

# Integrating Models and Policymaking

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5 March 2013



# **About Climate Interactive**

# Climate Interactive's Mission

- **Goal:** Improve **timely**, policy relevant analysis for negotiators, NGOs, and the public as they tackle climate and energy systems
  - Stay apolitical, not get into partisanship
- **How:** Climate Interactive focuses on providing the best trusted, vetted, free, and open tools
  - While we do some analysis upon request, our goal is to empower others to do independent analysis easily, quickly, and in a scientifically rigorous manner



Our cutting-edge tools help people **see what works** to address the biggest challenges facing our lives on Earth.

# Climate Interactive Provides

- C-ROADS (Climate Rapid Overview and Decision Support)
- En-ROADS (Energy Rapid Overview and Decision Support)
- Climate Pathways – iOS application/mobile
- C-Learn – (web-hosted sim based on C-ROADS)
- World Climate (in-person negotiation exercise/war game)
- Kenya Pastoralist Drought model (climate adaptation and resiliency)
- Water-Energy Nexus simulator [proposed]
- ClimateScoreboard.org
- Climate Momentum (Flash-based online simulator)
- Firm-level Electrical Utility model – carbon tax
- Process facilitation skills

# Climate Interactive Project Partners

## Financial and In-kind Supporters



## In-kind Supporters



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# Reach 2°C?

- What will the temperature be in 2100 if:
  - the US reduces 30% below 2005 by 2050
  - the EU reduce 60% below 1990 by 2040
  - China reduces carbon intensity by 60% by 2030
  - and the rest of world continues as projected?

