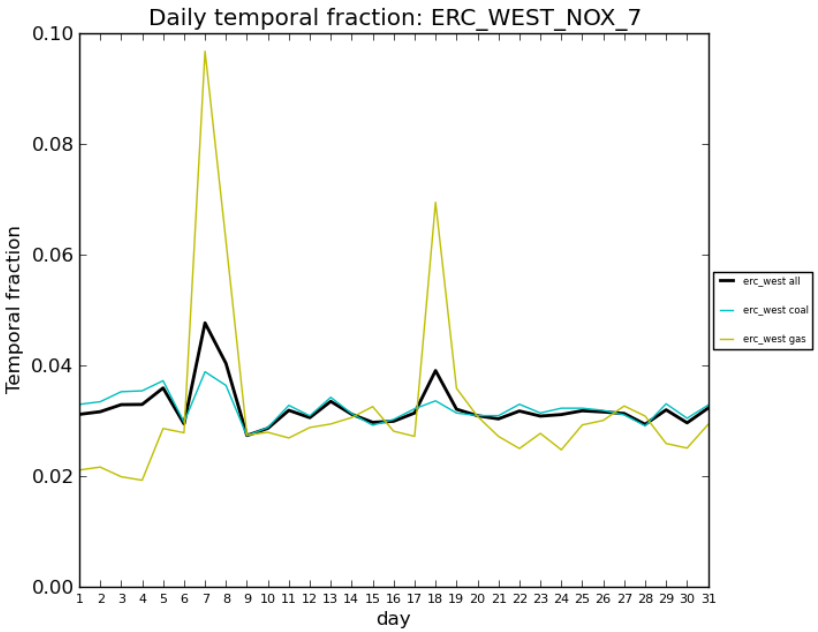


Seasonal emissions going down

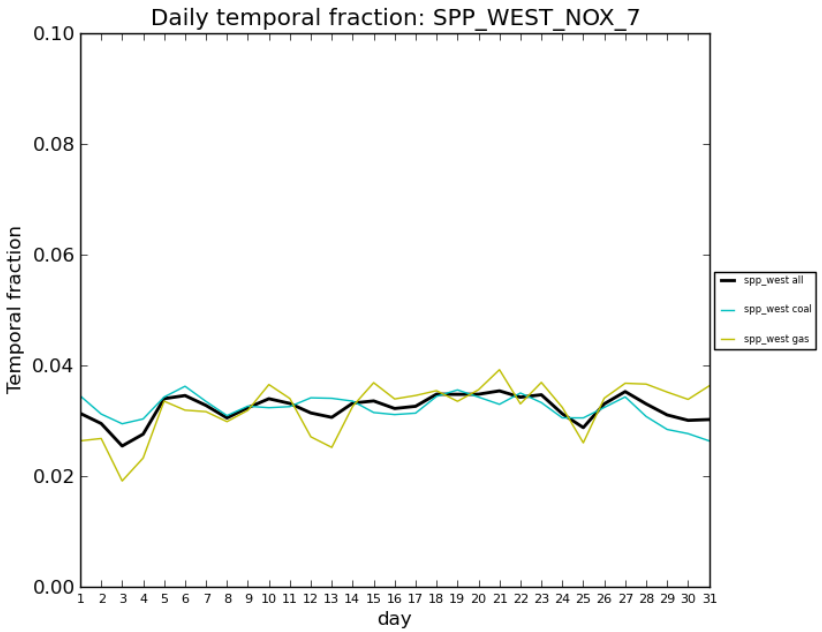
Average Month-day Profiles: Region- and fuel-specific

Profiles differ between regions

(yellow=gas, blue=coal, black=composite)

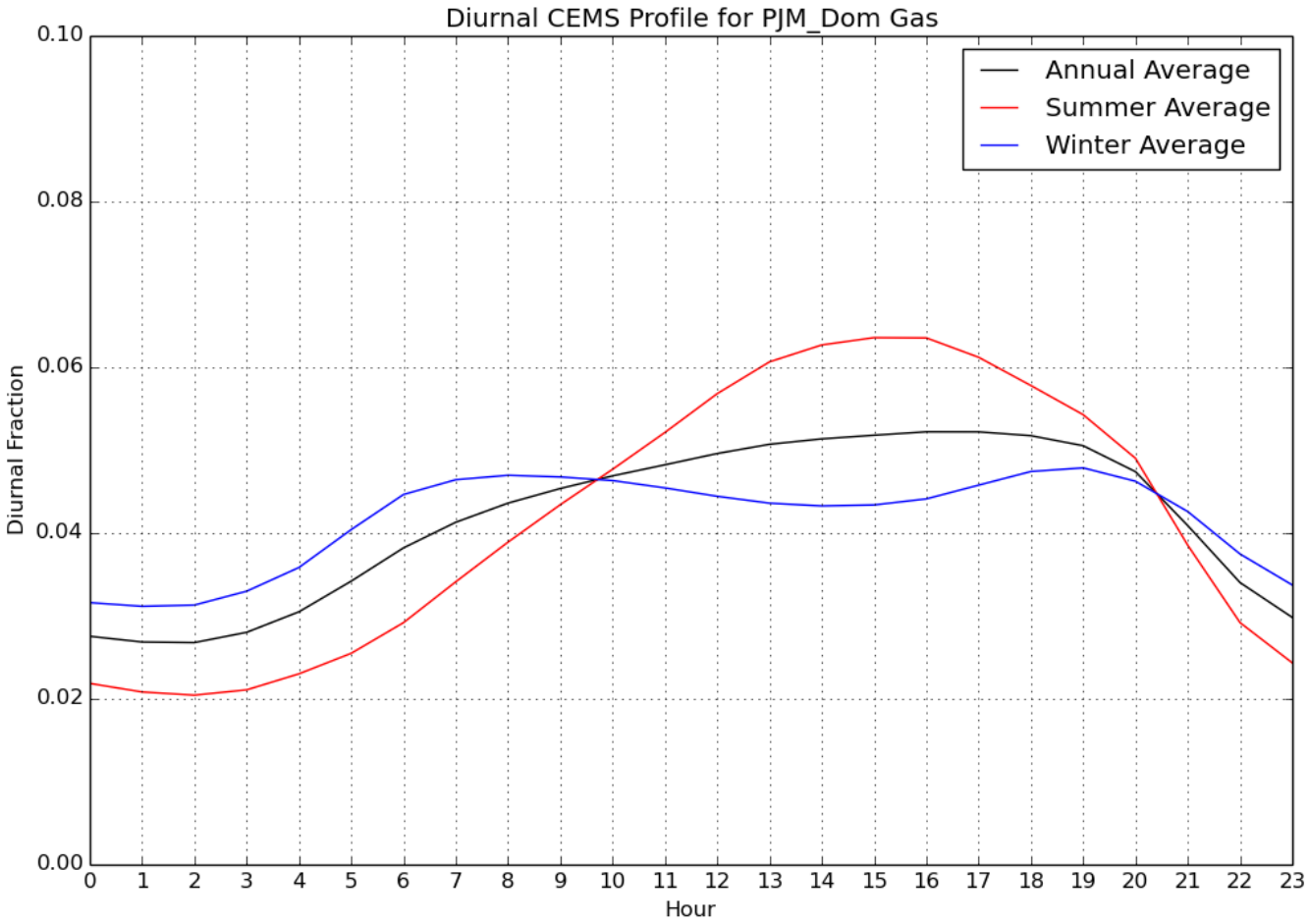


IPM Region in W Texas



IPM Region in E Oklahoma and W Arkansas

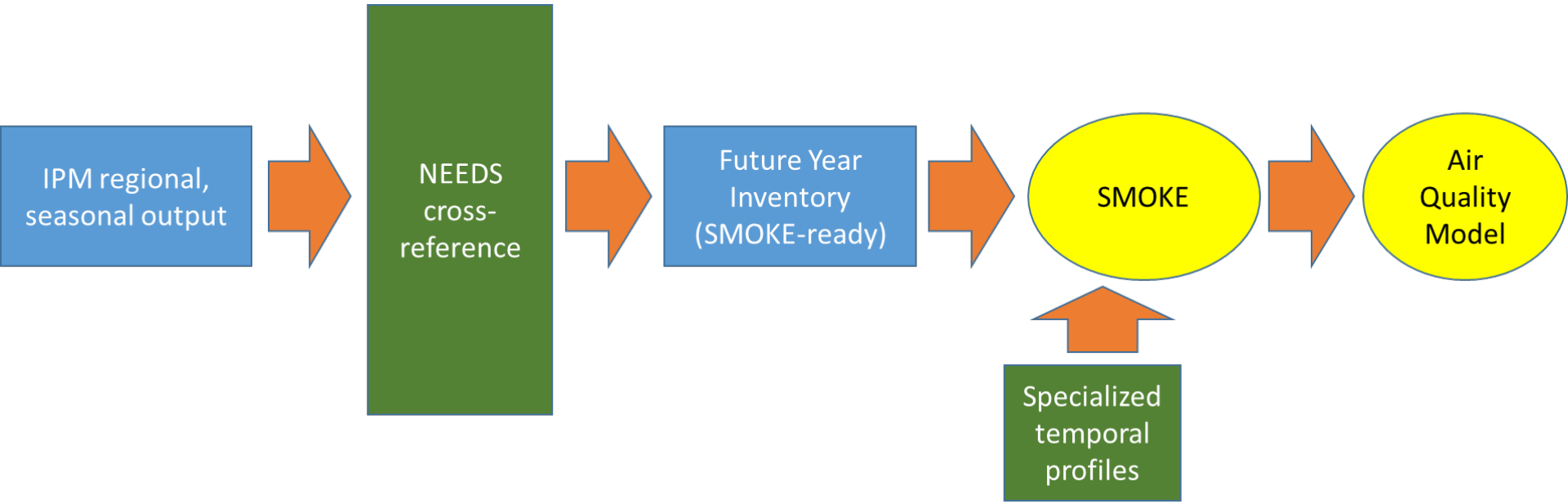
Average Profiles: Winter vs. Summer



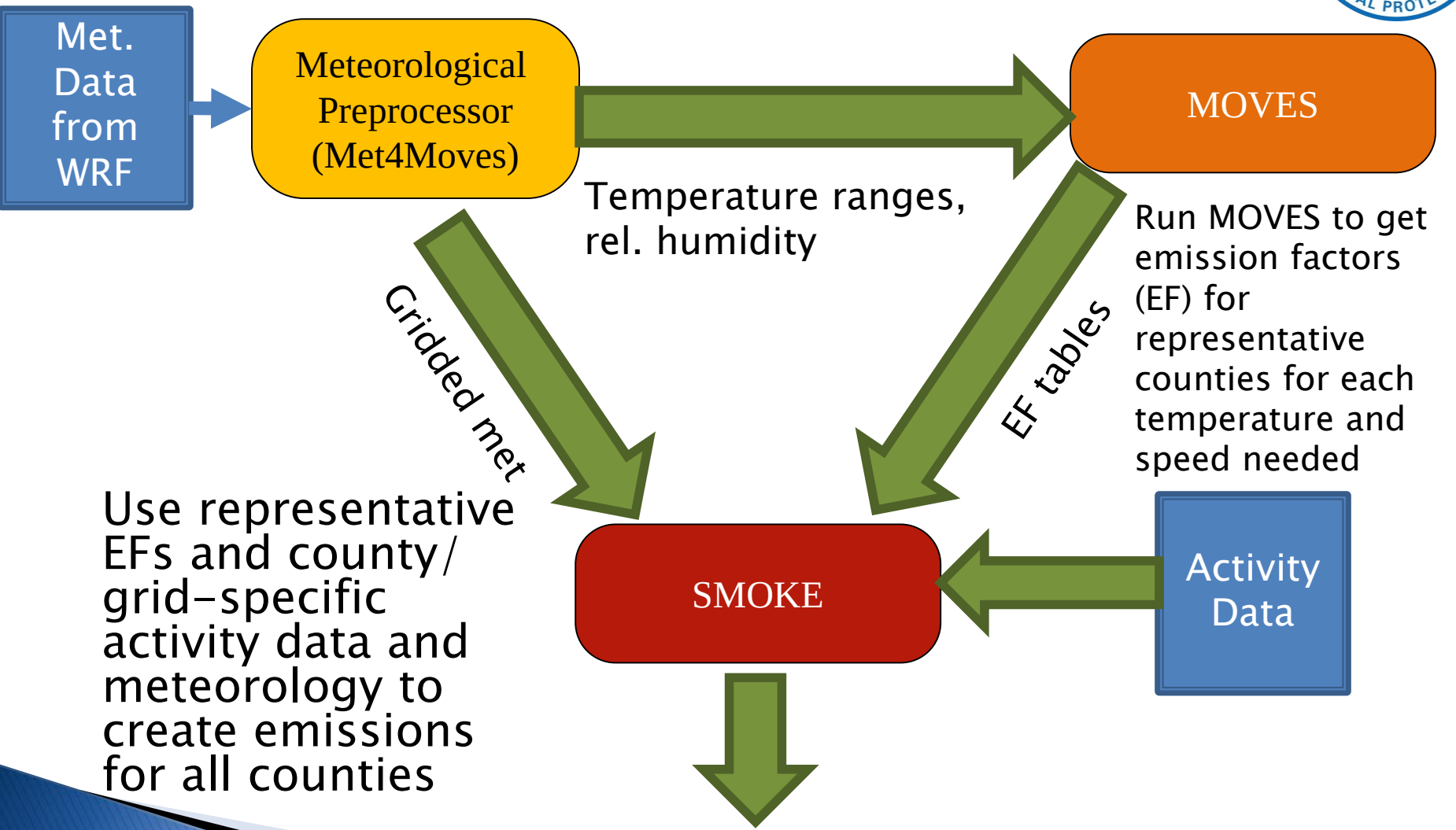
IPM region- and fuel-specific profile – mid-Atlantic

Questions?

- Any questions on projections background or EGU projections?



