Overview of Scenario Activities and Interactions with the Technology Experts in the SRREN

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IAMC Meeting, Tsukuba, Japan

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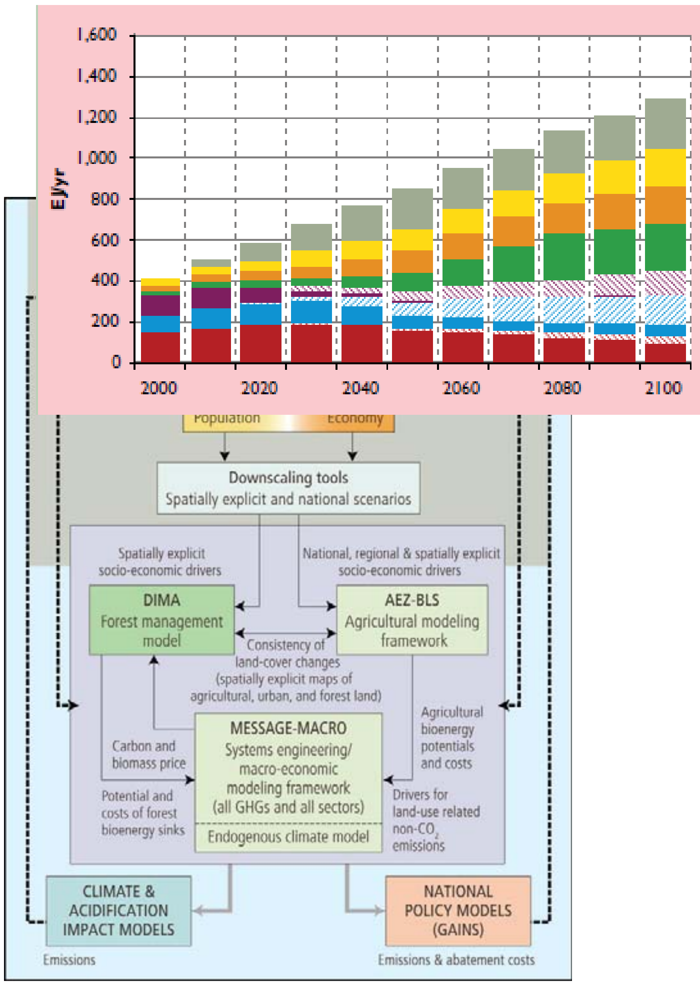
- Structure of the Oslo meeting
- Overview of SRREN scenario review
- Overview of feedback from technology experts
- A path forward

How do we bridge the different approaches to analysis?

ENERGY SUPPLY SCENARIO

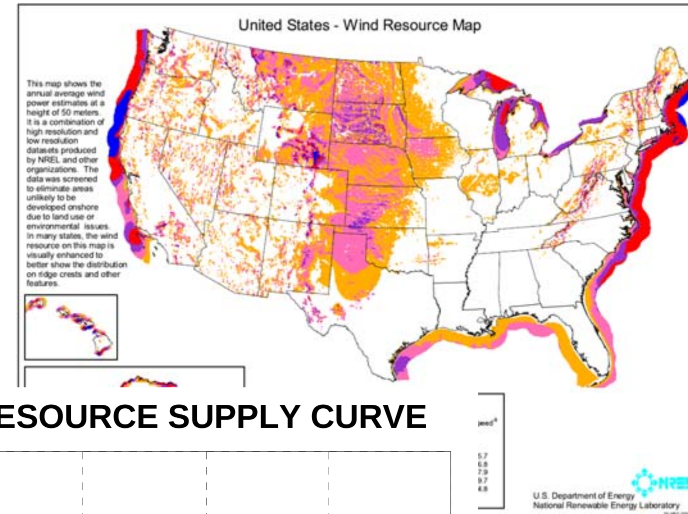


Energy-economic or integrated assessment models

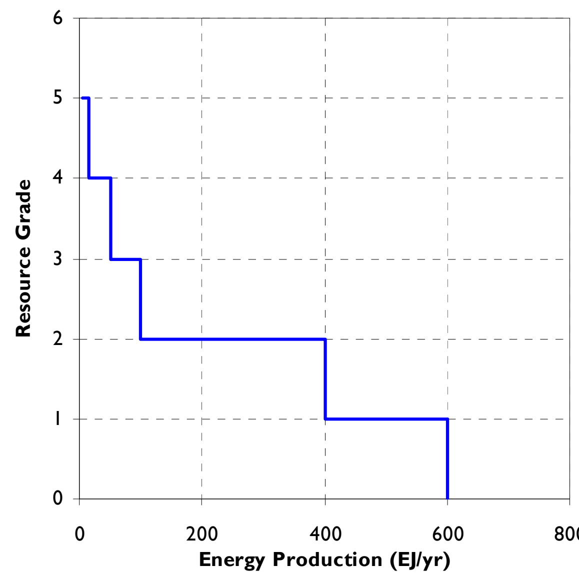
The interaction should go both ways.

Scenarios of scale, timing, location.