# C-ROADS Motivation: Difficulty Comparing Proposals and Estimating Aggregate Impact

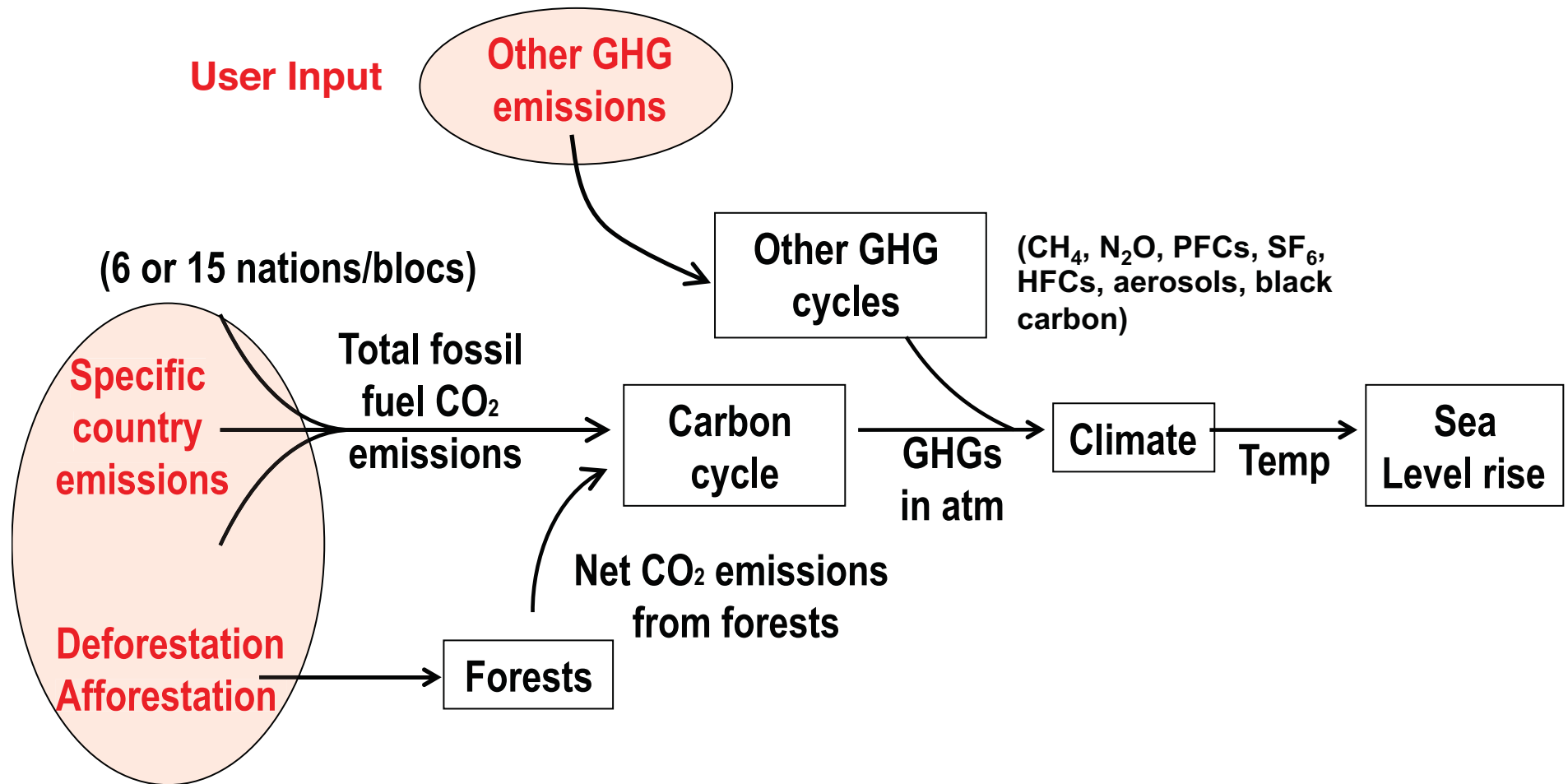
- “Currently, in the UNFCCC negotiation process, the concrete **environmental consequences of the various positions are not clear** to all of us. There is a **dangerous void of understanding** of the short and long term impacts of the espoused ...unwillingness to act on behalf of the Parties.”
  - Christiana Figueres, former UNFCCC negotiator for Costa Rica, now Executive Secretary of the UNFCCC, 2009
- “...delegates [in Bonn] complained that **their heads were spinning** as they were trying to understand the science and assumptions underlying the increasing number of proposals tabled for Annex I countries’ emission reduction ranges. “They all seem to use **different base years and assumptions...: how can we make any sense of them?**” commented one negotiator.”
  - Press Report, ENB, 2009
  - <http://www.iisd.ca/vol12/enb12403e.html>