Onroad Emissions Modeling

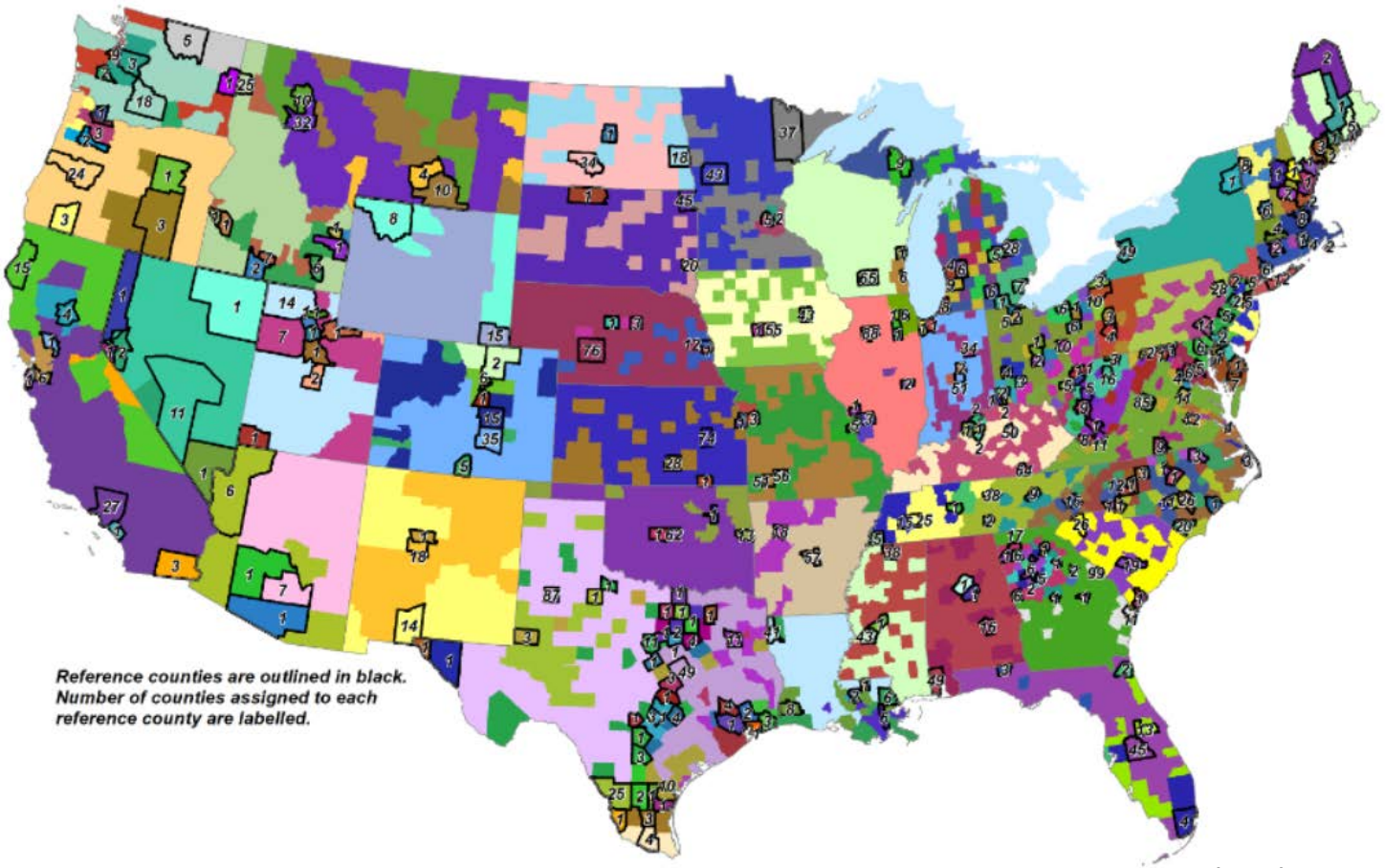


Onroad Projections Overview

- MOVES2014a is used to develop emission factors for light-duty and heavy-duty vehicles
- Main components adjusted for projections:
  - Regulatory impacts
  - Fuel changes
  - Inspection and Maintenance (I/M) programs
  - Age distributions
  - Future year Vehicle Miles Traveled (VMT) and other activity
  - Most of these changes are included in the approximately 300 representative county databases from which emission factors are computed

Representative Counties

- 3000+ counties are mapped to approx. 300 representative counties according to: state, fuels, age distribution, ramp fraction, I/M programs, emissions standards



Onroad Projections Constants

- Constant between base year and future year
  - Meteorology
  - Representative counties
    - If change representative counties, will create artificial spatial inconsistencies between base and future years
  - Spatial surrogates for gridding
  - Speeds (usually)

VMT projections 2011v6.3 Platform

- National projections based on AEO2016
  - Light-Duty gas, diesel and E-85
    - Table 42: LD vehicle miles travel by technology type
      - Motorcycles, cars, light-duty trucks
  - Heavy-Duty gas and diesel, Bus CNG
    - Table 50: Freight Transportation Energy Use
      - Heavy-Medium (Buses and Single Unit trucks)
      - Heavy (Combo Unit Trucks)
  - Geographic variation in projections using projected human population data

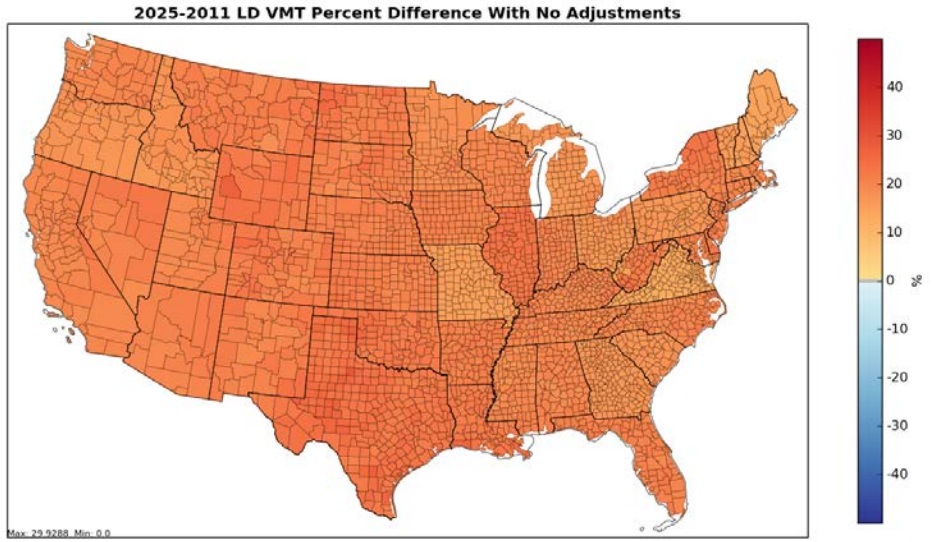
VMT projections variation (1 of 2)

- Use AEO2016 to get magnitude of change
- Adjust light duty (LD) VMT projections geographically based on human population projections
- Analysis indicated strong correlation between population and LD VMT
- Correlation between population and medium and heavy duty (MD/HD) VMT is not as strong
  - Use national projection for these source types

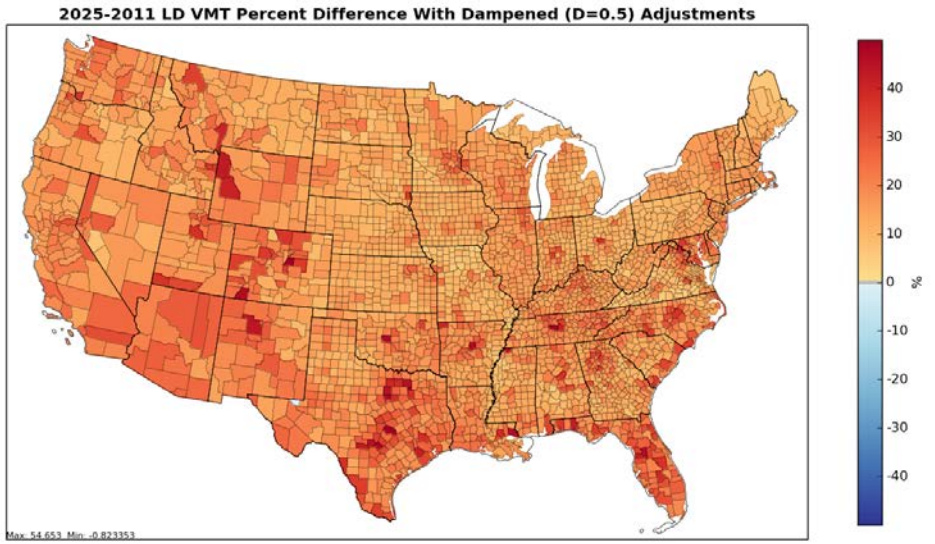
VMT projections variation (2 of 2)

- LD VMT projections for 2025

National projection



With county adjustment

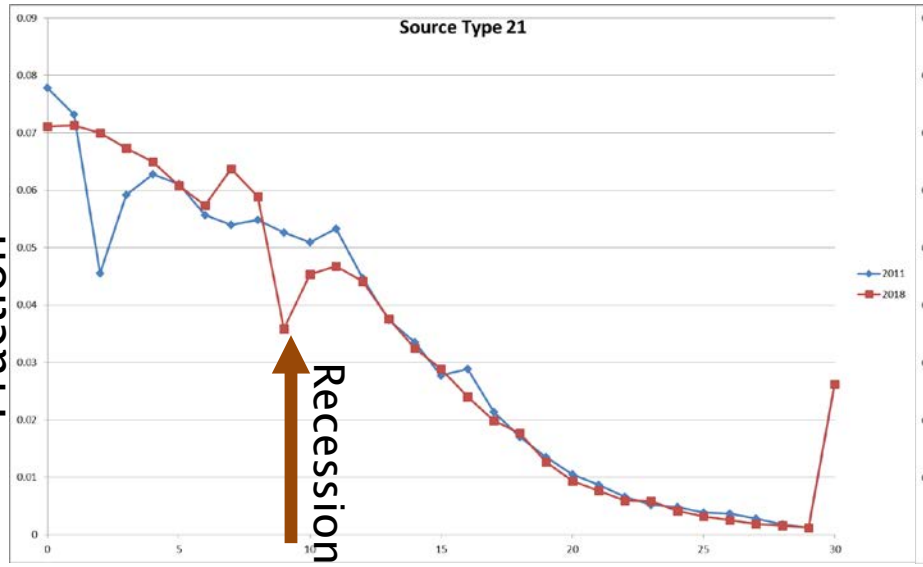


Age distribution

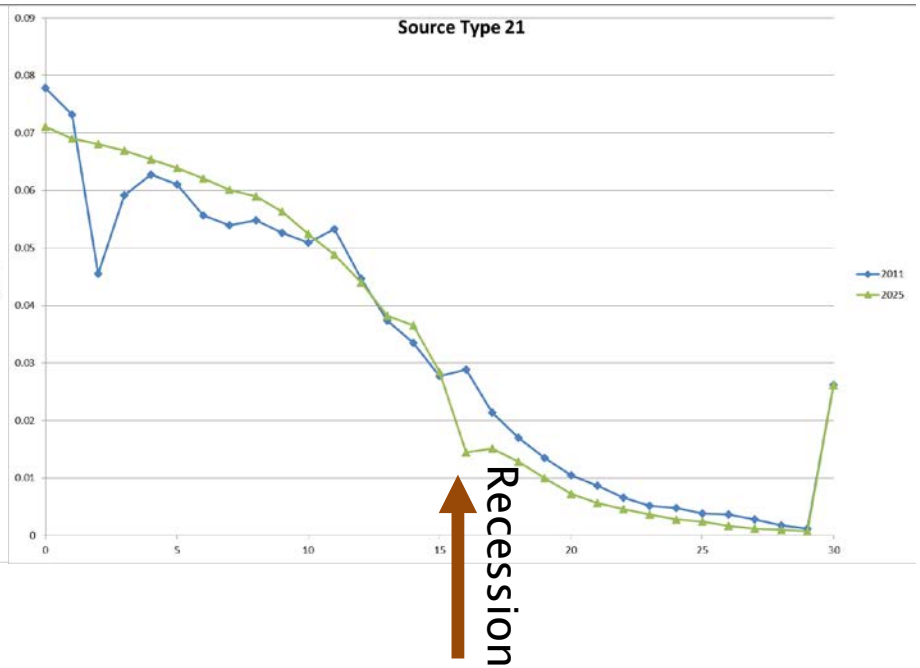
- Previous platforms (2011v6.1 and before) have used same age distribution in future years as base year
- Problem is that this will project the 2008/2009 recession into the wrong years in the future
  - 2025 projection would have a recession in 2022/2023
- In V6.2 and V6.3 platforms, project the age distribution so that recession stays in the 2008/2009 MYs in the future

Projecting Age distribution

2018



2025



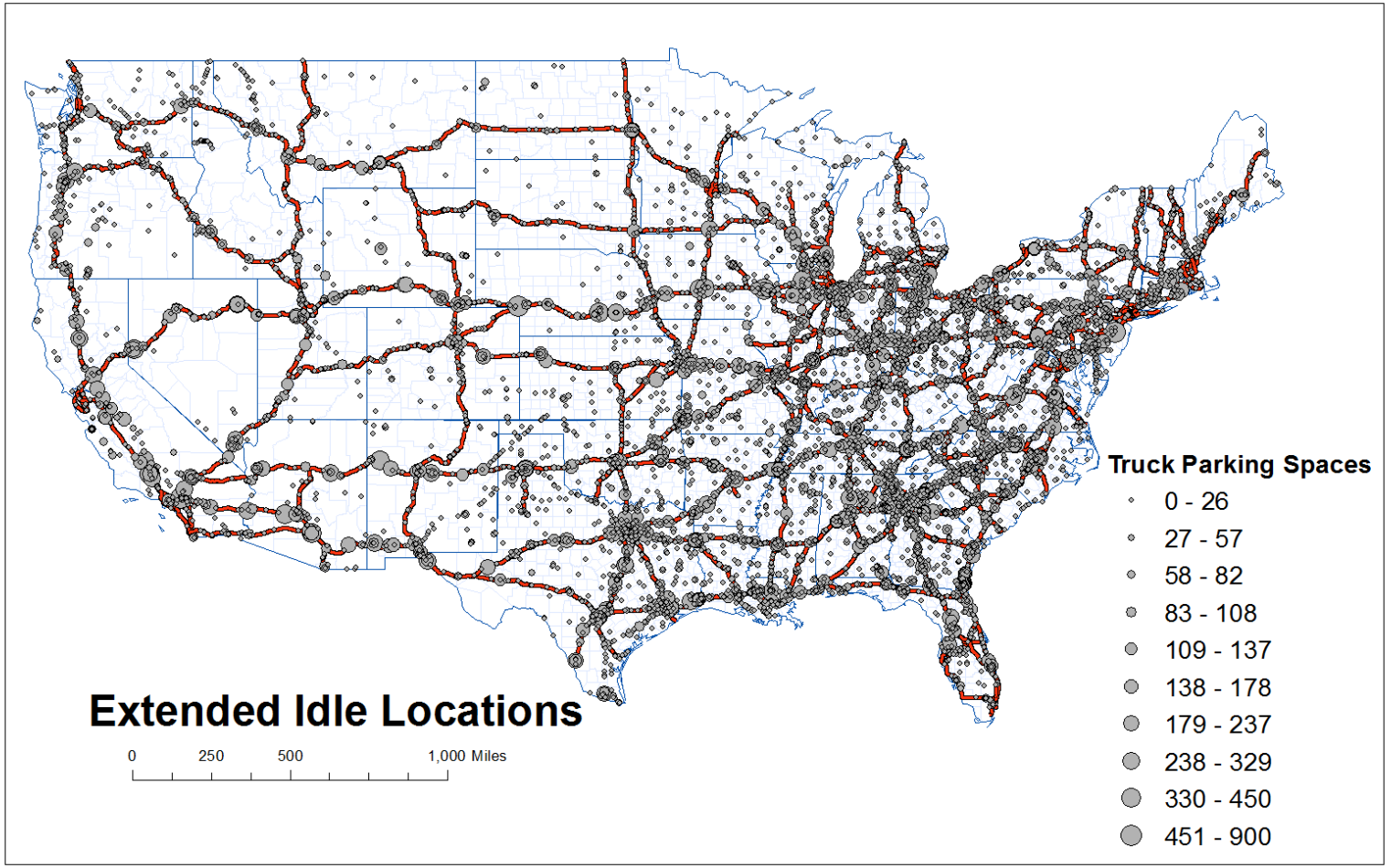
- Shift in recession to older section of age distribution to maintain model year impacts
- Dampening of spikes/troughs due to scrappage
- If project far enough into the future, will converge to the same age distribution