Supply curves and related aggregate representations, technology characteristics

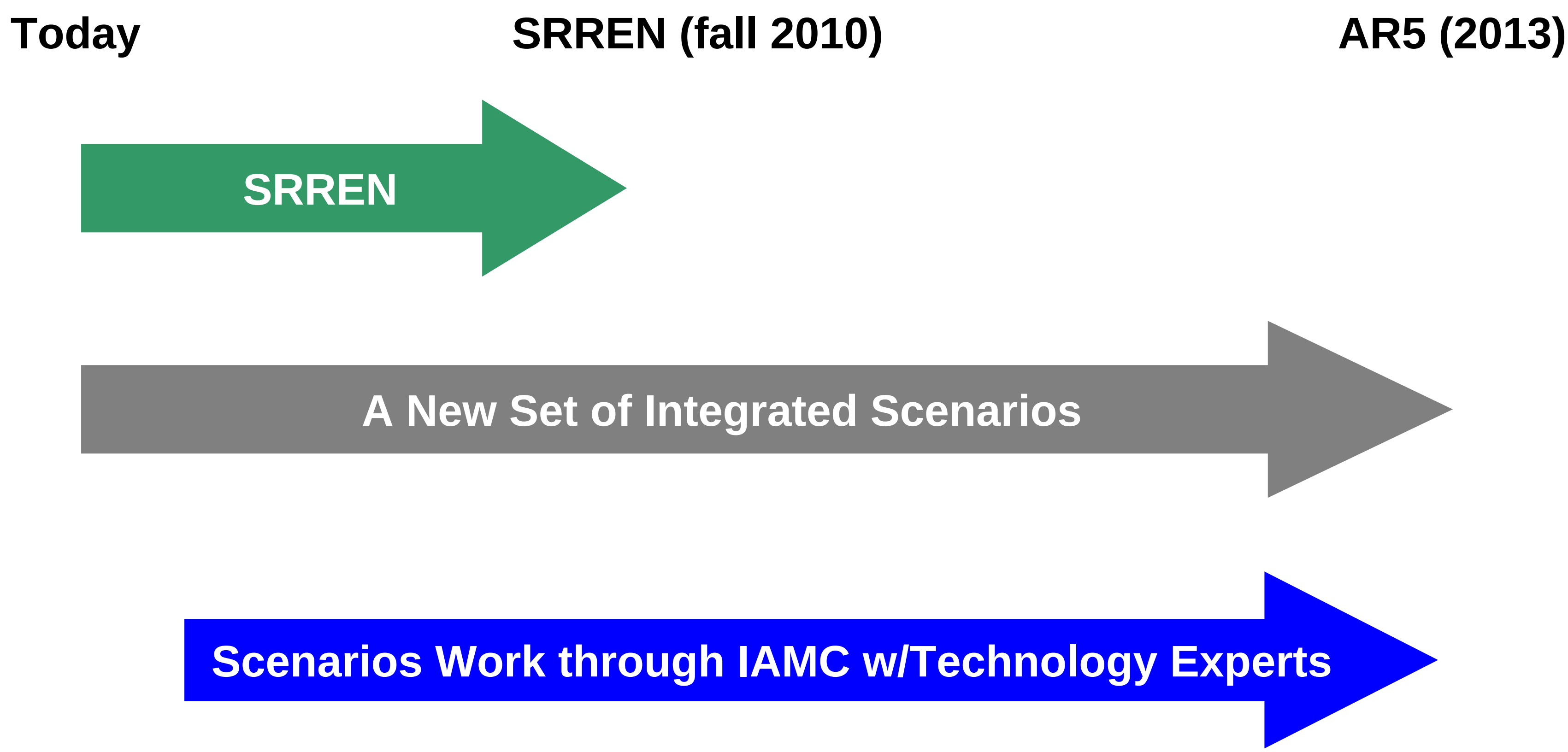


RESOURCE SUPPLY CURVE



Bottom-up assessments of technology cost and potential

A Little Context on the Short-Term and Long-Term Goals



Overview of the Oslo meeting

- 2-Day workshop
- Participants
  - representatives from 9 IA modeling teams
  - ~20 technology experts (CLAs+LAs) from technology chapters
- Agenda
  - Presentation of current status of SRREN scenario review
  - 9 IA models presentations (8 global/1 regional)
  - 6+1 technology chapter presentations (biomass, solar, geothermal, ocean, hydro, wind, and systems integration)
  - Lots of discussion
  - Conclusions: “Memorandum of Common Understanding”

SRREN Scenario Review

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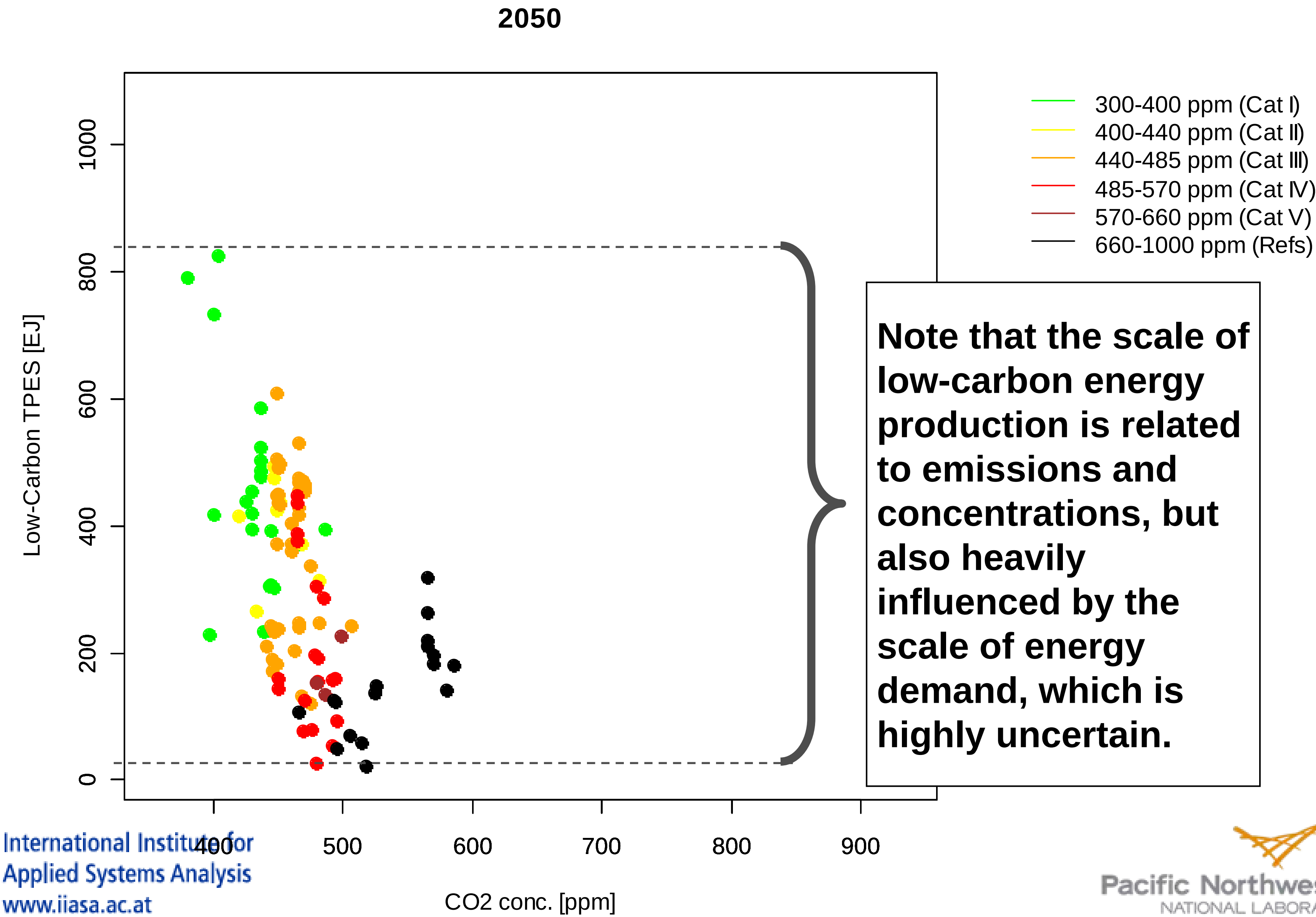
Submission to SRREN scenario survey

- SRREN survey
  - 1st and 2nd best scenarios
  - Details on renewables
  - Technology matrix
- Caveats
  - Results are biased
  - difficult to consistently assess some important issues, e.g. impact of limits on CCS and nuclear or delayed participation.
- Solution
  - focus a bit more heavily on some coordinated studies such as EMF 22, ADAM, and RECIPE.

