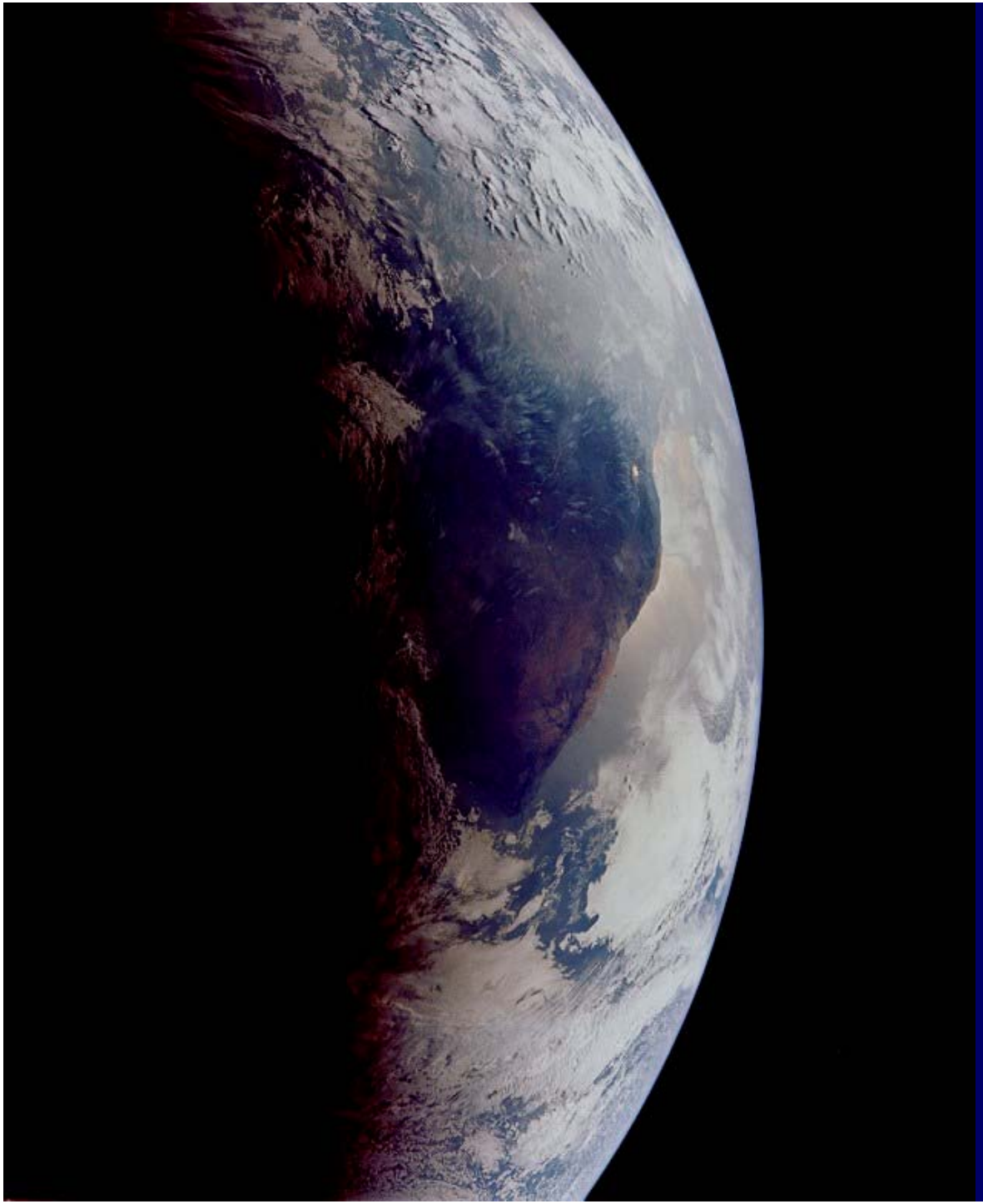


Calculating environmental benefits

REEC annual meeting

November 21, 2005

World Resources Institute

What's the issue?

"What is the emissions impact when a renewable energy project generates electricity?"

Why is it important?

Multiple applications & end uses

- Cap-and-trade systems
- Air quality planning (criteria air pollutants)
- Greenhouse gas inventories & strategies (national, regional, state, & corporate)
- REC trading / green power marketing
- Corporate social responsibility reporting

Methodology for quantifying emissions impacts would:

- Dispel uncertainty
- Build integrity
- Enable cost estimates
- Establish foundation for markets

But, does one size fit all?