Onroad Projection Details

- Vehicle Population (VPOP) uses same VMT projection factors
- Speciation
  - Changes in model year and fuels impacts not only the emissions but the speciation
  - Speciation internal to MOVES2014- makes it possible to consider detailed model year, regulatory class, and fuel information
- Hoteling
  - Calculate the total hoteling hours from future year combination long-haul restricted VMT
  - Split between auxiliary power units (APUs) and extended idling (EXT) changes in future years due to greater penetration of APUs

Onroad Hoteling

- Hoteling = Overnight truck idling: extended idle and APU
- Temporal profile opposite of truck driving hours
- Spatial surrogate is based on truck parking spaces



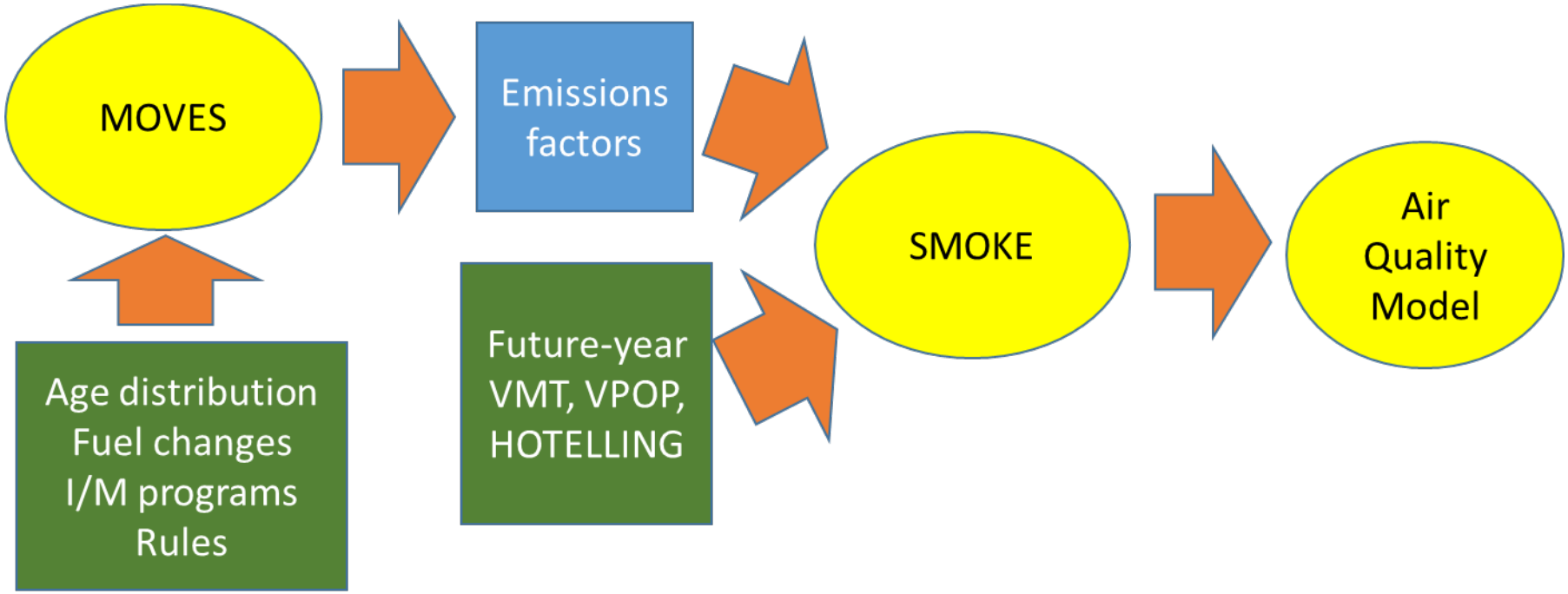
Nonroad Projections

- Nonroad sector = Exhaust, evaporative, and refueling emissions from nonroad engines (not including CMV, aircraft and locomotives)
- Now within MOVES2014a, previously used National Mobile Inventory Model (NMIM)
- Collect input databases
- Run for future year with appropriate MET/fuels
  - Meteorology is consistent with base year
  - Fuels should be consistent with future year and ideally with onroad
- Use CARB data for California
- Change VOC speciation
  - Account for changes in fuels (i.e. shift toward E10)

International Onroad and Nonroad Projections

- Canada
  - When no future year inventory is available, the Canadian onroad and nonroad emissions have been projected using U.S. emissions changes (trends) by SCC and pollutant
  - Year 2025 Canadian inventory recently acquired includes onroad and nonroad emissions
- Mexico
  - Ran MOVES-Mexico for years 2023 and 2028
  - Mexico nonroad inventory projected to years 2018, 2025 and 2030 and interpolated as needed

Onroad / mobile sources overview Questions?



Introducing: NEI non-EGU Point/Nonpoint Projections

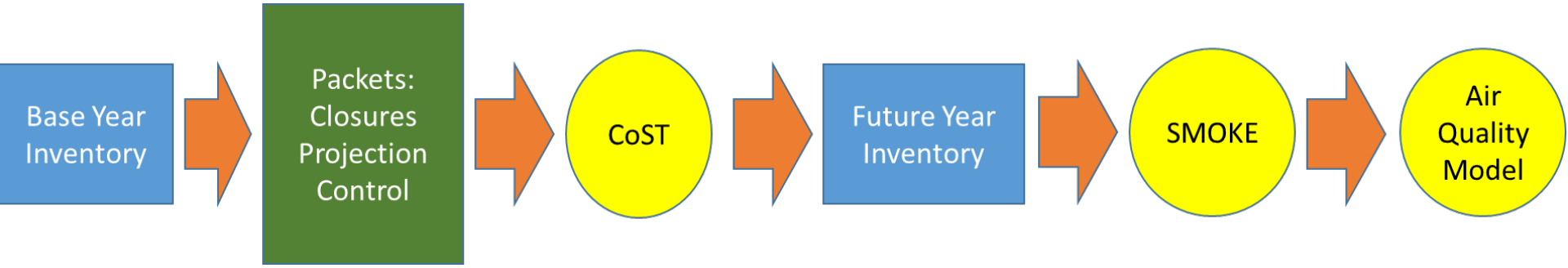
The remainder of this section discusses how we project emissions for NEI non-EGU point and nonpoint inventories

Data Sources for Non-EGU Projections

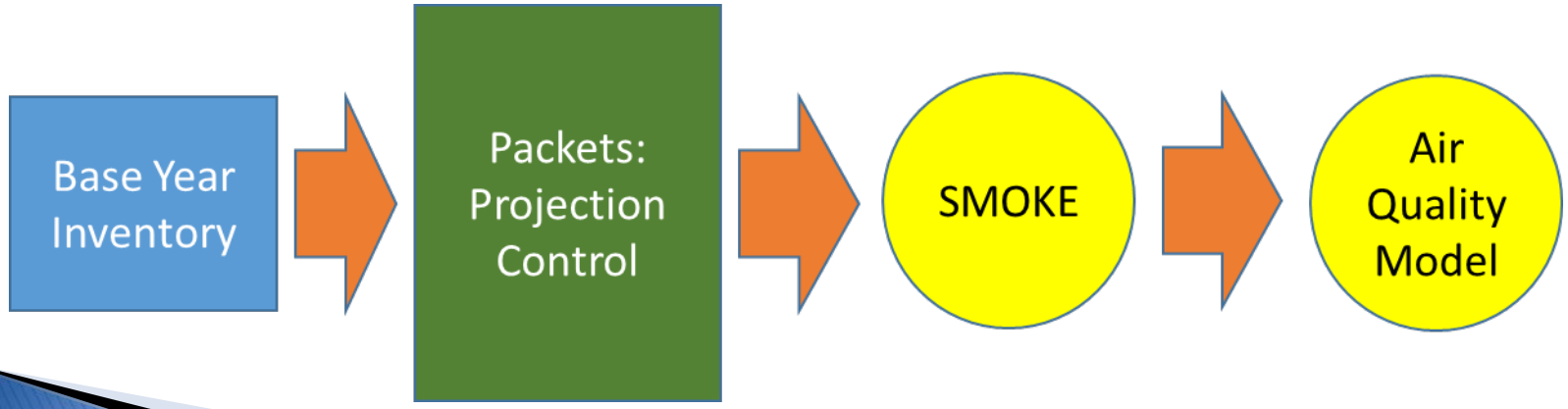
- Energy Information Administration/Annual Energy Outlook
  - Oil & gas, industrial sources, VMT
- Data from multiple EPA offices
  - Office of Research and Development: animal NH3
  - Office of Air Quality Planning and Standards: RICE NESHAPs, regional haze, consent decrees, oil & gas, RWC, CISWI
  - Office of Transportation and Air Quality: commercial marine vessels, trains, portable fuel containers (PFCs), upstream emissions
  - Office of Atmospheric Programs: oil & gas
  - Office of Enforcement and Compliance Assurance (OECA): consent decrees
- Outside agencies
  - State/local/regional: closures, projections, ICI boilers, fuel sulfur
  - Federal Aviation Administration: aircraft
  - Contractors: projections and controls for industrial sources including oil & gas, RWC
- Collaboration needed to determine "most-appropriate" data for many source categories

Available Tools for Projection of non-EGU Point/Nonpoint Projections

Control Strategy Tool (CoST) – a good organizational and reporting tool



SMOKE – traditional approach; good for simplified projection tasks



Control Strategy Tool (CoST)

- Part of the Emissions Modeling Framework (EMF)
  - https://www.cmascenter.org/cost/documentation/2.12/html/
- Used to project most NEI non-EGU point and nonpoint inventories
  - Exceptions include stand-alone future year inventories (e.g., biodiesel and cellulosic plants, new cement kilns)
- Has a hierarchy for how "packets" are applied
- Tracks the impact of each packet on the inventory
- Used for projections, but also includes algorithms for other analyses like maximum emissions reduction and least-cost

Control Strategy Tool: Packet Types

- Plant CLOSURE
  - Facility, unit, stack and/or process-level
  - Effective date needed
  - July 1 cut-off
- PROJECTION
  - Scalars (e.g., 0.5 = 50% reduction, 2.0=100% increase)
  - All inventories: geographic (FIPS state / county), pollutant, source classification code (SCC)
  - Point only: facility/sub-facility/North American Industry Classification System (NAICS)
- CONTROL
  - Similar facility/geographic/SCC/pollutant applicability as PROJECTION packets
  - Percent reductions (0-100), optional rule effectiveness and rule penetration
  - Compliance date optional
  - July 1 cut-off (before July 1 of year is applied, after is not)

Closure Packet Example

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	fips	plantid	pointid	stackid	segment	plant	effective_date	reference	comments_xxx					
2	1013	7212711	10819013			Coastal Forest Products	1/1/2012		! EIS unit closure status=PS: Coastal Forest Products LLC					
3	1015	923311	48124913			Chemical Agent Disposa	1/1/2013		! EIS unit closure status=PS: Chemical Agent Disposal Facility					
4	1015	923311	48125613			Chemical Agent Disposa	1/1/2013		! EIS unit closure status=PS: Chemical Agent Disposal Facility					
5	1017	7441811	10843613			Knauf Fiber Glass	1/1/2013		! EIS unit closure status=PS: Knauf Fiber Glass					
6	1017	7441811	10843713			Knauf Fiber Glass	1/1/2013		! EIS unit closure status=PS: Knauf Fiber Glass					
7	1017	7441811	10843813			Knauf Fiber Glass	1/1/2013		! EIS unit closure status=PS: Knauf Fiber Glass					
8	1017	7441811	10843913			Knauf Fiber Glass	1/1/2013		! EIS unit closure status=PS: Knauf Fiber Glass					
9	1017	7441811	10844013			Knauf Fiber Glass	1/1/2013		! EIS unit closure status=PS: Knauf Fiber Glass					
10	1017	7441811	10844113			Knauf Fiber Glass	1/1/2013		! EIS unit closure status=PS: Knauf Fiber Glass					
11	1017	7441811	10844213			Knauf Fiber Glass	1/1/2013		! EIS unit closure status=PS: Knauf Fiber Glass					
12	1017	7441811	10844313			Knauf Fiber Glass	1/1/2013		! EIS unit closure status=PS: Knauf Fiber Glass					
13	1025	10631911	58459413			Scotch Gulf Lumber LLC	1/1/2013		! EIS unit closure status=PS: Scotch Gulf Lumber LLC					
14	1033	7212211	10828213			Wise Alloys LLC	1/1/2012		! EIS unit closure status=PS: Wise Alloys LLC					
15	1035	10545111	83303913			Pruet Production Comp	1/1/2012		! EIS unit closure status=PS: Pruet Production Company					
16	1035	10545111	83304013			Pruet Production Comp	1/1/2012		! EIS unit closure status=PS: Pruet Production Company					

README | CoST Packet Matching Hierarchy | **CLOSURES_packet_example** | PROJECTION_packet_example | PROJECTION_extended_e ...

Closures are applied wrt a target year (e.g., 2020): Records with effective dates up to July 1 of target year will be applied

Closures can be applied at multiple levels:

- Region_cd = FIPS state & county
- Facility = plant
- Unit = point
- Release point = stack
- Process = segment

Projection Packet Example

	A	B	C	D	E	F	G	L	M	N	P	Q
1	Country_cd	Region_cd	facility_id	unit_id	rel_point_id	process_id	...	SCC	Poll	Reg_code	NAICS	Ann_proj_
2	US	09001	14621711	88741013	96626912	120536814						1.044
3	US	09001	14621711	99532913	96626612	140180514						1.044
4	US	09001	14621711	99533013	96626512	140180614						1.044
5	US	09001	14621711	99533113	96626712	140180714						1.044
10	US	09003	2753811	41000513	39105612	48269014						1.044
11	US	09003	2753811	41000613	39105912	48268914						1.044
12	US	09003	2753811	41000713	39105712	48268814						1.044
13	US	09003	2753811	41000813	39105512	48268714						1.044
22	US	09007	2706711	40863013	38981012	48745614						1.044
23	US	09007	2706711	40863113	38980912	48745514						1.044
27	US	09007	2706711	40863513	38981312	48745114						1.044
67	US	24009	5169611	87920713	84068812	119329114						1
68	US	24009	5169611	87920813	84068912	119329214						1
69	US	24009	5169611	87920913	84069012	119329314						1
70	US	24009	5169611	87921013	84069112	119329414						1
71	US	24009	5169611	87921113	84069212	119329514						1
72	US	24009	5169611	87921213	84069312	119329614						1
73	US	24009	5169611	87921313	84069412	119329714						1

... | PROJECTION_packet_example | PROJECTION_extended_exampl ...