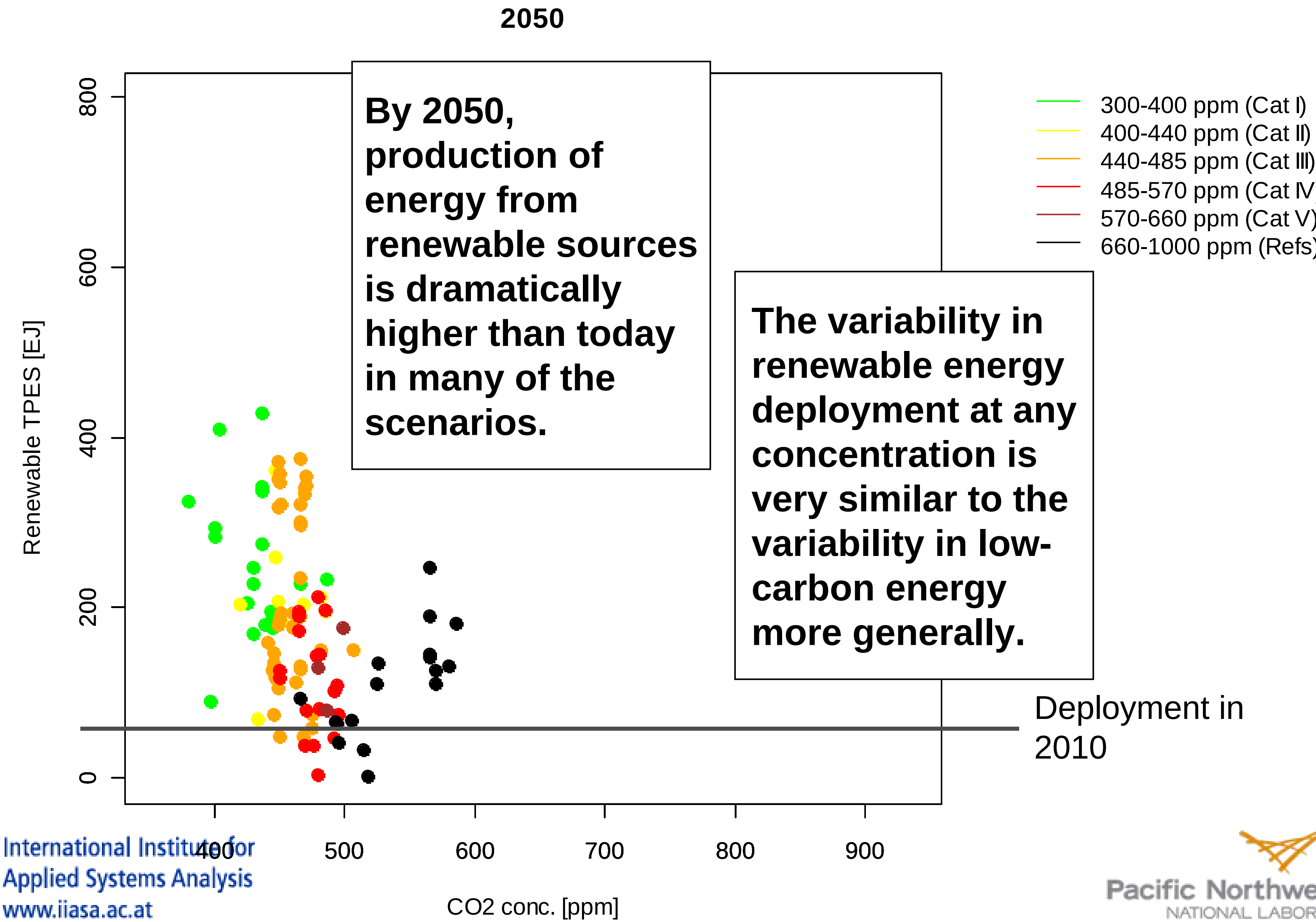
Participating Model	Number of Scenarios
AIM	3
DNE21	7
ETP	3
GRAPE	2
GTEM	7
IMAGE	4
MARKAL / AIM CGE	3
MERGE-ETL	17
MESSAGE	7
MiniCAM	8
POLES	15
REMIND	28
TIAM	10
WITCH	12
Total	126

The remaining primary energy must come from low-carbon sources.



Note that the scale of low-carbon energy production is related to emissions and concentrations, but also heavily influenced by the scale of energy demand, which is highly uncertain.

Renewable energy will provide some portion of the low-carbon demand.



By 2050, production of energy from renewable sources is dramatically higher than today in many of the scenarios.

The variability in renewable energy deployment at any concentration is very similar to the variability in low-carbon energy more generally.