- By end use?
- Between countries?

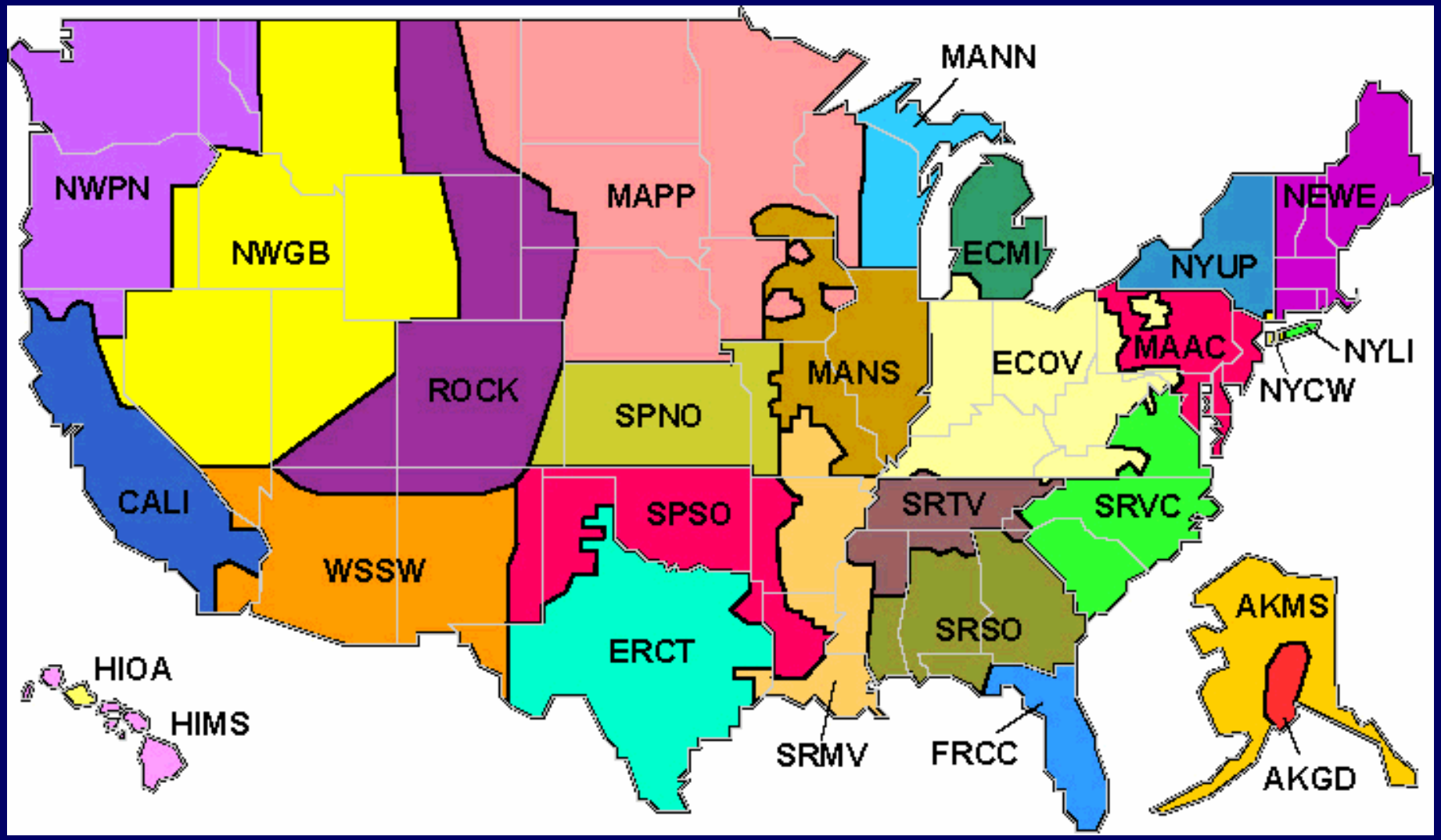
A suite of related issues

- Protocol for calculating avoided emissions
- Links to environmental regulations/ emissions market design
- Selling environmental attributes separately (e.g., CO2, NOx)
- Additionality
- RECs treatment in mandatory & voluntary markets
- REC tracking systems