Factors to apply are here

Projection entries can also be specified at multiple levels

Control Packet Example

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	
1	FIPS	SCC	POLL	Primary Control	Control Efficiency %	rule ff	rule pen	SIC	MACT	APPFLAG	REPFLAG	plantid	pointid	stackid	segment	complian ce_date	NAICS	comments
2	09000	2102001000	CO		34.0	100	100			Y	R					1/1/2016		"! Boiler MACT /I
3	09000	2102001000	NOX		4.0	100	100			Y	R					1/1/2016		"! Boiler MACT /I
4	09000	2102001000	PM10-PRI		4.0	100	100			Y	R					1/1/2016		"! Boiler MACT /I
5	09000	2102001000	PM25-PRI		4.0	100	100			Y	R					1/1/2016		"! Boiler MACT /I
6	09000	2102001000	SO2		4.0	100	100			Y	R					1/1/2016		"! Boiler MACT /I
7	09000	2102001000	VOC		34.0	100	100			Y	R					1/1/2016		"! Boiler MACT /I
8	09000	2102002000	CO		34.0	100	100			Y	R					1/1/2016		"! Boiler MACT /I
110	09001	10300501	CO		6	100	100			Y	A	843611				1/1/2016		"! ICI Boiler MAC
111	09001	10300501	NOX		4	100	100			Y	A	843611				1/1/2016		"! ICI Boiler MAC
112	09001	10300501	PM10-PRI		4	100	100			Y	A	843611				1/1/2016		"! ICI Boiler MAC
113	09001	10300501	PM25-PRI		4	100	100			Y	A	843611				1/1/2016		"! ICI Boiler MAC
114	09001	10300501	SO2		4	100	100			Y	A	843611				1/1/2016		"! ICI Boiler MAC
115	09001	10300501	VOC		6	100	100			Y	A	843611				1/1/2016		"! ICI Boiler MAC
116	09003	10200501	CO		6	100	100			Y	A	918811				1/1/2016		"! ICI Boiler MAC
117	09003	10200501	NOX		4	100	100			Y	A	918811				1/1/2016		"! ICI Boiler MAC
118	09003	10200501	PM10-PRI		4	100	100			Y	A	918811				1/1/2016		"! ICI Boiler MAC

... Closure_effective_date | Extended Format_Mapping

Ending FIPS with 000 applies to entire state
Rule effectiveness and penetration usually 100
APPFLAG of Y means to apply it
REPFLAG of R means replace, A mean add on
Records applied if compliance_date < July 1 of target year

Control Strategy Tool: Hierarchy

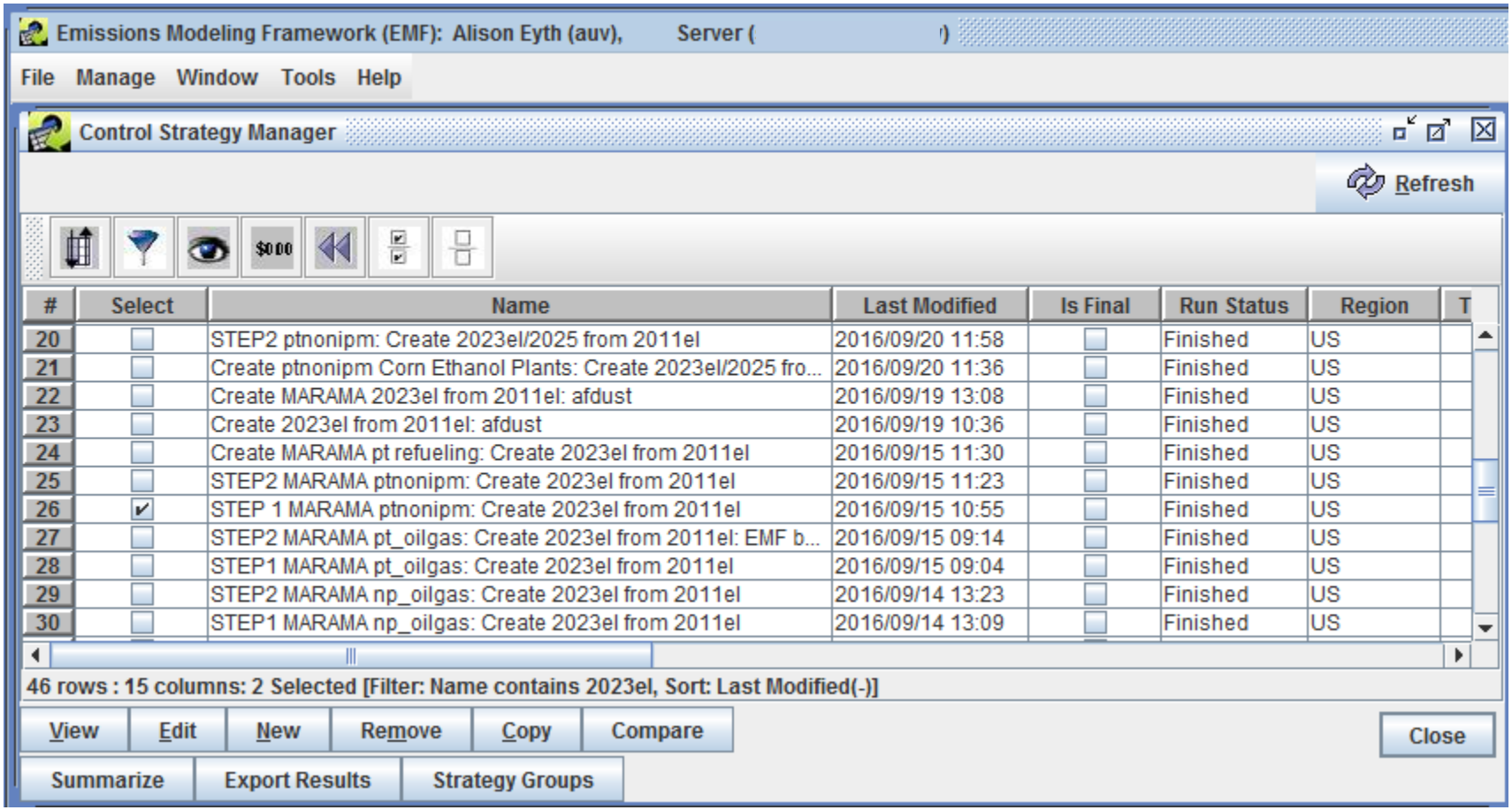
- CLOSURES, PROJECTION, CONTROL packet types applied separately in a run
- All packets for each type concatenated and QA'd
- Most-specific applicable (compliance date, application flag) entry supercedes more general entries
- Consequences for consent decrees, comments, broad control programs
  - Need to be careful how you build packets
  - **QA very important to ensure output from strategy matches intended inputs – especially for overlaps**

General -> Specific

Rank	Matching Hierarchy	Inventory Type
1	REGION_CD, FACILITY_ID, UNIT_ID, REL_POINT_ID, PROCESS_ID, SCC, POLL	point
2	REGION_CD, FACILITY_ID, UNIT_ID, REL_POINT_ID, PROCESS_ID, POLL	point
3	REGION_CD, FACILITY_ID, UNIT_ID, REL_POINT_ID, POLL	point
4	REGION_CD, FACILITY_ID, UNIT_ID, POLL	point
5	REGION_CD, FACILITY_ID, SCC, POLL	point
6	REGION_CD, FACILITY_ID, POLL	point
7	REGION_CD, FACILITY_ID, UNIT_ID, REL_POINT_ID, PROCESS_ID, SCC	point
8	REGION_CD, FACILITY_ID, UNIT_ID, REL_POINT_ID, PROCESS_ID	point
9	REGION_CD, FACILITY_ID, UNIT_ID, REL_POINT_ID	point
10	REGION_CD, FACILITY_ID, UNIT_ID	point
11	REGION_CD, FACILITY_ID, SCC	point
12	REGION_CD, FACILITY_ID	point
13	REGION_CD, NAICS, SCC, POLL	point, nonpoint
14	REGION_CD, NAICS, POLL	point, nonpoint
15	STATE, NAICS, SCC, POLL	point, nonpoint
16	STATE, NAICS, POLL	point, nonpoint
17	NAICS, SCC, POLL	point, nonpoint
18	NAICS, POLL	point, nonpoint
19	REGION_CD, NAICS, SCC	point, nonpoint
20	REGION_CD, NAICS	point, nonpoint
21	STATE, NAICS, SCC	point, nonpoint
22	STATE, NAICS	point, nonpoint
23	NAICS, SCC	point, nonpoint
24	NAICS	point, nonpoint
25	REGION_CD, SCC, POLL	point, nonpoint
26	STATE, SCC, POLL	point, nonpoint
27	SCC, POLL	point, nonpoint
28	REGION_CD, SCC	point, nonpoint
29	STATE, SCC	point, nonpoint
30	SCC	point, nonpoint
31	REGION_CD, POLL	point, nonpoint
32	REGION_CD	point, nonpoint
33	STATE, POLL	point, nonpoint
34	STATE	point, nonpoint
35	POLL	point, nonpoint

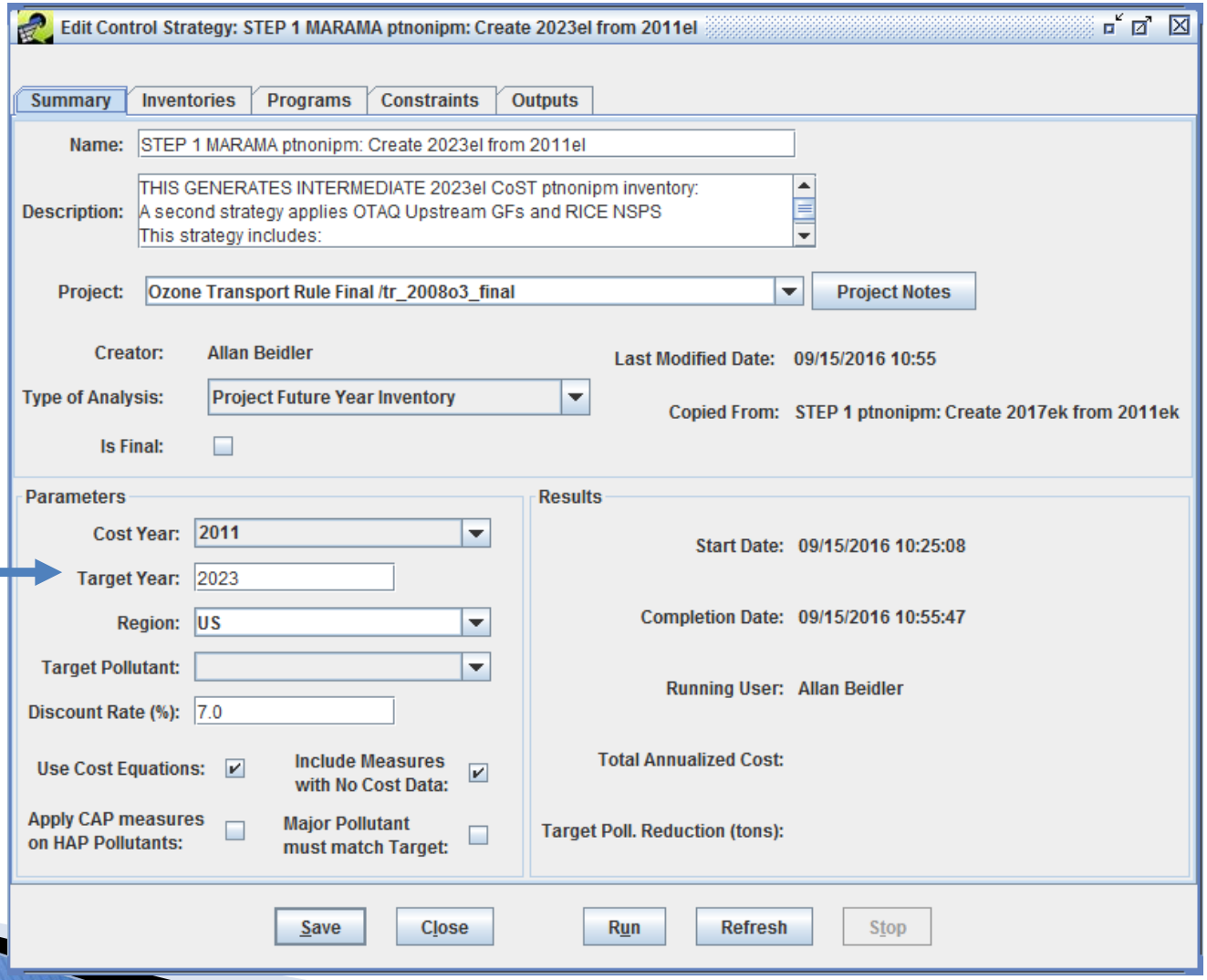
Entries in packets that are more specific have **higher priority** than the more general ones