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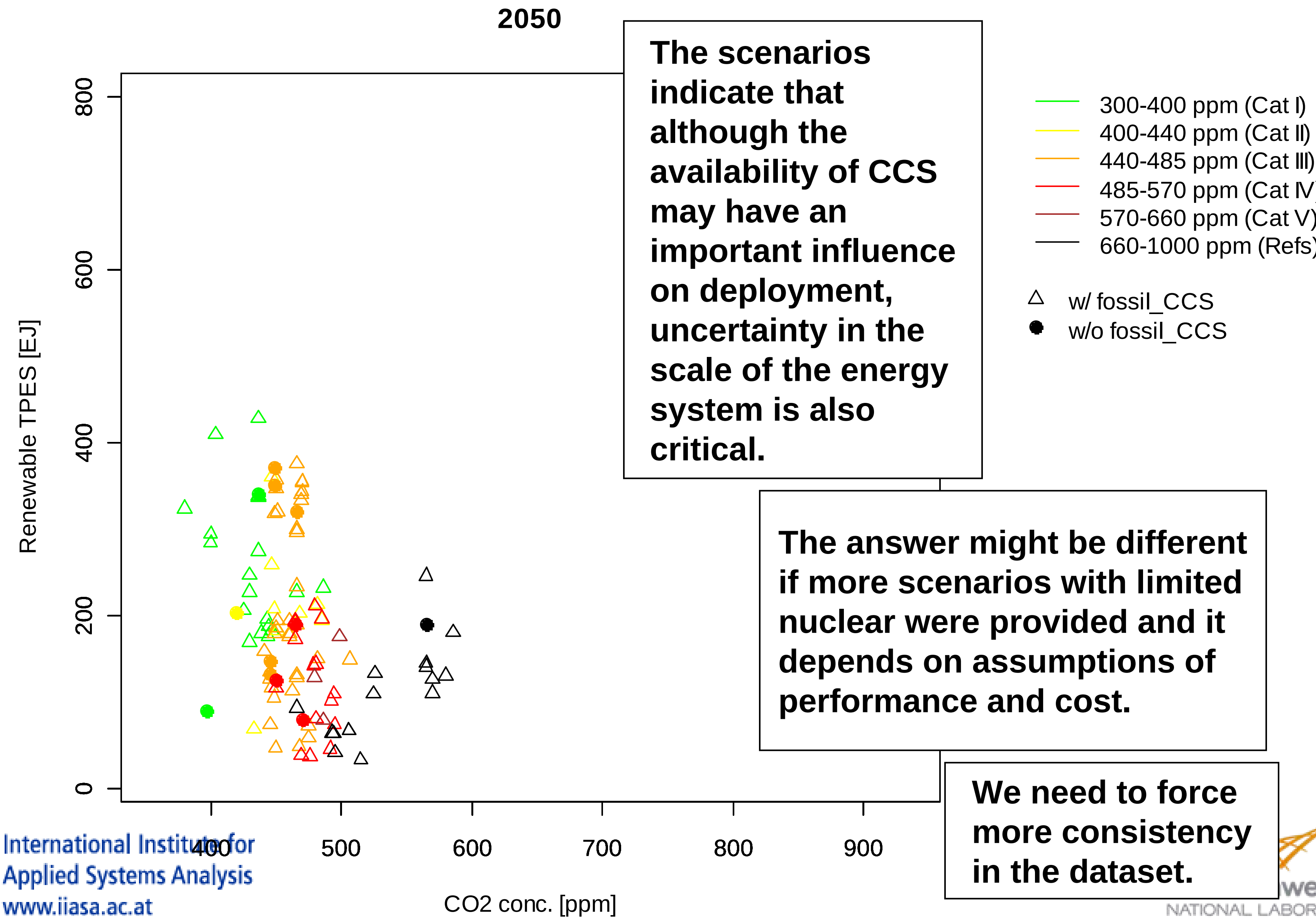
How does the availability of CCS influence the deployment of renewable energy?



The scenarios indicate that although the availability of CCS may have an important influence on deployment, uncertainty in the scale of the energy system is also critical.

The answer might be different if more scenarios with limited nuclear were provided and it depends on assumptions of performance and cost.

We need to force more consistency in the dataset.

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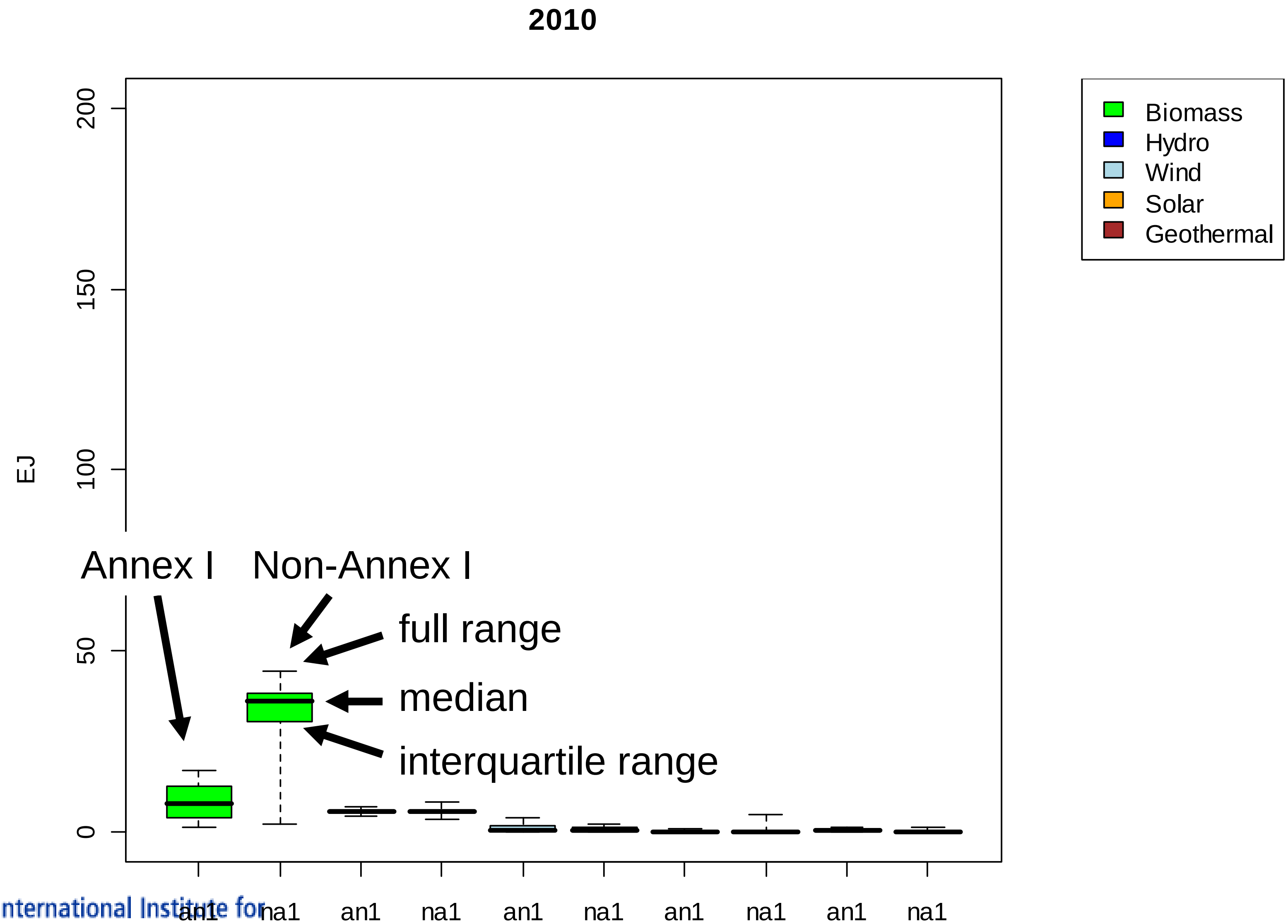
Renewable Energy Deployments