Methodologies differ along three dimensions

Dimension	Common options
Geographic scale	• State/province • Power pool • Nation

Geographic scope: U.S. example



Methodologies differ along three dimensions

Dimension	Common options
Geographic scale	• State/province • Power pool • Nation
Type of emissions rate	• System average (all, fossil-only) • Operating margin • Build margin • “Combined margin”

Approaches for estimating emissions rates

Type of emissions rate	Approach *(U.S. examples)*
System average	• Government database *(E-GRID)*
Operating margin	• Manual/spreadsheet modeling *(ERT, LBNL)* • Dispatch models *(ISO NE, Ozone Transport Commission, LBNL)* • System planning models
Build margin	• Historical data *(last x plants built)* • Government permitting records *(next x plants approved or decommissioned)*
Combined margin	• x% operating margin + (100-x)% build margin

Methodologies differ along three dimensions

Dimension	Common options
Geographic scale	• State/province • Power pool • Nation
Type of emissions rate	• System average (all, fossil-only) • Operating margin • Build margin • “Combined margin”
Temporal scale	• Annual vs. seasonal vs. hourly • Historical vs. forward-looking (future modeling)

Common assessment parameters

- "Accuracy"
- Practicality
- Transparency
- Conservativeness

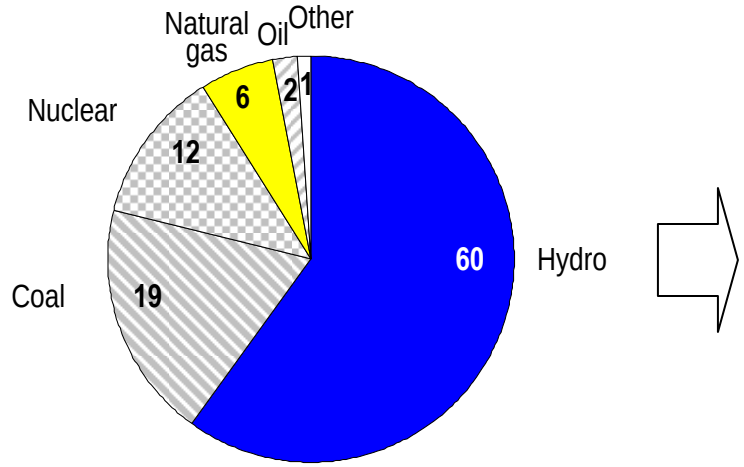
- Data availability
- Cost
- Ease of use
- Replicability

Emissions rate type vs. assessment parameters

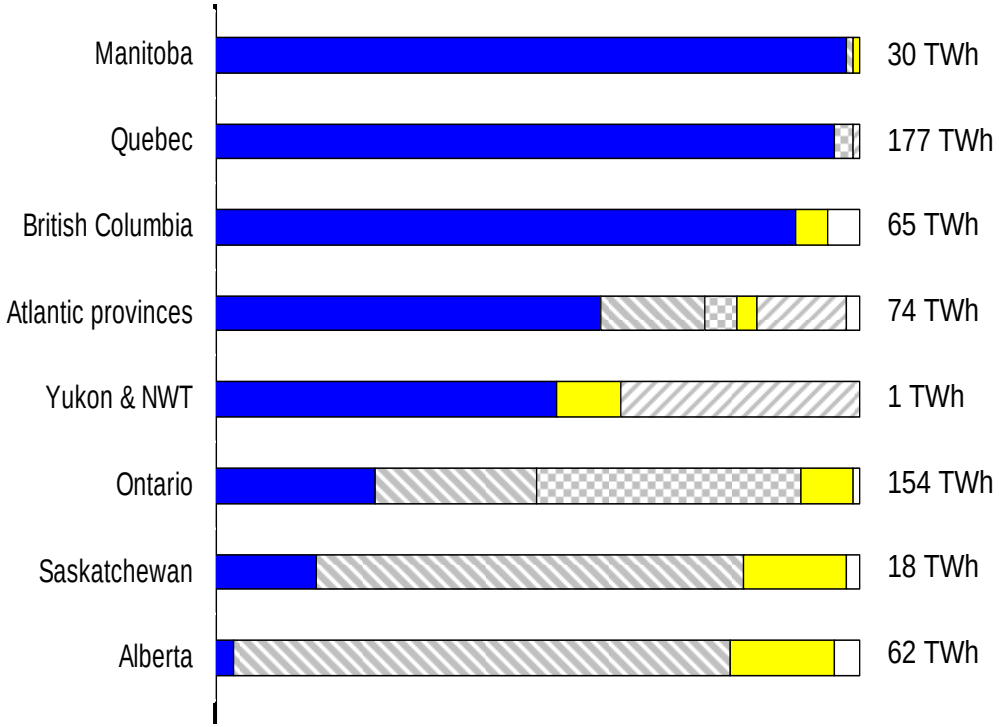
Type of emissions rate	Accuracy	Practicality
System average	• Lower	• Hi (available, free, replicable)
Operating margin	• Higher	• Lower (no generally accepted model, $$)
Build margin	• Not necessarily higher for short-term, perhaps for long-term	• Medium
Combined margin		