Control Strategies within the Emissions Modeling Framework

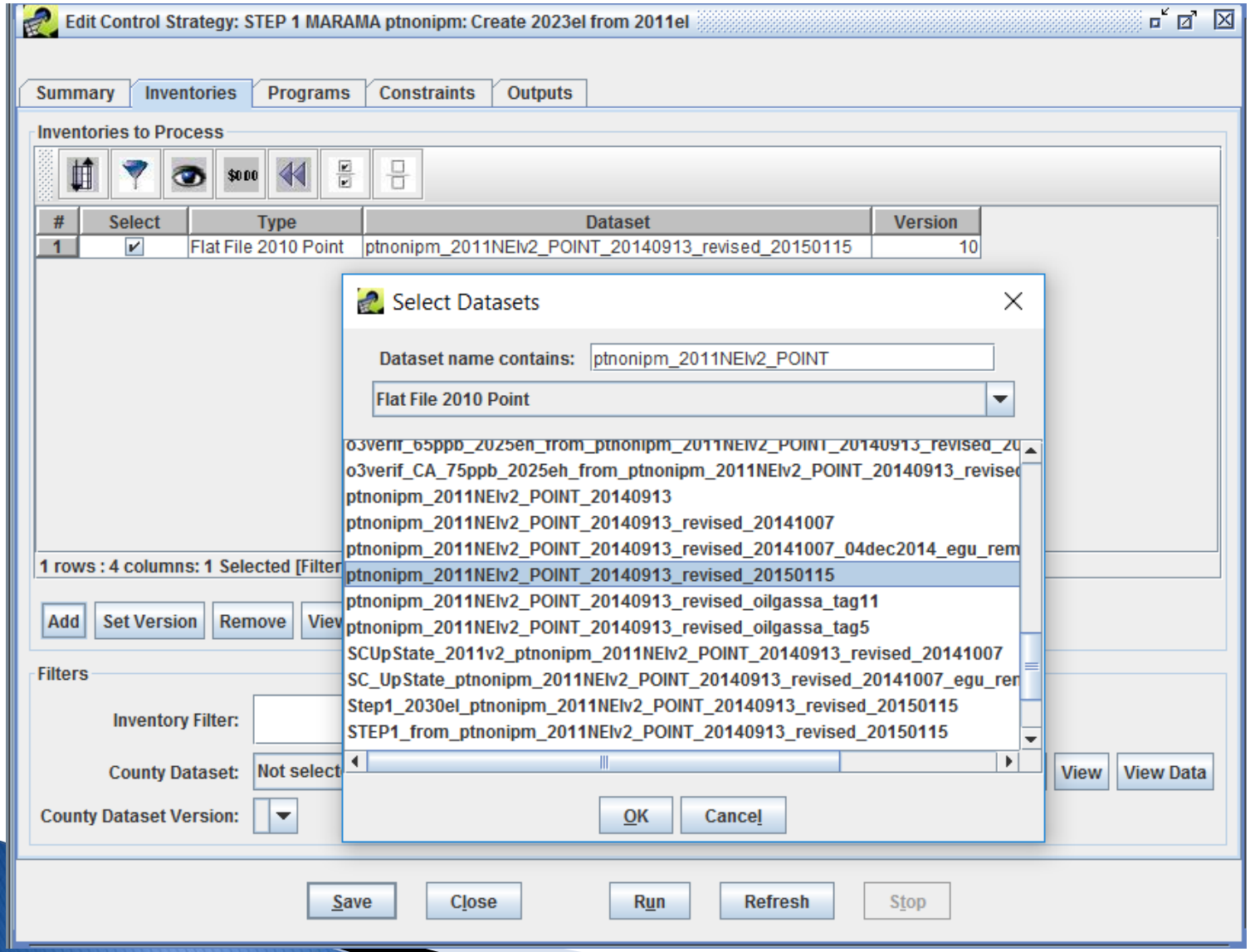


Editing a Control Strategy

Target Year is a key parameter

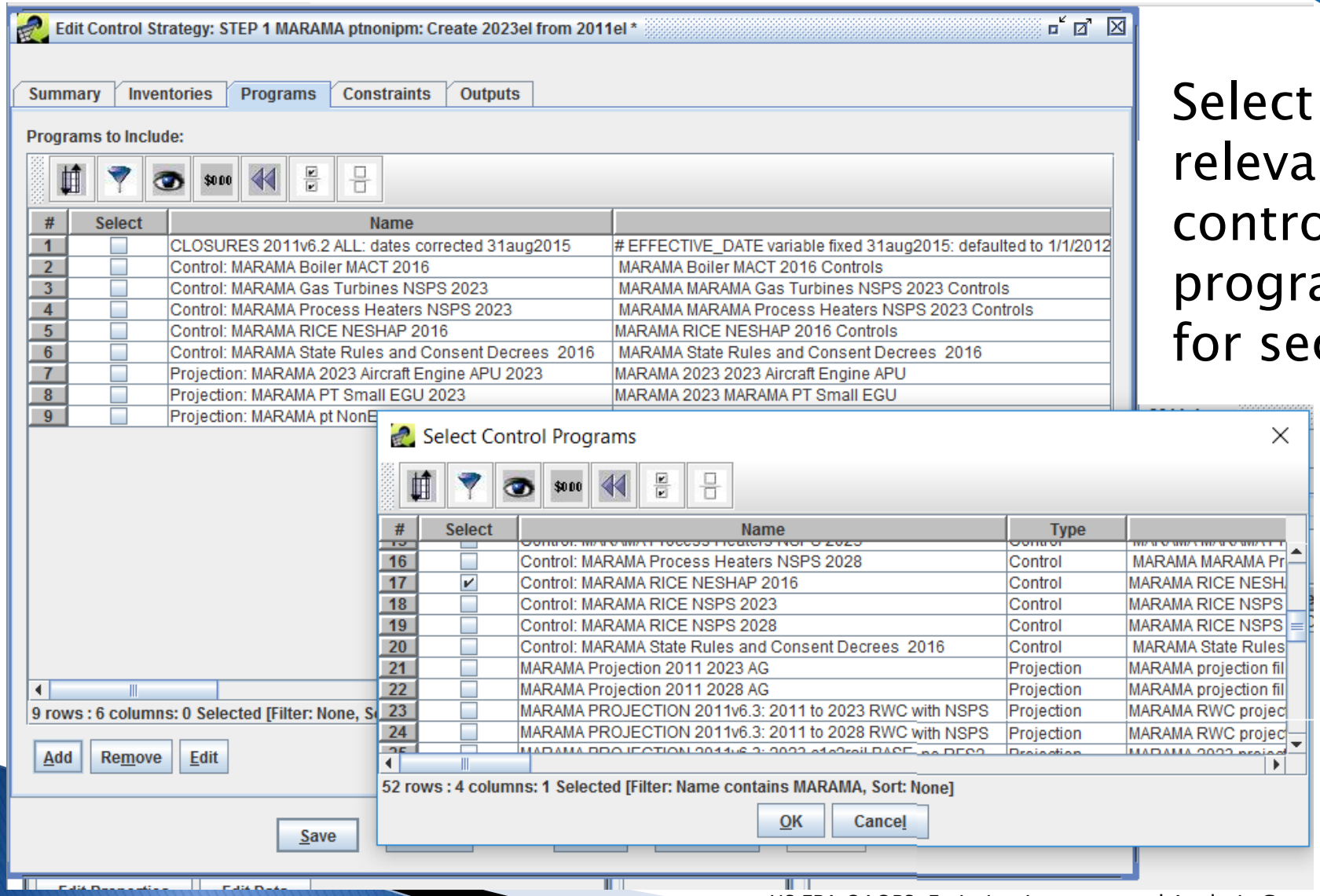


Select Inventories for Strategy



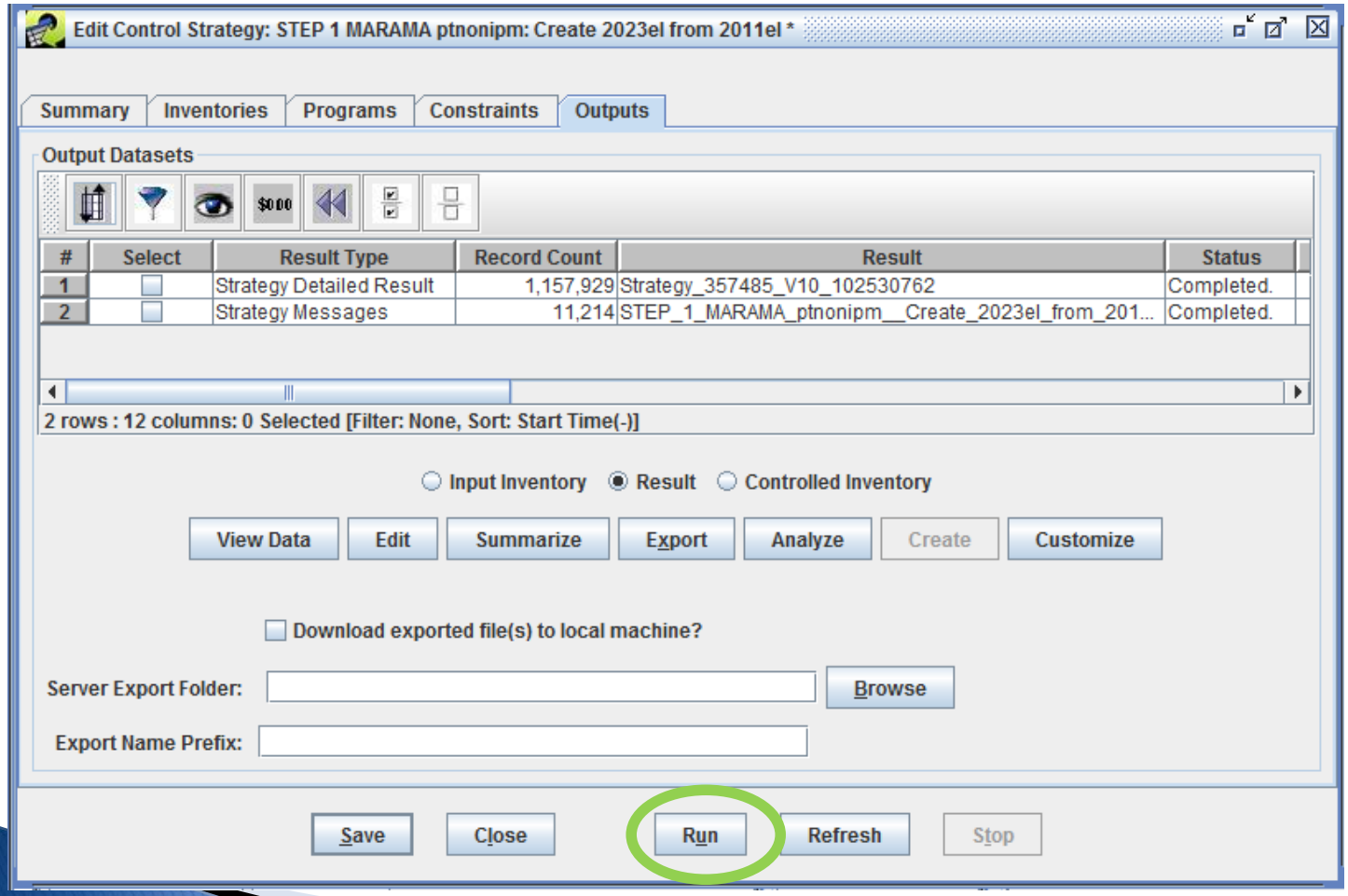
Select one or more inventories to project

Select Control Programs



Select all relevant control programs for sector

Control Strategy Tool: Outputs



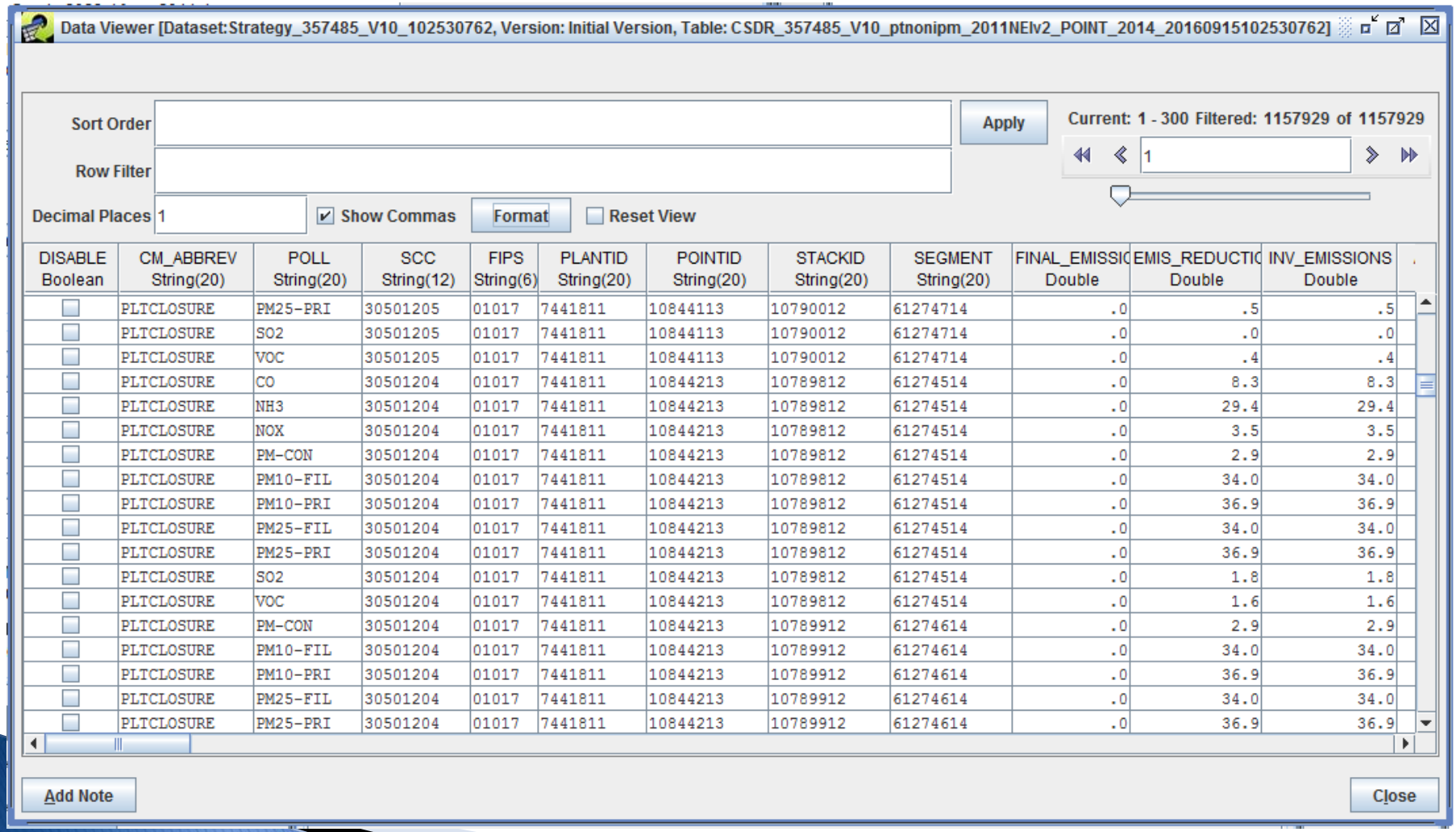
After strategy is run, outputs will appear: Detailed result and Messages

It is important To review these outputs

Summaries of detailed result are also helpful

After QA, create a controlled inventory from here

Example Detailed Result (selected columns)



DISABLE Boolean	CM_ABBREV String(20)	POLL String(20)	SCC String(12)	FIPS String(6)	PLANTID String(20)	POINTID String(20)	STACKID String(20)	SEGMENT String(20)	FINAL_EMISSIC Double	EMIS_REDUCTIC Double	INV_EMISSIONS Double
	PLTCLOSURE	PM25-PRI	30501205	01017	7441811	10844113	10790012	61274714	.0	.5	.5
	PLTCLOSURE	SO2	30501205	01017	7441811	10844113	10790012	61274714	.0	.0	.0
	PLTCLOSURE	VOC	30501205	01017	7441811	10844113	10790012	61274714	.0	.4	.4
	PLTCLOSURE	CO	30501204	01017	7441811	10844213	10789812	61274514	.0	8.3	8.3
	PLTCLOSURE	NH3	30501204	01017	7441811	10844213	10789812	61274514	.0	29.4	29.4
	PLTCLOSURE	NOX	30501204	01017	7441811	10844213	10789812	61274514	.0	3.5	3.5
	PLTCLOSURE	PM-CON	30501204	01017	7441811	10844213	10789812	61274514	.0	2.9	2.9
	PLTCLOSURE	PM10-FIL	30501204	01017	7441811	10844213	10789812	61274514	.0	34.0	34.0
	PLTCLOSURE	PM10-PRI	30501204	01017	7441811	10844213	10789812	61274514	.0	36.9	36.9
	PLTCLOSURE	PM25-FIL	30501204	01017	7441811	10844213	10789812	61274514	.0	34.0	34.0
	PLTCLOSURE	PM25-PRI	30501204	01017	7441811	10844213	10789812	61274514	.0	36.9	36.9
	PLTCLOSURE	SO2	30501204	01017	7441811	10844213	10789812	61274514	.0	1.8	1.8
	PLTCLOSURE	VOC	30501204	01017	7441811	10844213	10789812	61274514	.0	1.6	1.6
	PLTCLOSURE	PM-CON	30501204	01017	7441811	10844213	10789912	61274614	.0	2.9	2.9
	PLTCLOSURE	PM10-FIL	30501204	01017	7441811	10844213	10789912	61274614	.0	34.0	34.0
	PLTCLOSURE	PM10-PRI	30501204	01017	7441811	10844213	10789912	61274614	.0	36.9	36.9
	PLTCLOSURE	PM25-FIL	30501204	01017	7441811	10844213	10789912	61274614	.0	34.0	34.0
	PLTCLOSURE	PM25-PRI	30501204	01017	7441811	10844213	10789912	61274614	.0	36.9	36.9

Non-EGU Control Packet: ICI Boiler (MACT)

- New EPA-MARAMA/OTC "hybrid" method:
  - CIBO (Council of Industrial Boiler Owners) data collected and analyzed to craft how boiler emissions changing due to regulations and economics (replacements and conversions)
  - Impacts nonpoint sources
  - Includes NO_X cobenefits
  - Simplified set of fuel-based control assumptions (coal, distillate and residual)
- Retains list of facility categories subject to control (point sources)
- Limited state comments/rules (NY, NJ)

Control Strategy Tool: Sectors/ Relative Complexity

- Some packets shared over multiple sectors, some packets contain several sources of data/programs
- Non-EGU point, not oil & gas (ptnonipm):
  - 22 packets, 2 control strategies run in series
- Oil & gas point (pt_oilgas):
  - 15 packets, 2 control strategies run in series
- Oil & gas nonpoint (np_oilgas):
  - 4 packets, 2 control strategies run in series
- Remaining nonpoint (nonpt):
  - 10 packets, 2 control strategies run in series
- Fugitive dust (afdust), ag NH3 (ag), RWC, CMV & trains (cmv, rail, othpt):
  - 1 projection packet for each sector

Questions?