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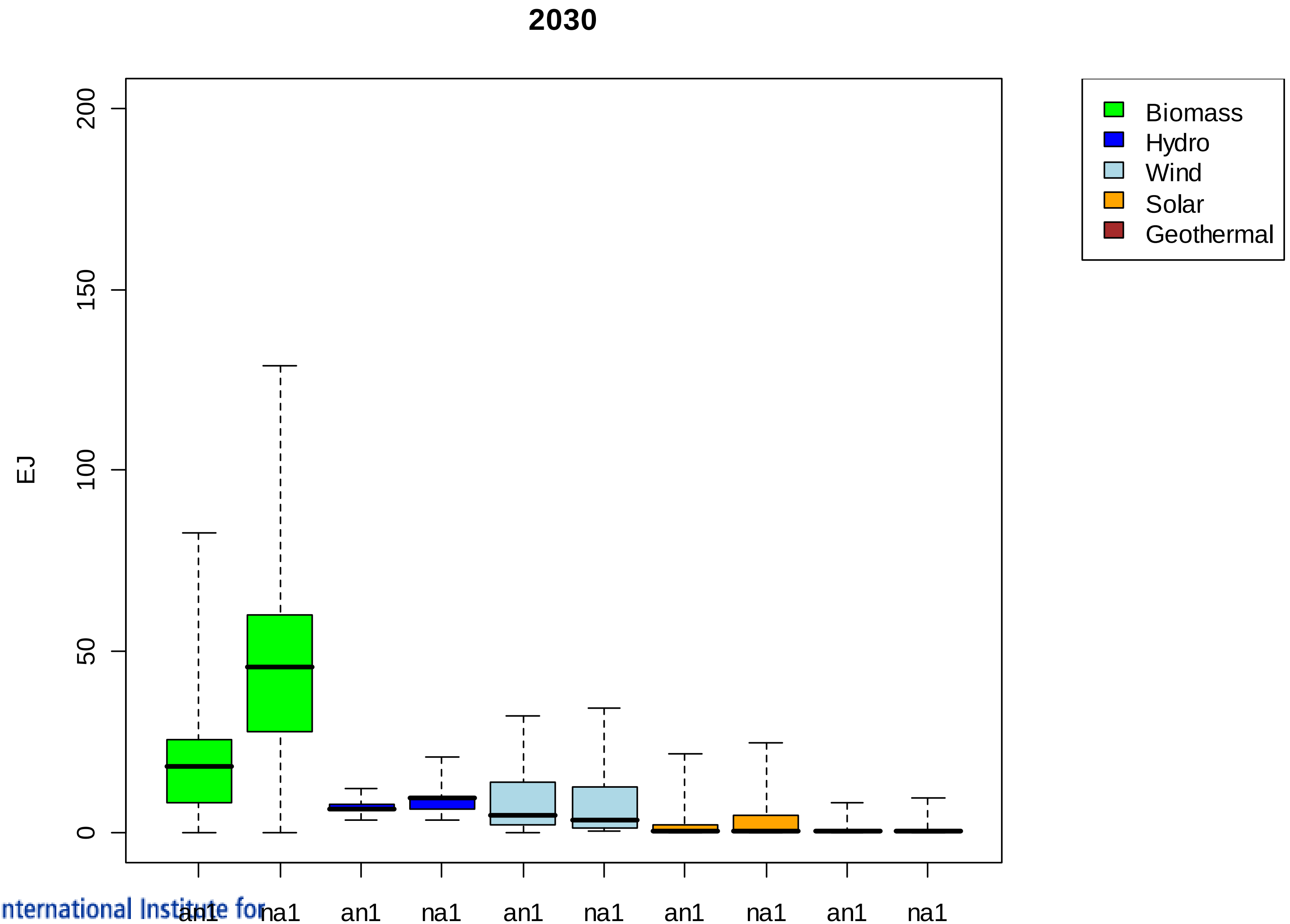
Renewable Energy Deployments



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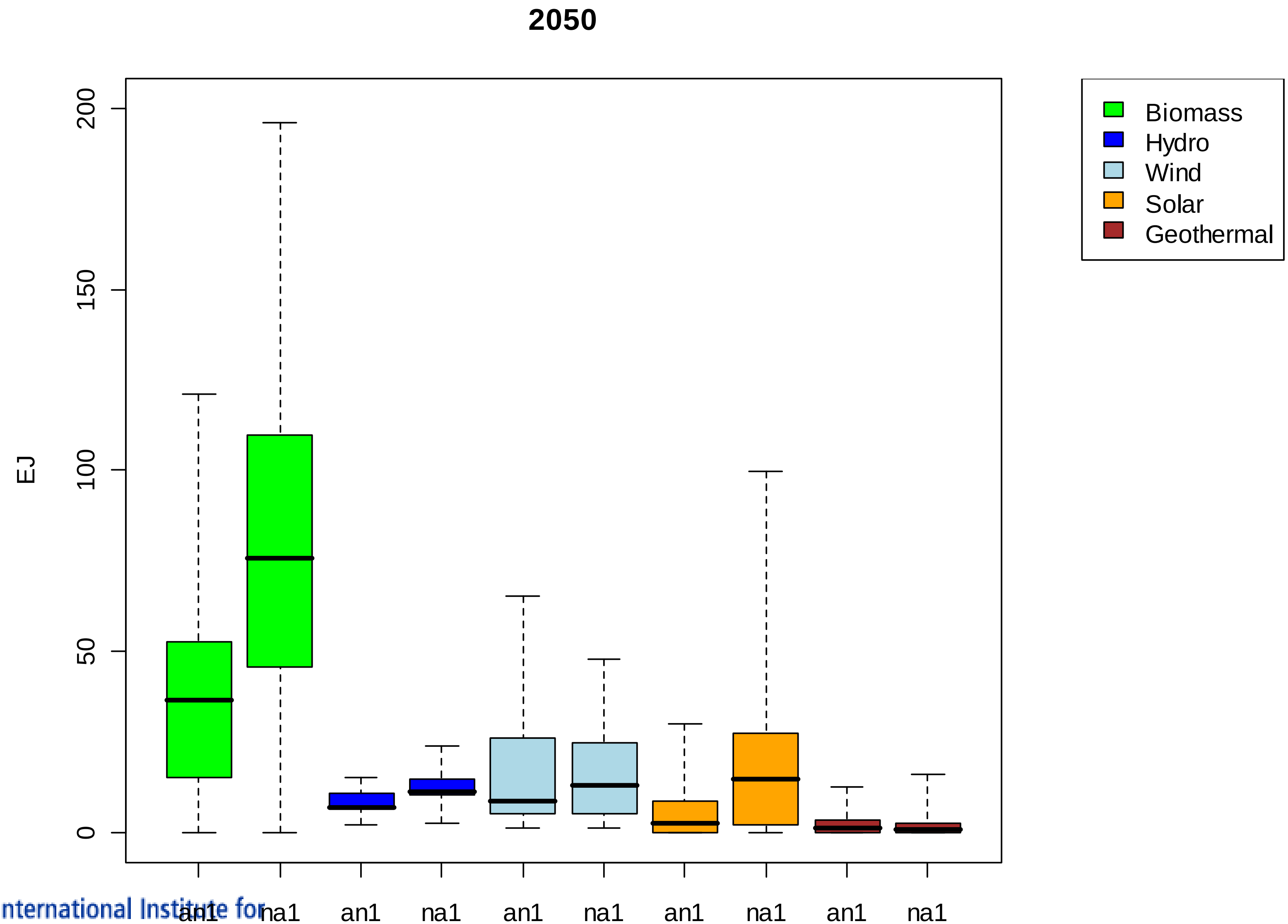
Renewable Energy Deployments