What is Canada considering?

Net Canadian electricity generation – 2002
Percent, 100% = 581 TWh



Net electricity generation by province/region – 2002
Percent, 100% = 581 TWh



Source: Statistics Canada. 2002. *Report on Energy Supply–Demand in Canada.*

What is Canada considering? (cont'd)

- When designing its Climate Change Plan, Canada proposed GHG offset credit system
- Offset credits would be bundled with green power and/or RECs for certified green power products
- Government selecting a standard national intensity factor (NIF) for electricity sector projects
  - Exact NIF to be finalized
  - ~200 kg CO_2e per MWh ≤ NIF ≤ 400 kg CO_2e per MWh

Source: Welsh, L.. 2005. *Canada's Approach to Green Power under Kyoto.* Presented at the Tenth National Green Power Marketing Conference, Austin, TX, October 2005.

What is Mexico considering?

Dimension	Common options
Geographic scale	• State/province • Electricity power pool • Nation
Type of emissions rate	• System average • Operating margin • Build margin • "Combined margin"
Temporal scale	• Annual vs. seasonal vs. hourly • Historical vs. forward-looking (future modeling)

Coeficientes de Emisión de GEI Eléctricos (CEE's) Recomendados por ATPAE (Históricos 1995-2001)

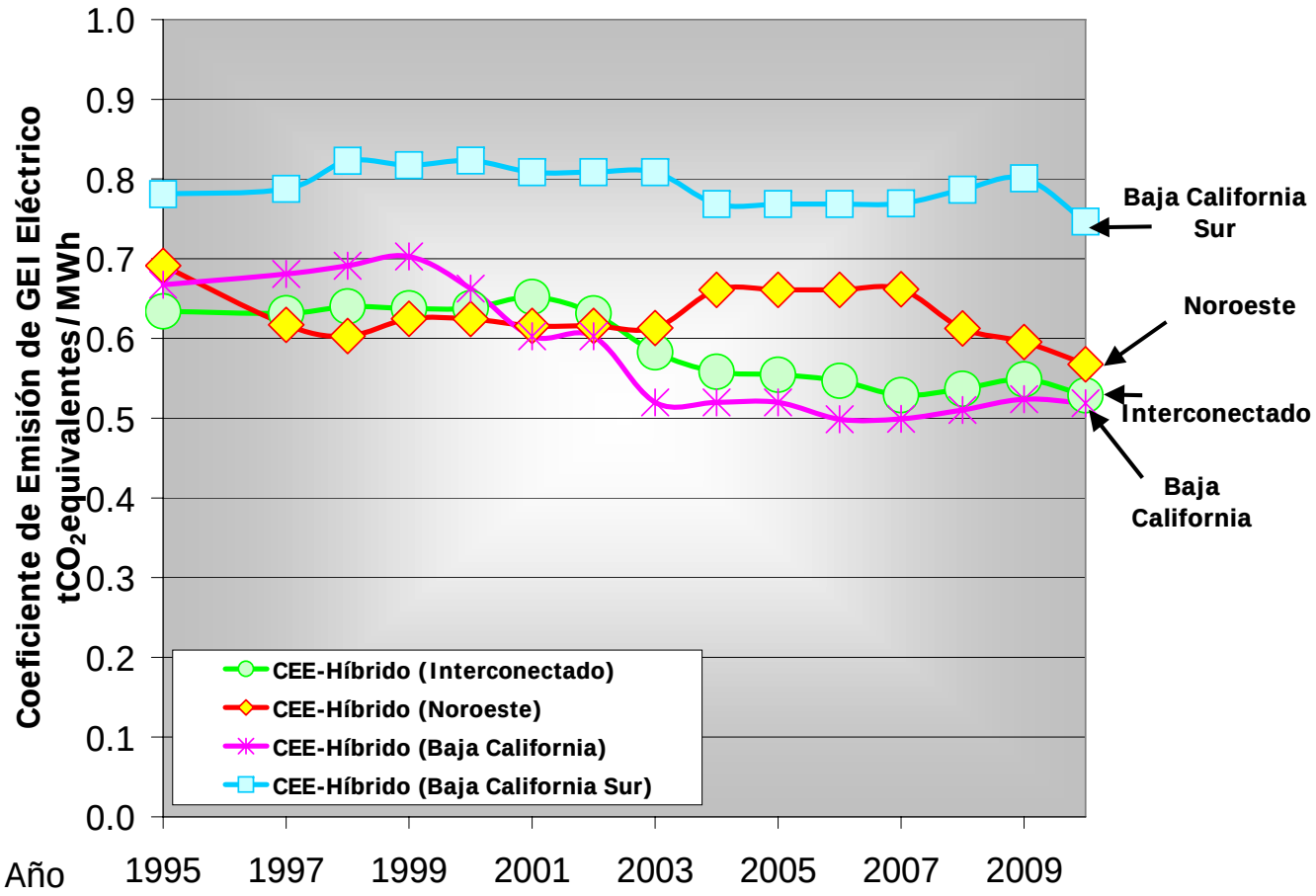
- Utilizar un coeficiente de emisión híbrido o combinado, que refleje los impactos en las plantas actuales, así como en las plantas nuevas (a instalarse o recientemente instaladas en el sistema)