- Any questions on the Control Strategy Tool so far or non-EGU projections in general?

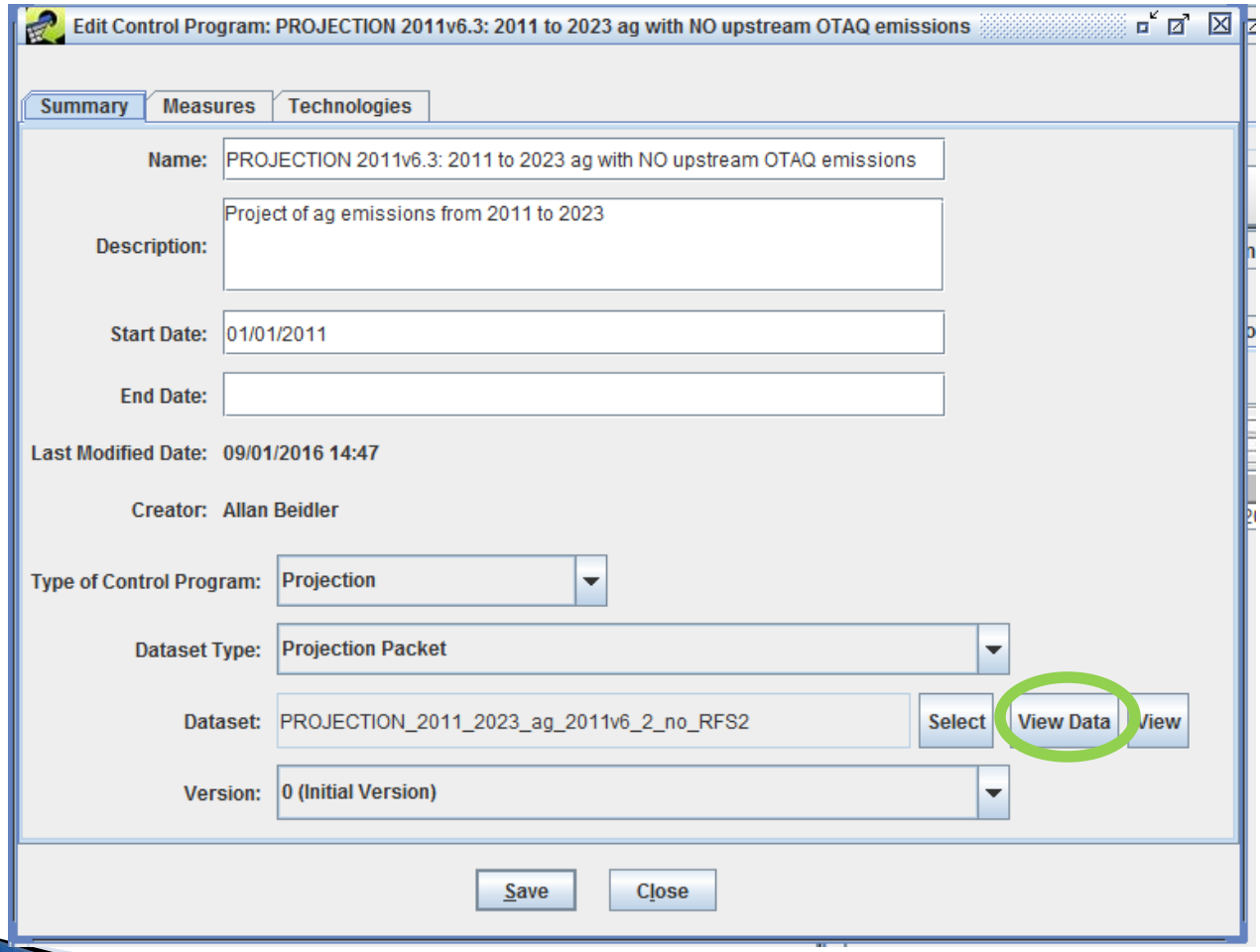
Non-EGU Projections: Ag NH3

- Animal-specific livestock only (no fertilizer approach; fertilizer future year = base year)
- Based on **national** population estimates from the USDA and Food and Agriculture Policy and Research Institute (FAPRI)
- Also used historical trends comparing number of animals vs production rates, net impact through 2025:
  - No change (growth) for dairy cows and turkey
  - Very slight decrease beef
  - Increases in pork, broilers, layers and poultry

Non-EGU Projections: Ag NH3 (continued)

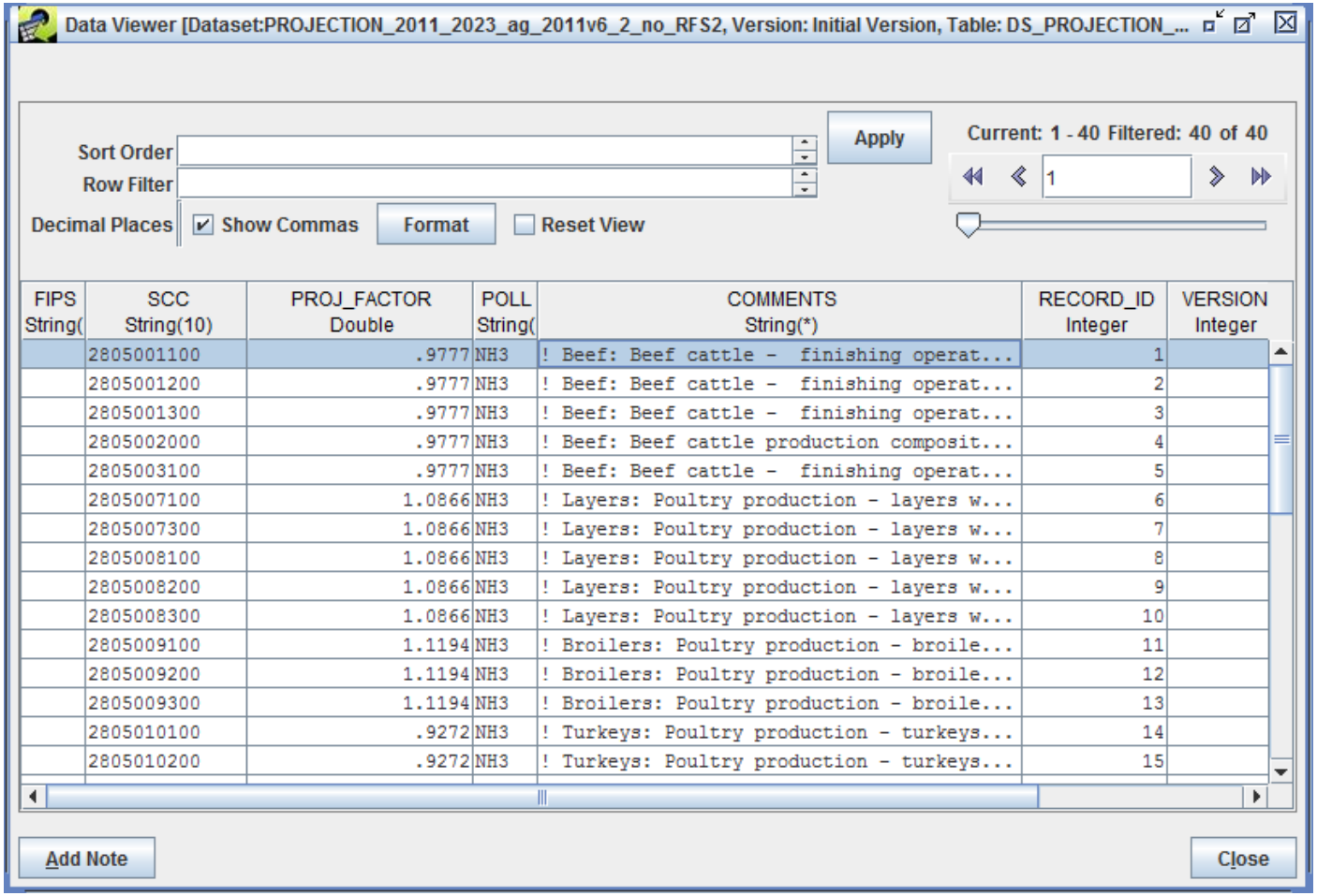
- Possible sources for 2014-platform projections:
- USDA agricultural projections through 2026 https://www.usda.gov/oce/commodity/projections/USDA_Agricultural_Projections_to_2026.pdf
- US Baseline Briefing Book: Projections for agricultural and biofuel markets http://amap.missouri.edu/images/spreadsheet/AMAP2017LivestockDairyTables.xlsx

Ag Control Program



Select a dataset for the control program then view the data…

Example Ag Projection Packet (selected columns)



FIPS String(	SCC String(10)	PROJ_FACTOR Double	POLL String(	COMMENTS String(*)	RECORD_ID Integer	VERSION Integer
	2805001100	.9777	NH3	! Beef: Beef cattle - finishing operat...	1	
	2805001200	.9777	NH3	! Beef: Beef cattle - finishing operat...	2	
	2805001300	.9777	NH3	! Beef: Beef cattle - finishing operat...	3	
	2805002000	.9777	NH3	! Beef: Beef cattle production composit...	4	
	2805003100	.9777	NH3	! Beef: Beef cattle - finishing operat...	5	
	2805007100	1.0866	NH3	! Layers: Poultry production - layers w...	6	
	2805007300	1.0866	NH3	! Layers: Poultry production - layers w...	7	
	2805008100	1.0866	NH3	! Layers: Poultry production - layers w...	8	
	2805008200	1.0866	NH3	! Layers: Poultry production - layers w...	9	
	2805008300	1.0866	NH3	! Layers: Poultry production - layers w...	10	
	2805009100	1.1194	NH3	! Broilers: Poultry production - broile...	11	
	2805009200	1.1194	NH3	! Broilers: Poultry production - broile...	12	
	2805009300	1.1194	NH3	! Broilers: Poultry production - broile...	13	
	2805010100	.9272	NH3	! Turkeys: Poultry production - turkeys...	14	
	2805010200	.9272	NH3	! Turkeys: Poultry production - turkeys...	15	

Non-EGU Projections: Fugitive Dust

- Impacts to unpaved and paved roads only
- Function of VMT
- Onroad VMT projected to future year using AEO2016
- County projection factor equation

$$\text{PROJFAC} = \frac{\text{(Future-year total county VMT)}}{\text{(Base-year total county VMT)}}$$

Example Fugitive Dust Packet

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	/PROJECTION 2011 2023/													
2	FIPS	SCC	PROJFAC											
3	1001	2294000000	1.16									! Paved Roads		
4	1001	2296000000	1.16									! Unpaved Roads		
5	1003	2294000000	1.05									! Paved Roads		
6	1003	2296000000	1.05									! Unpaved Roads		
7	1005	2294000000	0.89									! Paved Roads		
8	1005	2296000000	0.89									! Unpaved Roads		
9	1007	2294000000	1.25									! Paved Roads		
10	1007	2296000000	1.25									! Unpaved Roads		
11	1009	2294000000	1.20									! Paved Roads		
12	1009	2296000000	1.20									! Unpaved Roads		
13	1011	2294000000	0.90									! Paved Roads		
14	1011	2296000000	0.90									! Unpaved Roads		
15	1013	2294000000	0.97									! Paved Roads		
16	1013	2296000000	0.97									! Unpaved Roads		
17	1015	2294000000	1.36									! Paved Roads		
18	1015	2296000000	1.36									! Unpaved Roads		
19	1017	2294000000	1.03									! Paved Roads		
20	1017	2296000000	1.03									! Unpaved Roads		
21	1019	2294000000	1.10									! Paved Roads		

PROJECTION_2011el_2023el_AFDUST

Questions?

- Any questions on ag or fugitive dust projections?