# **C-ROADS Simulator**

Climate Rapid Overview and Decision  
Support

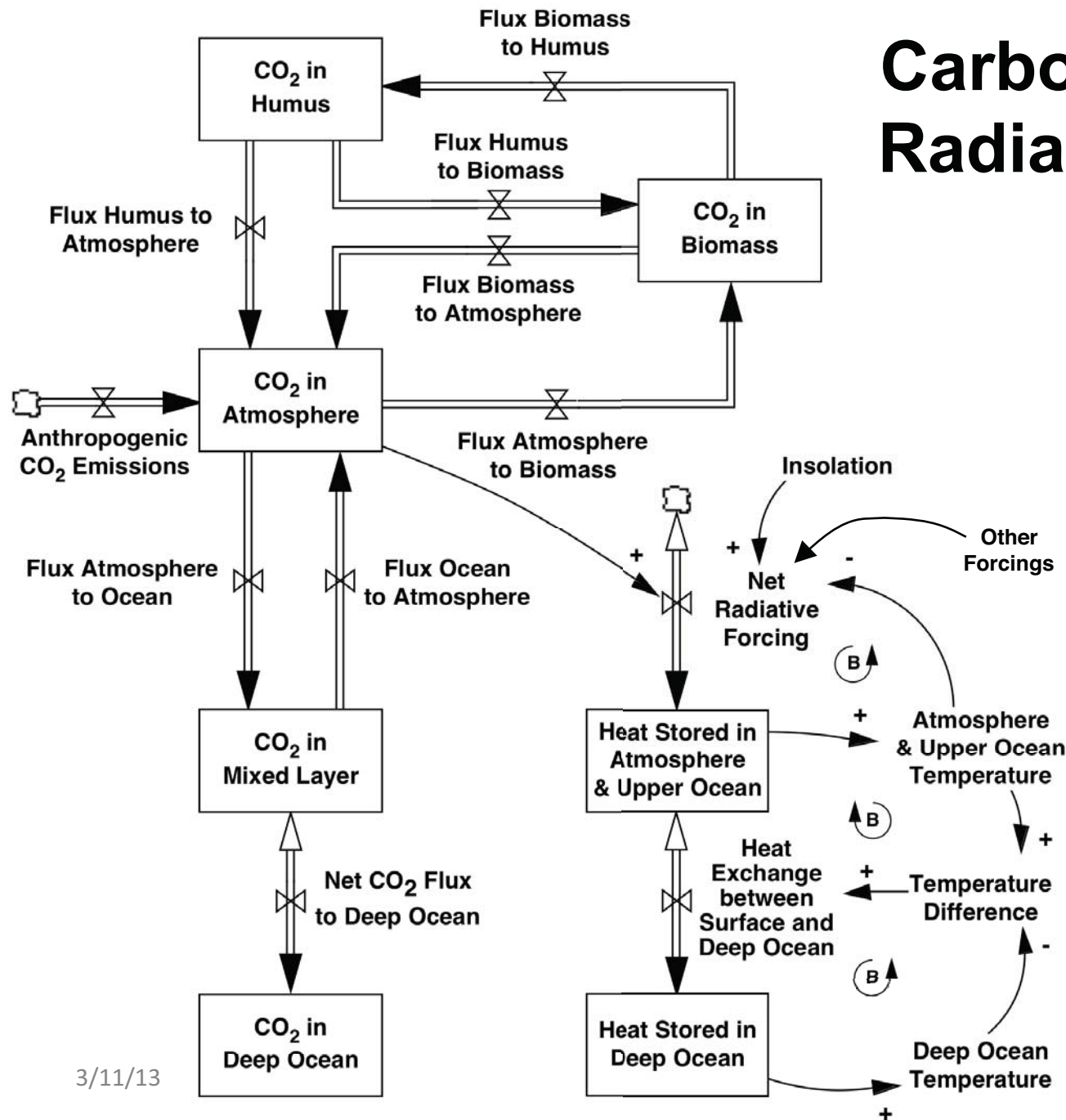
# C-ROADS Model Structure



**User Input**

Scientifically reviewed; Runs easily on a laptop;  
Emerges from team out of MIT; Shared with all groups  
(e.g., US, EU, China, NGOs);  
Open-box: equations and assumptions transparent

# Carbon Cycle and Radiative Balance



- CO<sub>2</sub>
- CH<sub>4</sub>, N<sub>2</sub>O
- PFCs, HFCs, SF<sub>6</sub> etc.
- Aerosols, Black carbon
- Carbon & heat transfer between surface & deep ocean