CEE-híbrido= 50% CEE-Termoeléctricas + 50% CEE-5 Recientes

	CEE-Híbrido* (tCO_2 eq. / MWh), Histórico 1995-2001				
Año	Sistema Interconectado	Sistema Noroeste	Sistema Baja California	Sistema Baja California Sur	Todo el Sistema Eléctrico Nacional
1995	0.6341	0.6911	0.6673	0.781	0.6273
1997	0.6317	0.6171	0.681	0.7877	0.6263
1998	0.6401	0.6029	0.6913	0.8228	0.6332
1999	0.6378	0.6247	0.7029	0.8172	0.6301
2000	0.638	0.6244	0.6627	0.8232	0.6612
2001	0.6521	0.6157	0.6029	0.8085	0.6539

Coeficientes de Emisión de GEI Eléctricos

Coeficientes de Emisión de GEI Eléctricos (CEE's) Proyectados al futuro hasta el año 2010



Coeficientes de Emisión de GEI Eléctricos

What is the U.S. considering?

Dimension	Common options
Geographic scale	• State/province • Power pool • Nation
Type of emissions rate	• System average • Operating margin • Build margin • "Combined margin"
Temporal scale	• Annual vs. seasonal vs. hourly • Historical vs. forward-looking (future modeling)

varies

System average and operating margin emerging as leading contenders

Type of emissions rate	Users
System average	• REC markets • Corporate GHG emissions inventories (GHG Protocol, US EPA Climate Leaders)
Operating margin	• NO_x state implementation plan (Maryland) • ISO New England (for criteria pollutants)
Build margin	• ?
Combined margin	• ?

GHG Protocol Electricity Workgroup

- Developing Supplement for GHG Protocol for Project Accounting (Official Release December 6)
- Flexible, Comprehensive Guidance on Estimating Baseline Emissions for GHG Projects
- Not Specific to Particular Countries or Geographic Regions

GHG Protocol Electricity Workgroup

- Guidance on:
  - Performance Standards vs. Baseline Scenarios
  - Grid definition
  - Calculating operating margin
  - Calculating build margin
  - How to weight OM & BM for a combined margin EF

GHG Protocol Electricity Workgroup

- Emission Factor Guidance Focusing on Tradeoffs:
  - Accuracy
  - Practicality
  - Conservativeness
  - Transparency