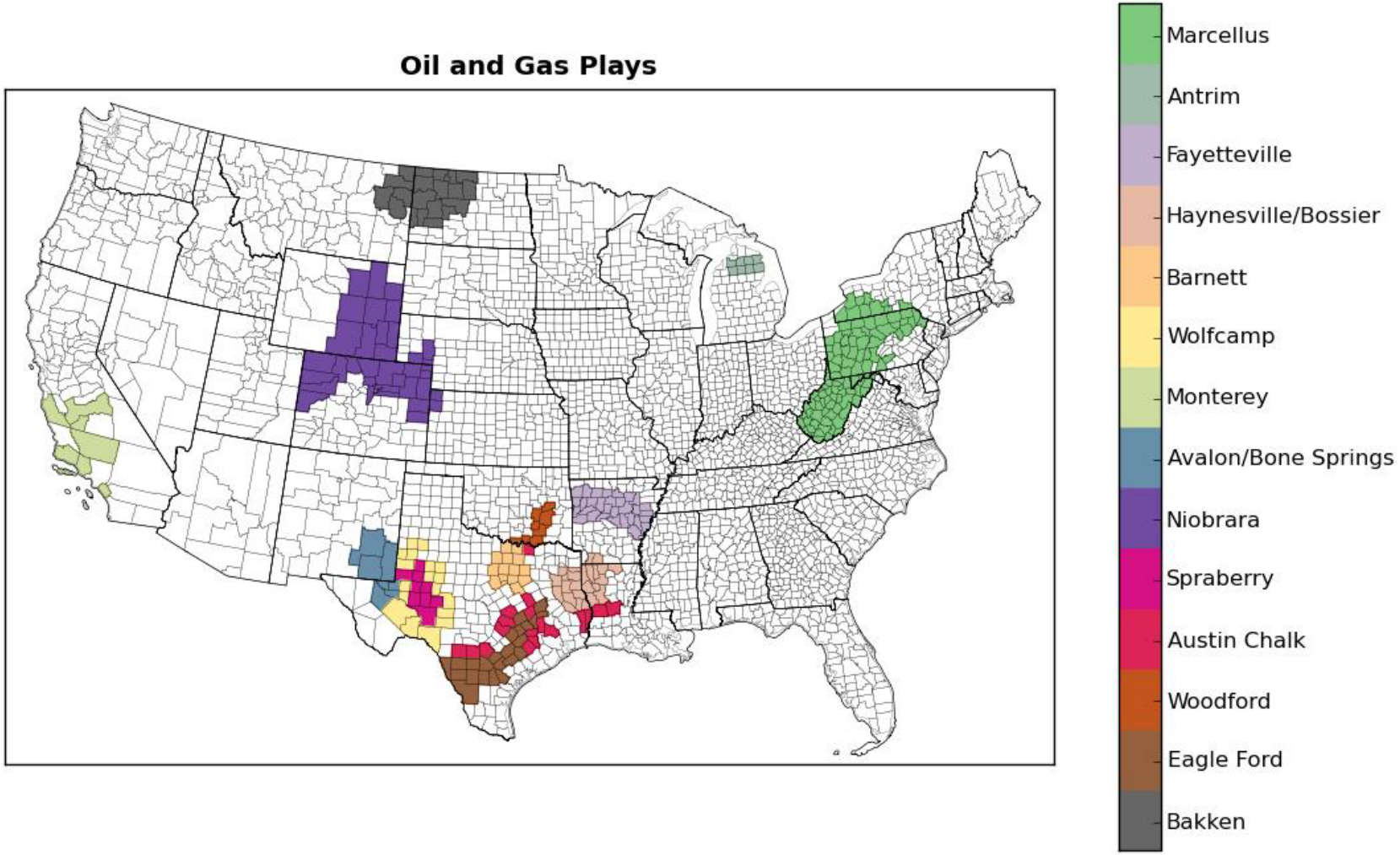
Oil and Gas Projections

- Volatile sector; growth changing frequently
- Various approaches
  - Pros and cons of each
- Various data sources
  - State historical data
  - AEO publicly available tables
  - AEO internal tables (EIA)

Oil and Gas Projections Overview

- Recent platforms use 2016/2017 AEO production data to estimate activity in future years
- Use of state historical production data to capture growth from 2011 to 2015 (latest available)
- O&G VOC New Source Performance Standards (NSPS) application
- New NSPS (NOX) for Process Heaters, Internal Combustion (IC) Engines and Turbines
- Sector "redesign" for point sources –many other control programs now apply
- Includes comments from states and regional planning organizations on the 2011 platform

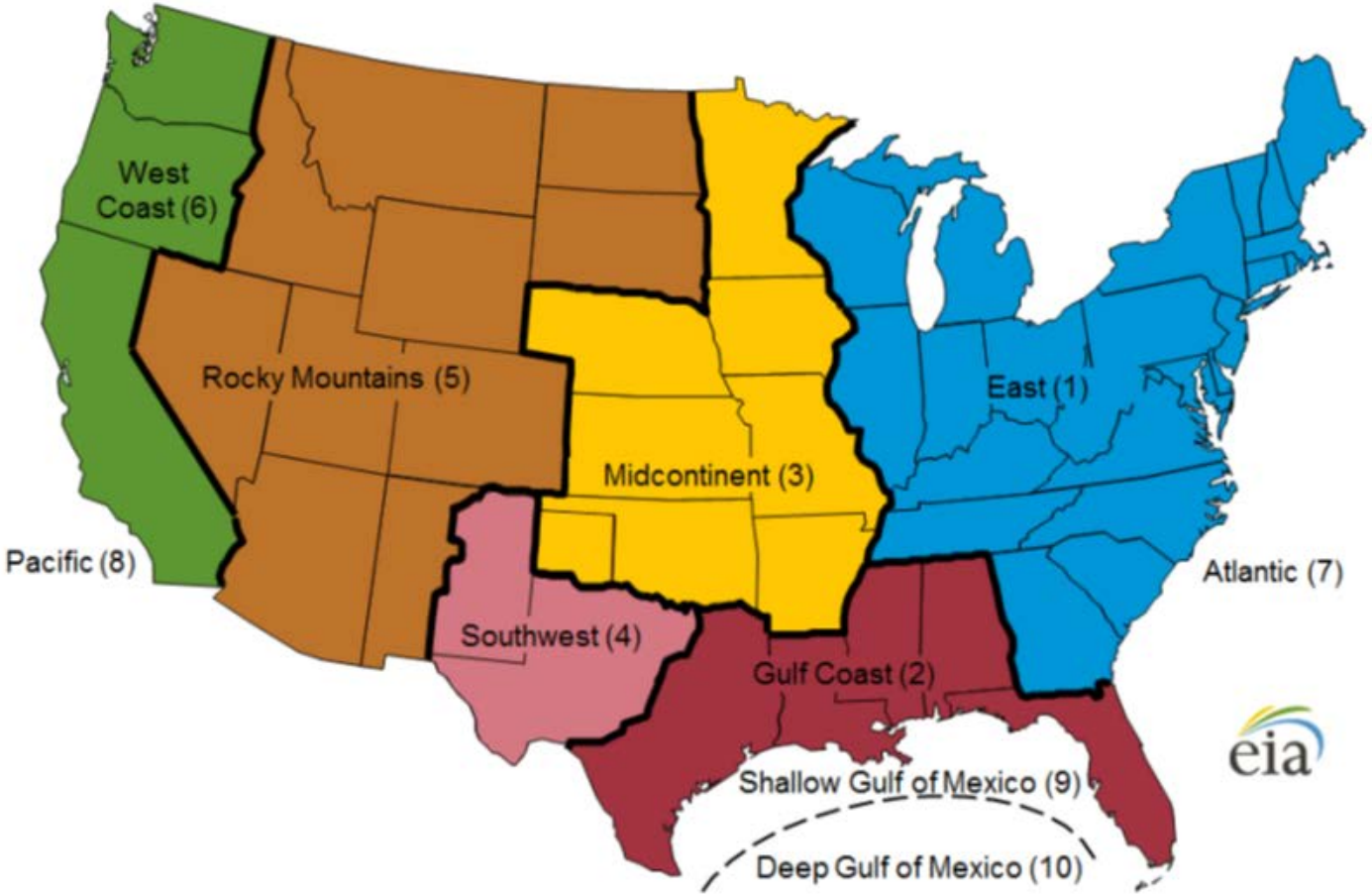
Oil and Gas Projections: Basin level production forecasts from 2011v6.2



Oil and Gas Projections: Basin-level

- AEO table/data generated internally by EIA; not always readily available to public
- Presents detailed information for some portions of the oil and gas sector
- Can present some "mass balance" issues when trying to match up with the total US production
  - Some unrealistic changes outside of basins
- Used this approach using 2011v6.2 modeling platform

Oil and Gas Projections: NEMS (or Supply) Regions



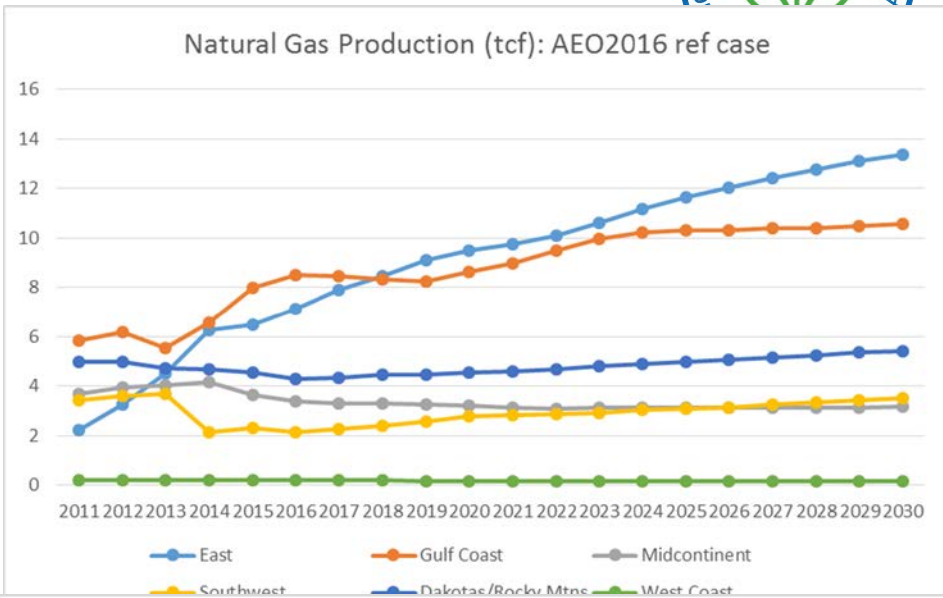
Source: U.S. Energy Information Administration.

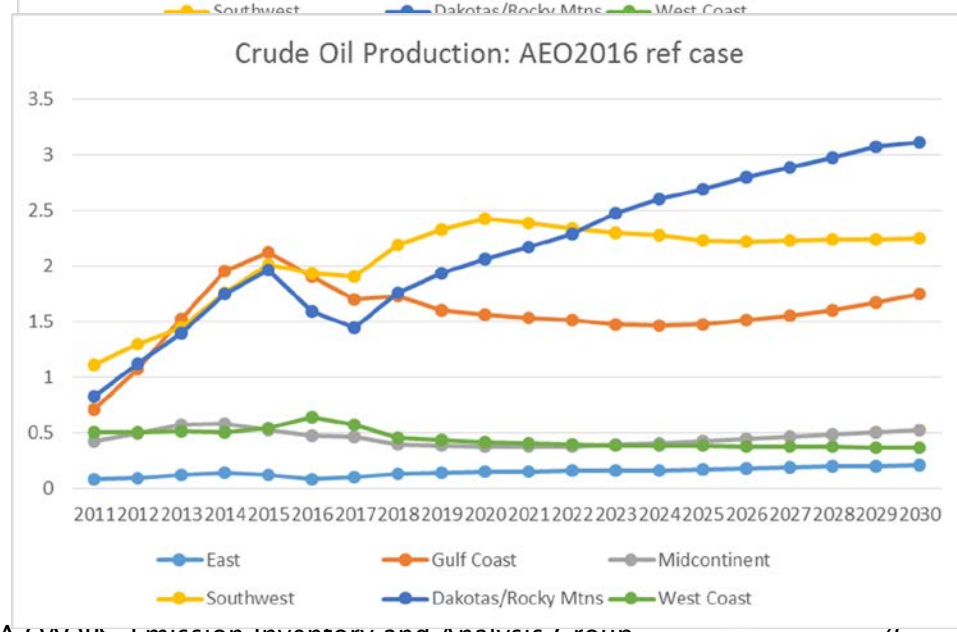
Oil and Gas Projections: Supply Region-level (2011v6.3 2023)

- AEO2016 Tables: Region production
  - Table 60: Lower 48 Crude Oil Production
  - Table 61: Lower 48 Natural Gas Production
- AEO2016 Tables: National production
  - Table 14: Oil and Gas Supply
    - Coalbed Methane production
    - Natural Gas Liquids production
    - Offshore production: State-owned sources only
- Develop SCC-oil/gas/both cross-reference to apply regional/national factors

Oil and Gas Projections: Supply Region-level

- Applied this method for 2011v6.3 modeling platform along with state-specific factors supplied from MARAMA
- Large regions where only 2-3 states make up the bulk of the production can cause issues with smaller-producing states in the region





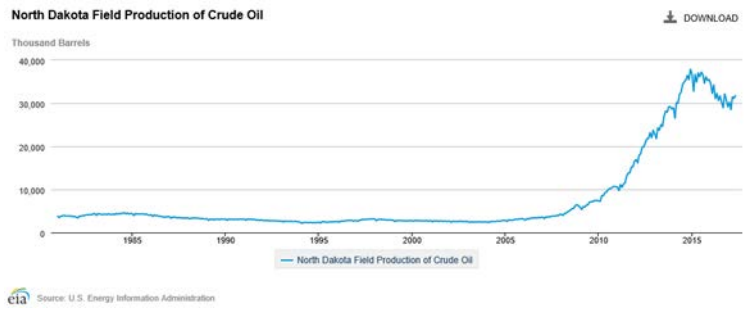
Oil and Gas Projections: Historical state data bridge to Supply Region-level forecast

- Historical state production data publicly available on EIA website used to project sources from base year to a recent year (e.g. 2015 or 2016)
- http://www.eia.gov/dnav/ng/ng_sum_lsum_a_epg0_r20_bcf_a.htm
- http://www.eia.gov/dnav/pet/pet_crd_crpdn_adc_mbbl_a.htm

- Can then use AEO Supply Region production forecasts to project from 2015 to desired future year
- Some adjustments based on historical trends for "low production" states may be needed
- Combine factors to get a state-specific projection factor from base year to desired future year
- Use SCC-oil/gas/both cross-reference to apply state-specific factors

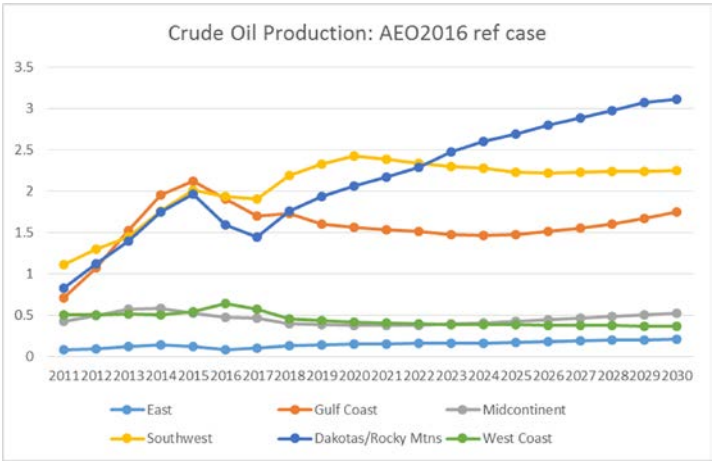
Oil and Gas Projections: Historical state data + AEO Supply Region

Historical state change



X

AEO Supply Region change



Combined Factors representing both historical state data and AEO supply region change for each state

Oil and Gas Projections: NSPS Controls

- For future-year NSPS controls (oil and gas, RICE, Natural Gas Turbines, and Process Heaters), we attempted to control only new sources/equipment using the following equation to account for growth and retirement of existing sources and the differences between the new and existing source emission rates.
- $\text{Control\_Efficiency}\ (\%) = 100 * (1- [(P_f-1)*Fn + (1-Ri)^t + (1-(1-Ri)^t)*Fn]/ P_f)$
  - P_f = growth rate expressed as ratio (e.g., 1.5=50% cumulative growth)
  - t = number of years between base and future years
  - Fn = emission factor ratio for new sources
  - Ri = retirement rate, expressed as decimal (e.g., 3.3%=0.033)

Possible Future work for Oil and Gas Projections

- Examine methods to take basin-level information into account where possible
- Better incorporate state regulations on emissions
- Improve SCC cross references to account variability in state-provided SCCs

Questions on Oil and Gas Projections?