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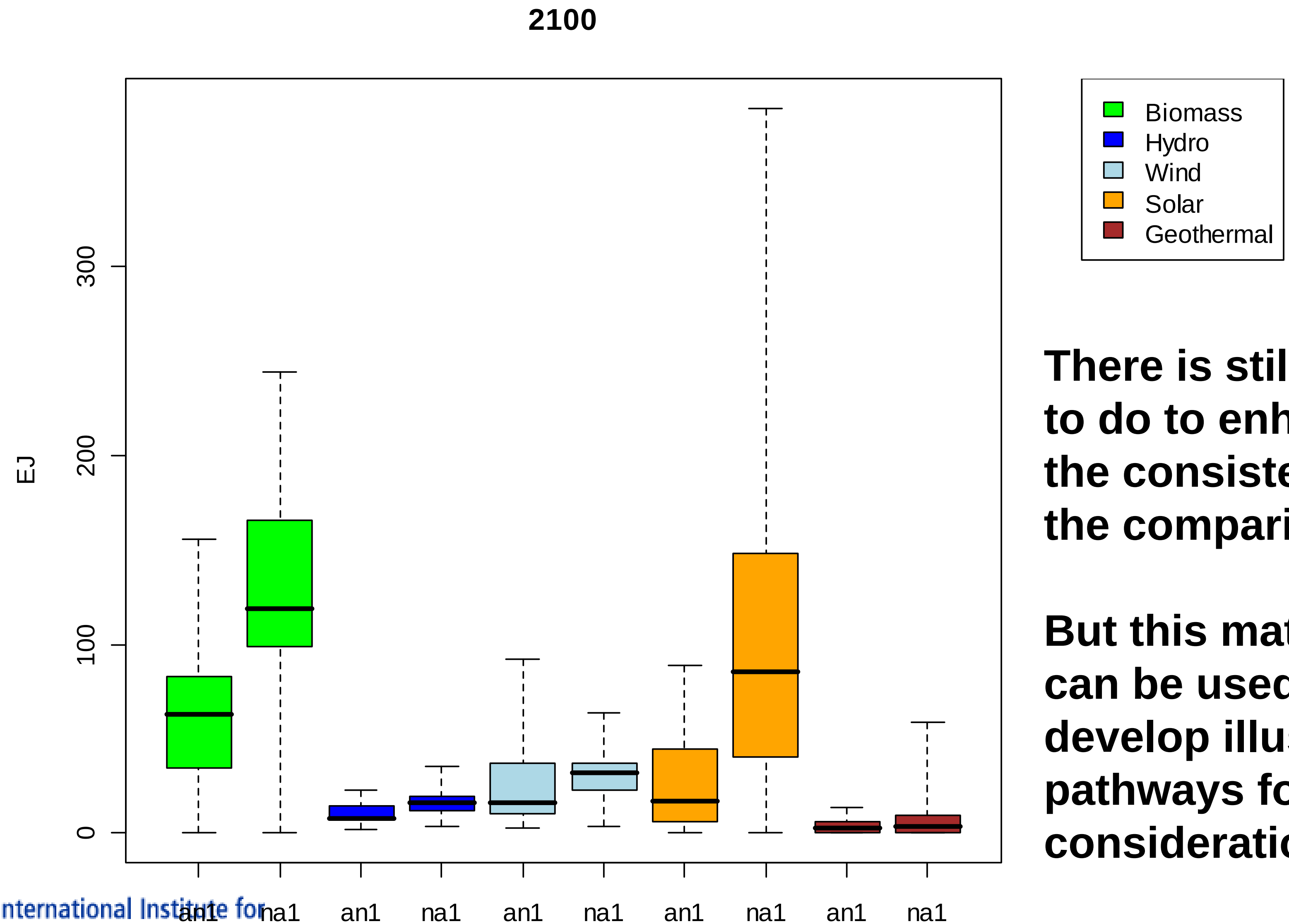
Renewable Energy Deployments



There is still work to do to enhance the consistency of the comparison.