GHG Protocol Electricity Workgroup

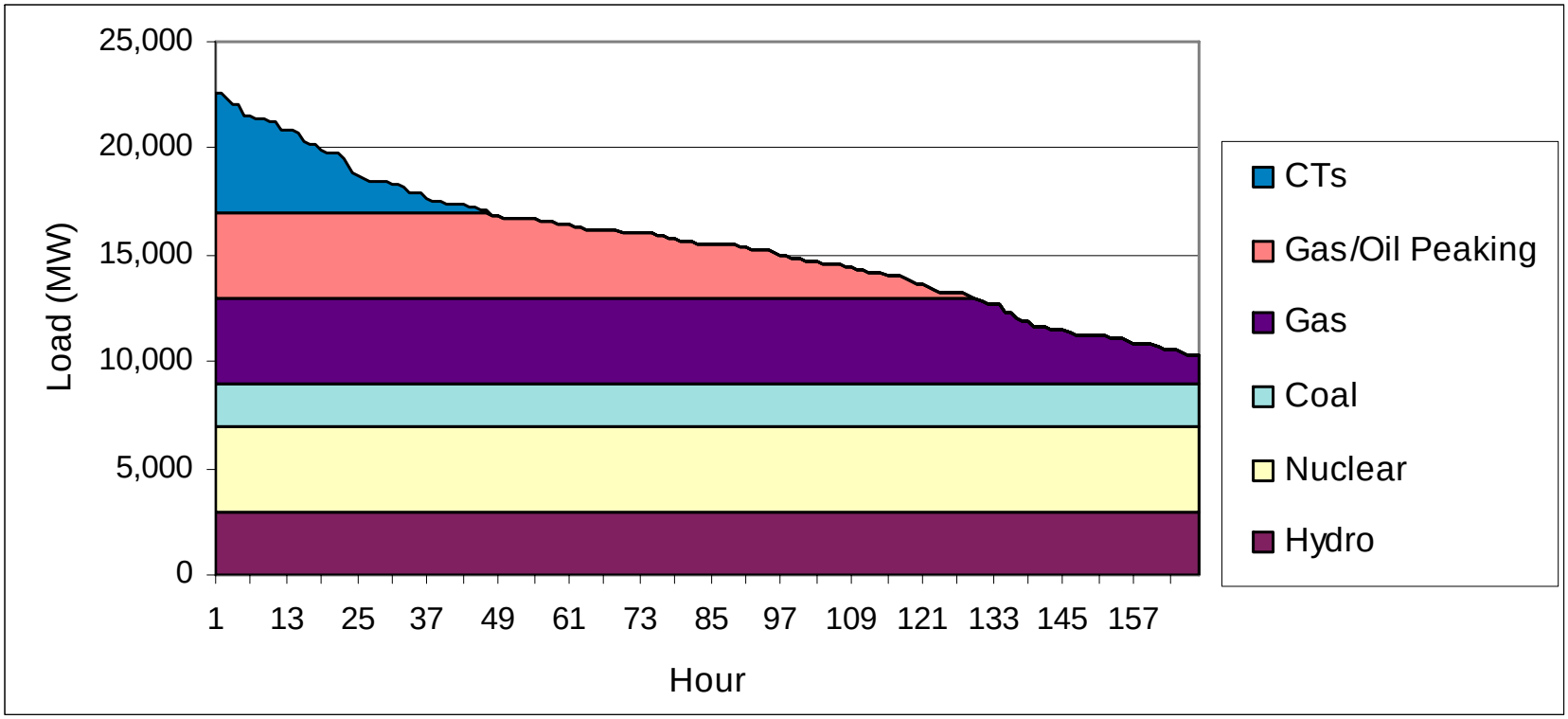
- Operating Margin Methodologies Covered:
  - System Average
  - Avg. Excluding Must Run
  - Load Duration Curve
  - Dispatch Data Analysis
  - Dispatch Modeling
- Build Margin Methodologies Covered:
  - Recent/Planned Additions
  - Proxy Plant

GHG Protocol Electricity Workgroup

- Key Points:
  - Specific to GHG Protocol for Projects & Baseline Setting
  - Best Practice Guidance, Not a “Standard”
  - Globally Applicable
  - Policy / Program Neutral

Appendix

Load Duration Curve with Simplified Dispatch Data



Synapse
Energy Economics, Inc.