Non-EGU Projections: Residential Wood Combustion

- Growth derived from year 2012 appliance shipments and forecast revenue forecasts (e.g. US Bureau of Economic Analysis)
- Updated to include recently promulgated NSPS for 'wood heaters': http://www2.epa.gov/residential-wood-heaters/final-new-source-performance-standards-residential-wood-heaters
- Net decrease rather than increase in RWC emissions vs business as usual approach in prior platform
- Reflect year 2015 rulemaking and minor corrections
- Appliance-specific retirement/replacement rates for most sources
- "No-change" assumption used in western states: WA, OR, CA
- No integration of burn ban data

Packets for RWC projections

- PROJECTION_2011_2017_RWC_2011v6.2_03mar2015_v0.txt
- BETA_Projections_RWC_2023_18apr2016_emf_csv_02sep2016_v0.txt
- PROJECTION_2011_2023_RWC_2011v6_3_csv_02sep2016_v0.txt

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	/PROJECTION 2011 2023/																
2	FIPS	SCC	PROJFAC	POLL													
3		2104008100	1.127									! Fireplace: general					
4	6000	2104008100	1.000									! Fireplace: general					
5	41000	2104008100	1.000									! Fireplace: general					
6	53000	2104008100	1.000									! Fireplace: general non-EPA certified					
7		2104008210	0.791									! Woodstove: fireplace inserts non-EPA certified					
8	6000	2104008210	1.000									! Woodstove: fireplace inserts non-EPA certified					
9	41000	2104008210	1.000									! Woodstove: fireplace inserts non-EPA certified					
10	53000	2104008210	1.000									! Woodstove: fireplace inserts EPA certified non-catalytic					
11		2104008220	1.238									! Woodstove: fireplace inserts EPA certified non-catalytic					
12	6000	2104008220	1.000									! Woodstove: fireplace inserts EPA certified non-catalytic					
13	41000	2104008220	1.000									! Woodstove: fireplace inserts EPA certified non-catalytic					
14	53000	2104008220	1.000									! Woodstove: fireplace inserts EPA certified non-catalytic					
15		2104008220	1.103	PM10-PRI								! Woodstove: fireplace inserts EPA certified non-catalytic					
16	6000	2104008220	1.000	PM10-PRI								! Woodstove: fireplace inserts EPA certified non-catalytic					
17	41000	2104008220	1.000	PM10-PRI								! Woodstove: fireplace inserts EPA certified non-catalytic					
18	53000	2104008220	1.000	PM10-PRI								! Woodstove: fireplace inserts EPA certified non-catalytic					
19		2104008220	1.103	PM25-PRI								! Woodstove: fireplace inserts EPA certified non-catalytic					
20	6000	2104008220	1.000	PM25-PRI								! Woodstove: fireplace inserts EPA certified non-catalytic					
21	41000	2104008220	1.000	PM25-PRI								! Woodstove: fireplace inserts EPA certified non-catalytic					

PROJECTION_2011_2023_RWC_2011v6

Non-EGU Projections: CMV and rail

- The future year cmv and rail emissions account for increased fuel consumption based on Energy Information Administration (EIA) fuel consumption projections for freight
- Final Locomotive-Marine rule
- Yard Locomotives in point source inventory
- CMV Exclusive Economic Zone (EEZ) issues
  - 200 nautical miles from state waters

Example Projections for CMV/rail

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	/PROJECTION 2011 2023/												
2	FIPS	SCC	PROJFA	PC	COMMENT1	COMMENT2	COMMI	COMMI T4					
10		2280002100	0.60	NOX	! Mobile Sources	Marine Vessels, Commercial	Diesel	Port emissions					
22		2280002200	0.60	NOX	! Mobile Sources	Marine Vessels, Commercial	Diesel	Underway emissions					
34		2285002006	0.68	NOX	! Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Class I Operations					
46		2285002007	1.06	NOX	! Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Class II / III Operations					
58		2285002008	0.52	NOX	! Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Passenger Trains (Amtrak)					
70		2285002009	0.52	NOX	! Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Commuter Lines					
82		2285002010	0.87	NOX	! Mobile Sources	Railroad Equipment	Diesel	Yard Locomotives					
94		28500201	0.87	NOX	! Internal Combust	Railroad Equipment	Diesel	Yard Locomotives					
107	6001	2280002100	0.71	NOX	! Mobile Sources	Marine Vessels, Commercial	Diesel	Port emissions					
119	6001	2280002200	0.60	NOX	! Mobile Sources	Marine Vessels, Commercial	Diesel	Underway emissions					
131	6001	2285002006	1.01	NOX	! Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Class I Operations					
143	6001	2285002008	1.15	NOX	! Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Passenger Trains (Amtrak)					
154	6001	2285002010	0.77	NOX	! Mobile Sources	Railroad Equipment	Diesel	Yard Locomotives					
166	6001	28500201	0.77	NOX	! Internal Combust	Railroad Equipment	Diesel	Yard Locomotives					
178	6005	2285002006	0.94	NOX	! Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Class I Operations					
190	6007	2285002006	0.94	NOX	! Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Class I Operations					
202	6007	2285002008	1.15	NOX	! Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Passenger Trains (Amtrak)					
213	6011	2285002006	0.94	NOX	! Mobile Sources	Railroad Equipment	Diesel	Line Haul Locomotives: Class I Operations					

PROJECTION_2011v6_3_2023_c1c2ra | Sheet1

Non-EGU Projections: Aviation

- Aircraft emissions are in ptnonipm sector
- Projected itinerant ITN (i.e., take off and landing) operations information available from the Federal Aviation Administration's (FAA) Terminal Area Forecast (TAF) System:
- https://www.faa.gov/data_research/aviation/taf/
- Two sets of projections factors used:
  - State-level for low traffic airports
  - Airport specific factors

Example Projection Factors for Aviation

	A	B	C	D	L	M	N	O	P	Q
1	/PROJECTION 2011 2025/									
2	FIPS	SCC	PROJFAC	POLL						
3	1000	2265008005	1.17		! State-specific ITN-aggregat	Off-highway Vehicle Gas	Airport Ground Sup	Airport Ground Support Equipment		
4	1000	2267008005	1.17		! State-specific ITN-aggregat	LPG	Airport Ground Sup	Airport Ground Support Equipment		
5	1000	2268008005	1.17		! State-specific ITN-aggregat	CNG	Airport Ground Sup	Airport Ground Support Equipment		
6	1000	2270008005	1.17		! State-specific ITN-aggregat	Off-highway Vehicle Dies	Airport Ground Sup	Airport Ground Support Equipment		
7	1000	2275001000	0.99		! State-specific ITN-aggregat	Aircraft	Military Aircraft	Total		
8	1000	2275020000	1.17		! State-specific ITN-aggregat	Aircraft	Commercial Aircra	Total: All Types		
9	1000	2275050011	1.00		! State-specific ITN-aggregat	Aircraft	General Aviation	Piston		
10	1000	2275050012	1.00		! State-specific ITN-aggregat	Aircraft	General Aviation	Turbine		
11	1000	2275060011	0.91		! State-specific ITN-aggregat	Aircraft	Air Taxi	Piston		
12	1000	2275060012	0.91		! State-specific ITN-aggregat	Aircraft	Air Taxi	Turbine		
13	1000	2275070000	1.17		! State-specific ITN-aggregat	Aircraft	Aircraft Auxiliary P	Total		
14	1000	27501015	0.99		! State-specific ITN-aggregated for Military Aviation:					
15	1000	27502011	1.17		! State-specific ITN-aggregated for Commercial Aviation:					
16	1000	27505001	1.00		! State-specific ITN-aggregated for General Aviation:					
17	1000	27505011	1.00		! State-specific ITN-aggregated for General Aviation:					
18	1001	2275001000	1.00		! LOCID= 1A9: Autauga Coun	Aircraft	Military Aircraft	Total		
19	1001	2275050011	1.00		! LOCID= 1A9: Autauga Coun	Aircraft	General Aviation	Piston		
20	1001	2275050012	1.00		! LOCID= 1A9: Autauga Coun	Aircraft	General Aviation	Turbine		
21	1003	2265008005	1.00		! LOCID= JKA: Jack Edwards:	Off-highway Vehicle Gas	Airport Ground Sup	Airport Ground Support Equipment		

PROJECTION_2011_2025_aircraft_S

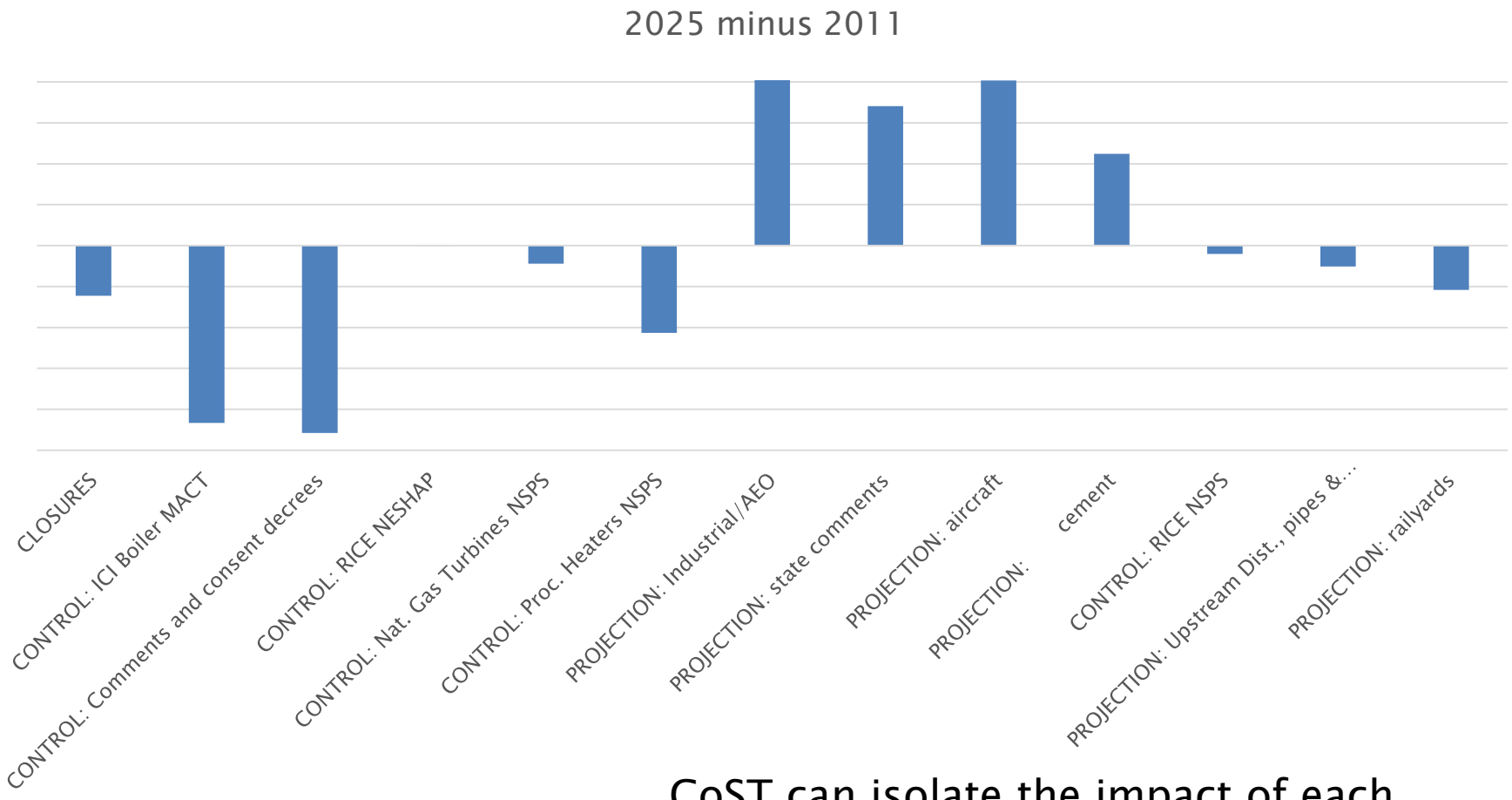
Non-EGU Projections: Non-CoST

- Some future-year sources do not exist in 2011 NEI
  - Biodiesel and cellulosic ethanol plants
  - Other sources added based on comments
- Difficult projections
  - Portable Fuel Containers (PFCs)
  - Combination of OTAQ inventories, state comments and extrapolations/scaling factors

Projections: Quality Assurance

- CoST detailed summaries
- Numerous template options for Structured Query Language (SQL)-based QA reports
  - By control program
  - Geography
  - Source category
  - Can limit pollutants
  - Option to show "unaffected" sources
- Can also create custom reports and summaries
- CoST filter/sorts, export to CSV

Projections High-level impacts: ptnonipm sector NO_X



CoST can isolate the impact of each control/projection packet

Non-EGU Projections: Challenges/Limitations

- Response to prior platforms:
  - Data provided for 2023 and 2025 with some data provided for many years
  - Many different sources of data – need to correctly layer these so appropriate controls/projections apply
- Promulgated vs proposed rules vs SIP inventories
- Rapidly-changing world!
  - 2017 AEO recently out + 2014 NEI v2 coming soon

Limitations / New Directions

- Year 2014 modeling platform
- Projections of changes in land use/population
  - Surrogates
  - New sources
  - VMT
  - Biogenics
  - Ag fertilizer
  - Etc.
- Fires
  - Impact on biogenics
  - Fires in future year modeling
- Temporalization of future year EGUs
- Data warehousing and sharing

Emissions Modeling Software and Data Downloads

- The CMAS Center (https://www.cmascenter.org/) distributes SMOKE, CMAQ, VERDI, the Surrogate Tool, Spatial Allocator, Speciation Tool, and the Control Strategy Tool (which includes the Emissions Modeling Framework)
- SMOKE software and documentation is available from http://www.cmascenter.org/smoke
  - SMOKE 4.0 has support for hemispheric modeling
  - SMOKE 4.5 has support for preparing emissions for AERMOD modeling
- A WIKI for SMOKE that answers common questions about emissions modeling is here: https://www.airqualitymodeling.org/index.php
- EPA's emissions modeling platform data, scripts, and documentation are available from https://www.epa.gov/air-emissions-modeling

Emissions Modeling Platform Data Availability

- Data, documentation, scripts available from
  - https://www.epa.gov/air-emissions-modeling
  - Version 6 platforms include:
    - 2011v6.3: January 2017 NODA (2011el/2023el), Final Cross-State Air Pollution Rule (CSAPR) Update (2011ek/2017ek), hemispheric case
  - Version 7 platform for 2014
  - Spatial surrogates available for 4km, 12km, 36km
  - Speciation data for CB05, CB6, SAPRC07TB
  - Temporal profiles for all sectors

Questions?

- Any final questions on the future year part of the training?

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