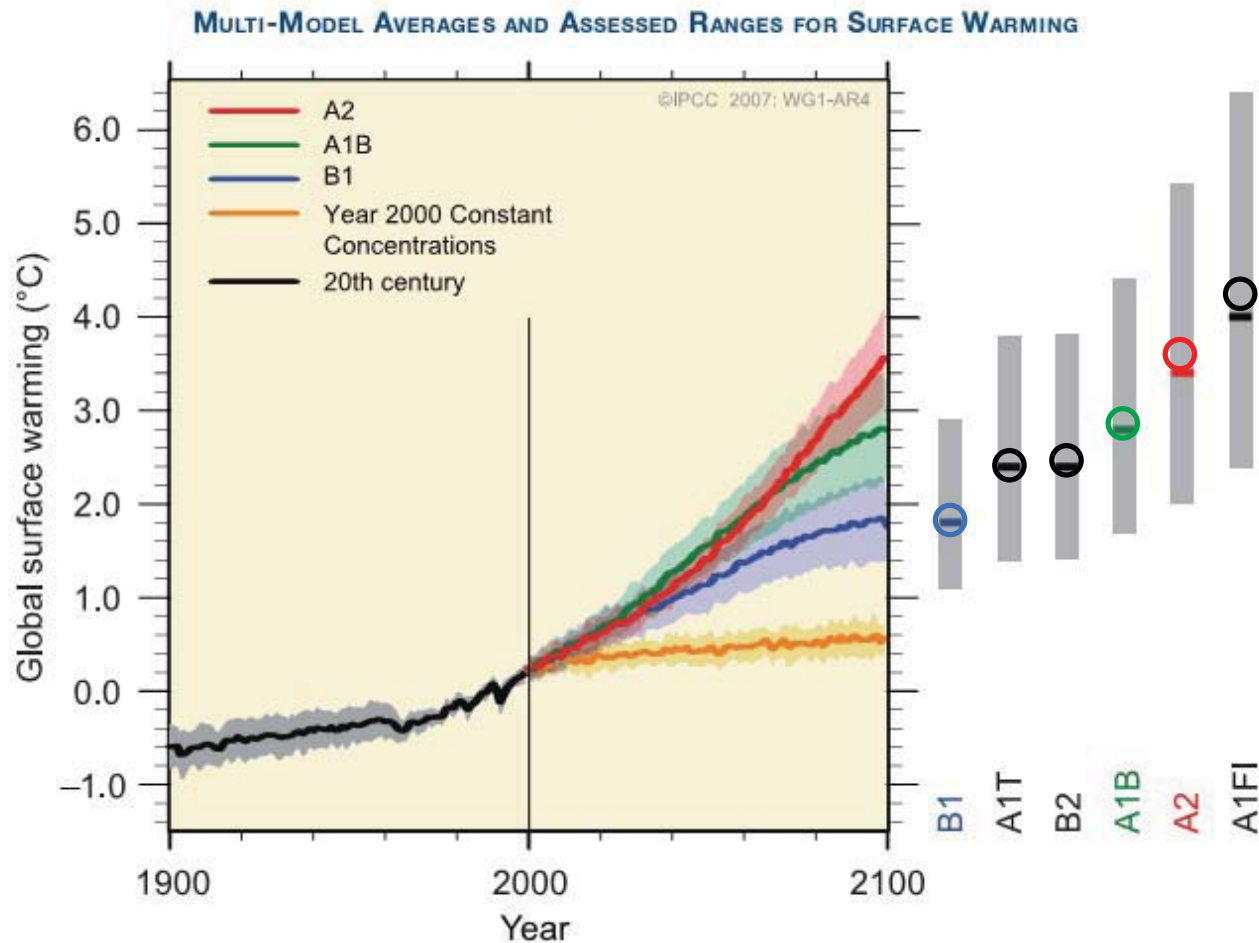
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# C-ROADS Scientific Review Panel

- Dr. Robert Watson - Department for Environment, Food and Rural Affairs (DEFRA) and former chair, IPCC -- *Panel Chair*
- Dr. Eric Beinhocker - McKinsey Global Institute
- Dr. Klaus Hasselmann - Max-Planck Institut für Meteorologie
- Dr. David Lane - London School of Economics
- Dr. Jorgen Randers - Norwegian School of Management BI
- Dr. Stephen Schneider - Stanford University
- Dr. Bert de Vries - Netherlands Environmental Assessment Agency, RIVM

# C-ROADS Calibration to AR4 Scenarios



Courtesy of the Intergovernmental Panel on Climate Change.  
Source: [Climate Change 2007: The Physical Science Basis](#).  
Summary for Policy Makers. Figure SPM.5. Page 14.

[www.climateinteractive.org](http://www.climateinteractive.org)

# Scientifically rigorous AND useful to decision-makers

Photograph of [Robert Watson](#) removed due to copyright restrictions.