But this material can be used to develop illustrative pathways for consideration

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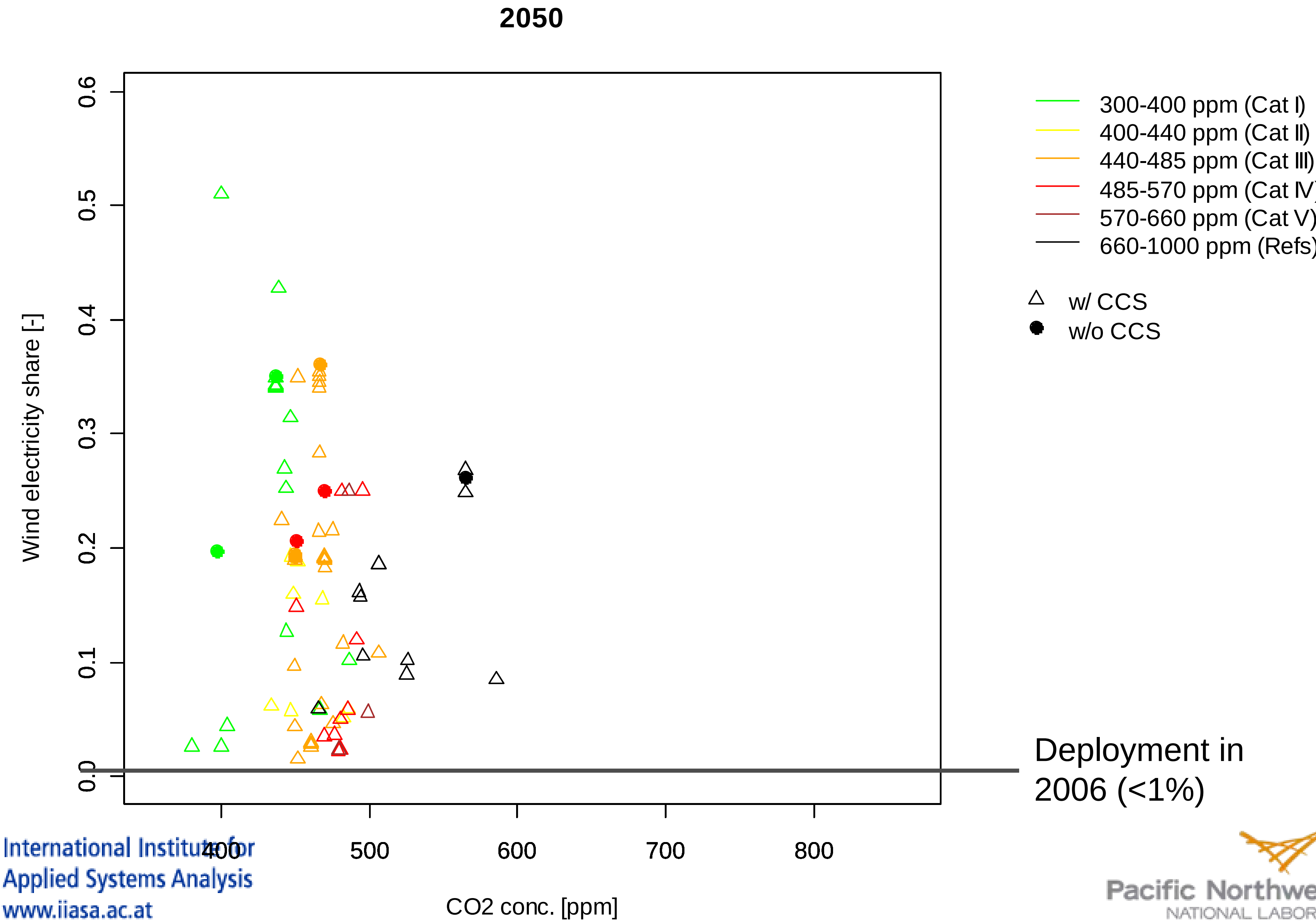
Is the system integration aspect sufficiently well covered in IA models?



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Technology Chapters

Bottlenecks (III): modelling frameworks:

Integrate biophysical and macro-economic models (partly tackled: OECD, FAO, UU/LEI, IMAGE/GTAP).

Feedbacks prices (and policies) on learning and intensification.

New advanced scenario's: policy driven, sustainability incorporated.Key additons:

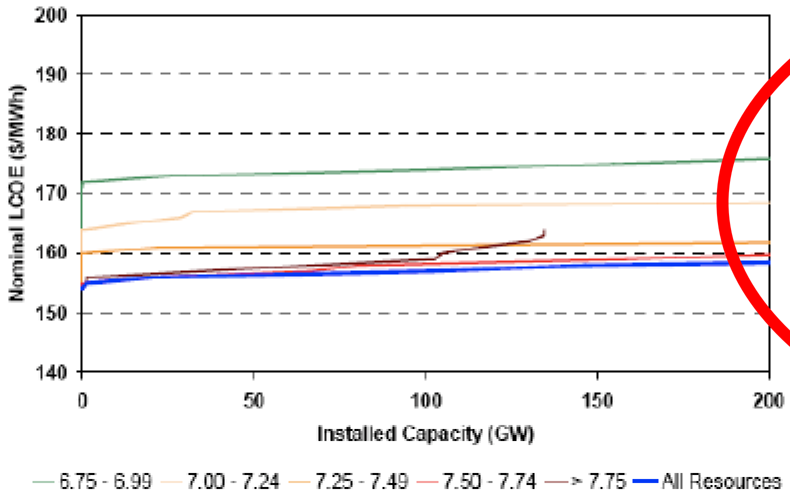
- 2nd (+) generation options
- Biomaterials
- Non-agricultural lands (forest, marginal, degraded, etc.)

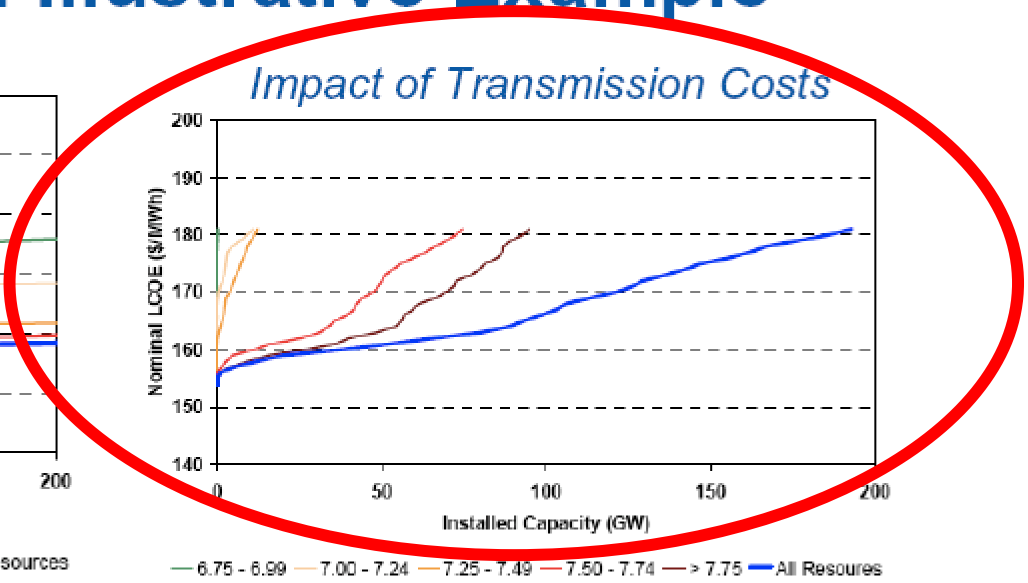
Backed by concrete examples; regional model verification