## **Dr. Robert Watson, Past Chair, IPCC**

“C-ROADS... This very rapid simulation model reproduces the response properties of state-of- the-art three dimensional climate models very well ... and with sufficient precision to provide useful information for its intended audience.”

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Photograph is in the public domain.

## **Senator John Kerry**

“I have to tell you — [C-ROADS] works, it is important, and it is already getting broad dissemination, ... I used it!”

[www.climateinteractive.org](http://www.climateinteractive.org)


# U.S. State Department's J. Pershing Presenting to the UN

  UNFCCC Webcast

Bonn Climate Change Talks - March 2009  
Seventh session of the AWG-KP and fifth session of the AWG-LCA

**OnDemand Webcast**

Floor English

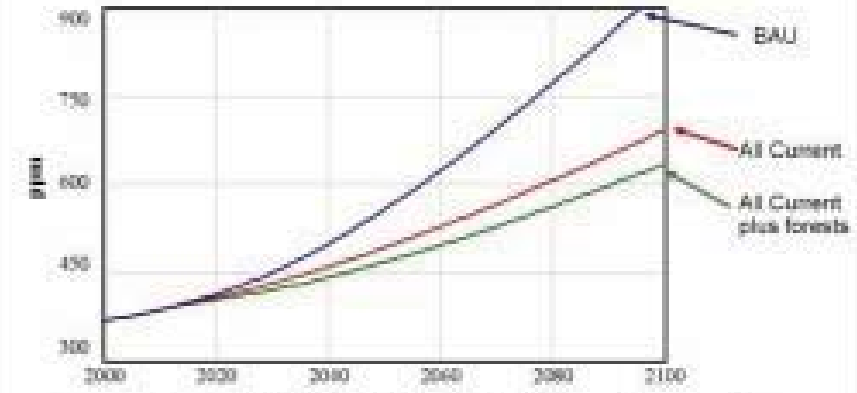


Mr. Jonathan Pershing  
United States of America

**Organizer:** UNFCCC  
**Type:** Plenary  
**Date:** 01 April 2009  
**Time:** 10:00 CEST  
**Location:** Saal Maritim

Agenda Charts

### CO<sub>2</sub> in Atmosphere Would Continue to Increase



Year	BAU (ppm)	All Current (ppm)	All Current plus forests (ppm)
2000	370	370	370
2020	420	410	400
2040	500	480	460
2060	620	580	530
2080	780	680	600
2100	900	750	650

Source: Testimony of Dr. Robert Corell, Heinz Center for Science, Economics, and the Environment and Dr. John Sterman, Director of MIT System Dynamics Group

Slide 6 of 7

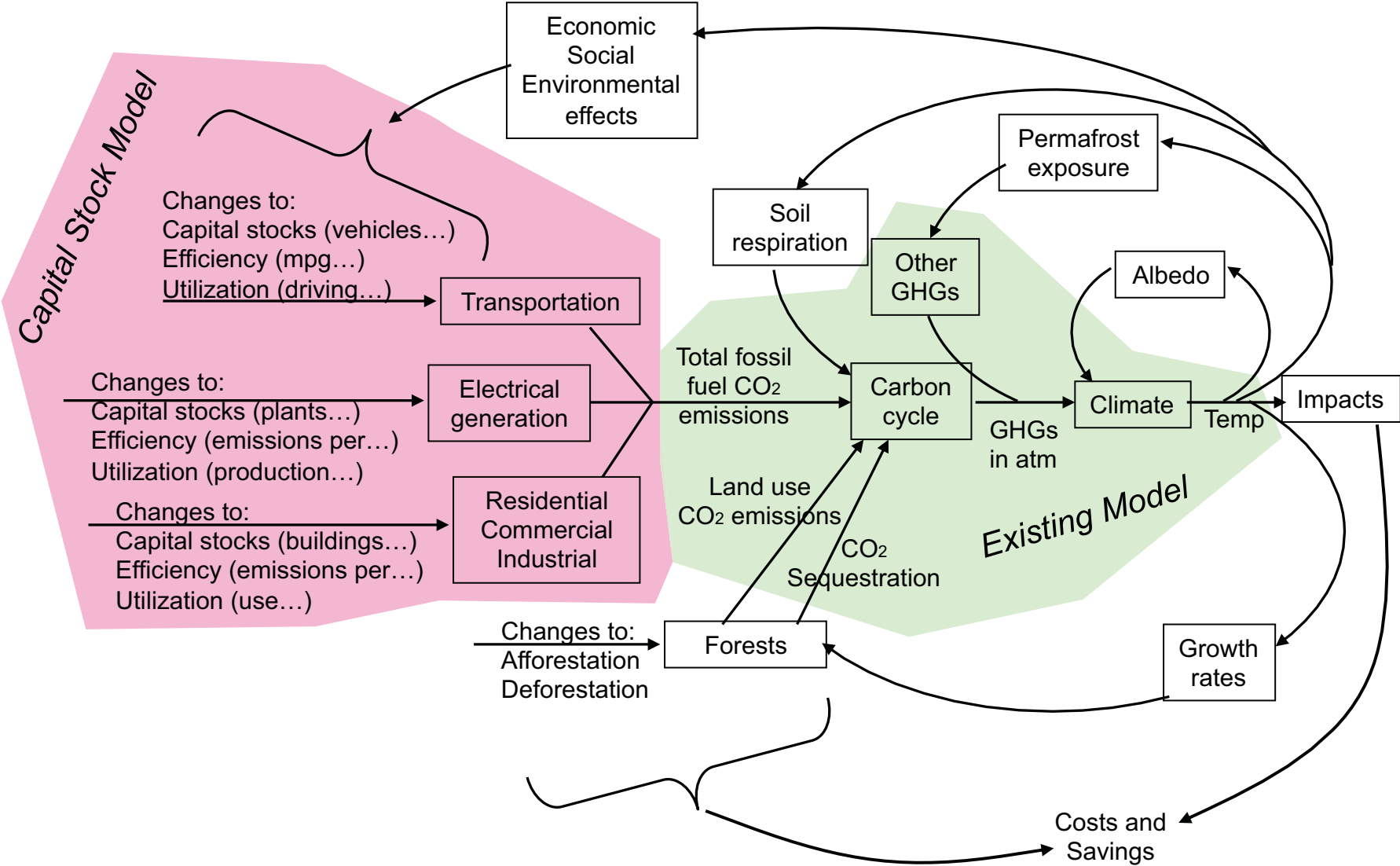
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# C-ROADS Summary

- Rigorous
- Clear users and engaged stakeholders
- Focused on policy questions
- Formulated in language of policy
- Transparent, open
- Approachable
- Real-time, to help build intuition



# Energy and Climate System Overview



# **EN-ROADS SIMULATOR**

# In En-ROADS

- Things take time:
  - Commercialization, permitting, financing, and construction all take time.
  - Non-electrified end uses (e.g., cars and industry) can be electrified, but not instantaneously.
- Success builds success:
  - Costs of energy supplies fall as cumulative experience is gained.
  - Rising market share for the new tech builds familiarity, and broadens the reach of infrastructure, so that success feeds on itself.
- There are constraints:
  - Rising costs and scarcity of materials put limits on the pace of growth in new tech.
  - Coal, oil, and gas resources are limited.
- Demand and supply are linked:
  - Energy demand falls if energy prices rise, and likewise.