INTERGOVERNMENTAL PANEL ON climate change

Source: Jose Moreira & Andre Faiij (Bioenergy)

Technology Trends and Impacts on Supply Curves: Illustrative Example





Southwestern US CSP

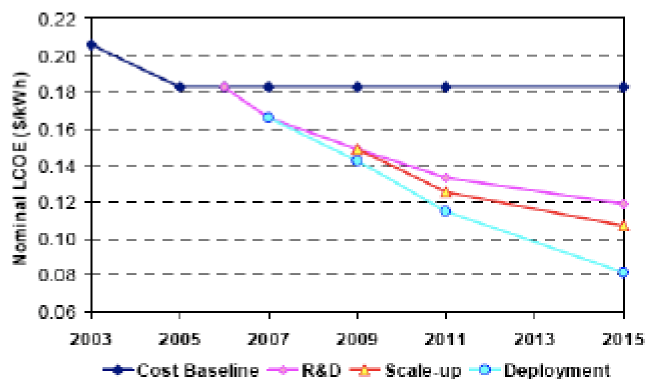


Figure 6. Projected cost reductions for parabolic trough systems out to 2015.

Source: Mehos, M. S.; Kearney, D. W. (2007). Potential Carbon Emissions Reductions from Concentrating Solar Power by 2030. Kutscher, C. F., ed. Tackling Climate Change in the U.S.: Potential Carbon Emissions Reductions from Energy Efficiency and Renewable Energy by 2030. Boulder, CO: American Solar Energy Society pp. 79-89; NREL Report No. CH-550-41270

Source: Dan Arvizu (Direct Solar)

Modelling Feedback

Important to separate data for each resource in Ocean

- Technology Challenges different
- Regional variations in resource

Guidance on data required – formats e.g. cost curves, load factors, efficiencies, deployment curves.

Variable Renewables – Solar, Wind, Ocean require long term averages for resource input (Inter-annual/intra-annual variations).

IPCC

Source: Segen Estefen (Ocean)

Models Are Improving, But… Challenges Remain

- Global wind resource data currently in use may under-state or mis-state resource in many regions: 3Tier data is likely the best available source
- Outdated estimates of current/future costs without adequate understanding of underlying cost/performance drivers (be careful with learning)
- Reasonable land-use exclusions and deployment limits given siting / environmental / manufacturing / social concerns
- Adequately addressing the natural characteristics of wind energy (variability, uncertainty, location dependence) is challenging
- Lack of understanding of the incremental transmission costs of wind, as penetration increases, by region, and compared to other technologies
- Envisioning and modeling innovative grid architectures for high renewable energy penetrations a major challenge for both top-down and bottom-up
- Ability to value storage as system resource, and relative to other less-costly mitigation options, will be important, especially at high penetrations
- Need to prioritize these improvements given real limits to top-down models
- Need to address all technologies consistently with respect to these issues

Source: Ryan Wiser (Wind)

Conclusions from Oslo Meeting

- SRREN
  - Scenario data to technology chapters
  - Feedback on attainability of deployments and enabling factors
- AR5
  - Interaction between technology and IA modeling communtiy („closing the loop“)

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INTERGOVERNMENTAL PANEL ON climate change

Working Group III (WG III) – Mitigation of Climate Change

ENHANCING THE INTERACTION BETWEEN BOTTOM-UP ASSESSMENTS AND TOP-DOWN APPROACHES IN THE FIELD OF RENEWABLE ENERGY RESEARCH

Main Conclusions Drawn from the IPCC Expert Meeting
Modeling Renewable Energies:
Coherence Between Model Assumptions and Latest Technological Knowledge
30-31 August 2010, Oslo, Norway

The potential role of renewable energies for mitigating climate change is traditionally analyzed along two different lines: The bottom-up approach focuses on the properties and distinctive features of technologies in great detail. The top-down approach focuses on the extent to which the respective technologies might be applied in business-as-usual scenarios and to what extent they should be used to achieve least cost climate protection goals considering integrative aspects. Whereas the focus of bottom-up assessments is on the technologies themselves (technology appraisal), the main goal of top-down models is to identify the economic implications of different climate protections goals, with a particular focus on determining least cost climate protection strategies.

In the past, modelling comparison exercises (e.g. EMF-22, ADAM and RECIPE) contributed significantly to explaining the strengths, limitations, and caveats associated with different analytical approaches to address selected issues in the fields of energy economics or climate policy. In order to achieve this goal, key input parameters or policy characteristics were identified and subsequently harmonized. Concerning renewable energies however, the input data (resource potential, investment cost, etc.) selected by different top-down modellers has often been taken from diverse sources. With few exceptions, there has been no attempt to construct a database for resources and costs that could reflect the current consensus in the field of technology specific assessments.

A main goal of the IPCC Special Report on Renewable Energy Sources and Climate Mitigation (SRREN) is to provide (1) a comprehensive, technology specific assessment of the most important renewable energies along with (2) a discussion of integration challenges in order to (3) identify their overall mitigation potential and associated costs in the context of different climate protection goals. In a subsequent step, (4) suitable policies will be identified that facilitate the application of renewable energies. In order to achieve this goal, the IPCC brings together leading experts from the bottom-up and top-down communities. This provides a unique opportunity to enhance mutual understanding and to improve the interaction between both communities.

An Ideal (Long-term) Approach to Enhance the Interaction

In order to achieve the aforementioned goal, in an information exchange with the different top-down modellers often participating in modelling comparison exercises, the bottom-up community would ideally provide a list of best-guess input data (including uncertainty ranges). Modellers could request specific data that, for instance, might ask for regional resource curves broken down in a

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A PATH FORWARD

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A technology-focused EMF-style study?

- IPCC asks for second-best scenarios that might be closer to reality than the usual first-best scenarios
- There are some recent examples into this direction (e.g. EMF22, ADAM, RECIPE), but this is not sufficient
- Interaction between IA Modeling community and technology community needed to get a better representation of main technology characteristics (e.g. fluctuating renewables) as well as expectations over the short- to medium term (e.g. industry upscaling, technology components)
- An improved understanding of each others needs is required to make this work, e.g.
    - TE → IAM: Resource supply curves – ideally gridded
    - IAM → TE: deployment levels to estimate future costs
- Iterative process
- Special Issue with technology papers as well as scenarios (IEA ETP has been quite successful with this concept as it goes beyond just modeling)

Thank You!

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