# Framing, Modeling, Data, and Project Team

- Sonia Aggarwal, CWF
- Casey Cronin, CWF
- Tom Fiddaman,  
Ventana
- Travis Franck, CI
- Hal Harvey
- Drew Jones, CI
- Stephanie McCauley, CI
- Phil Rice, CI
- Beth Sawin, CI
- Lori Siegel, CI
- John Sterman, MIT
- Clara Vondrich, CWF
- Diana Wright

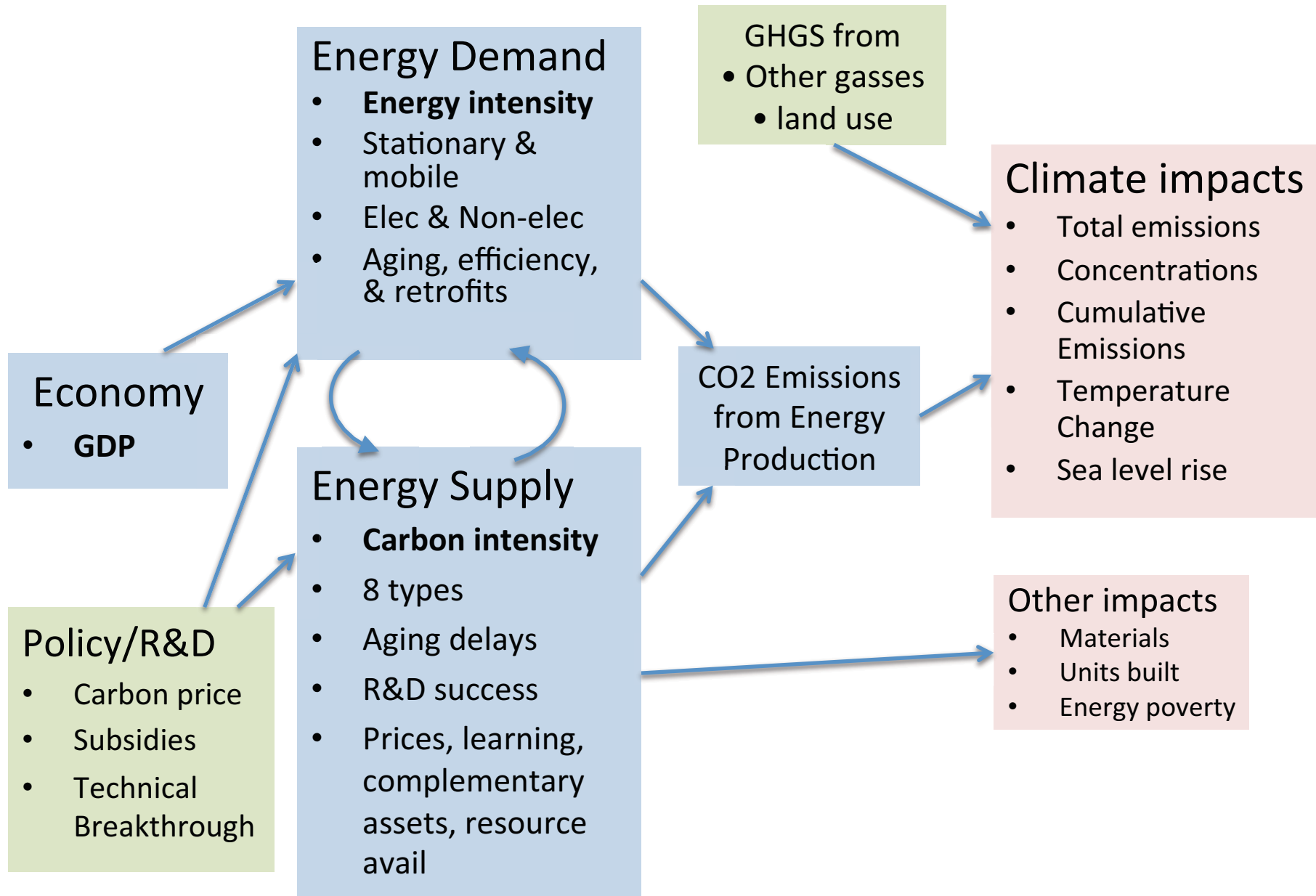
Funded primarily by:



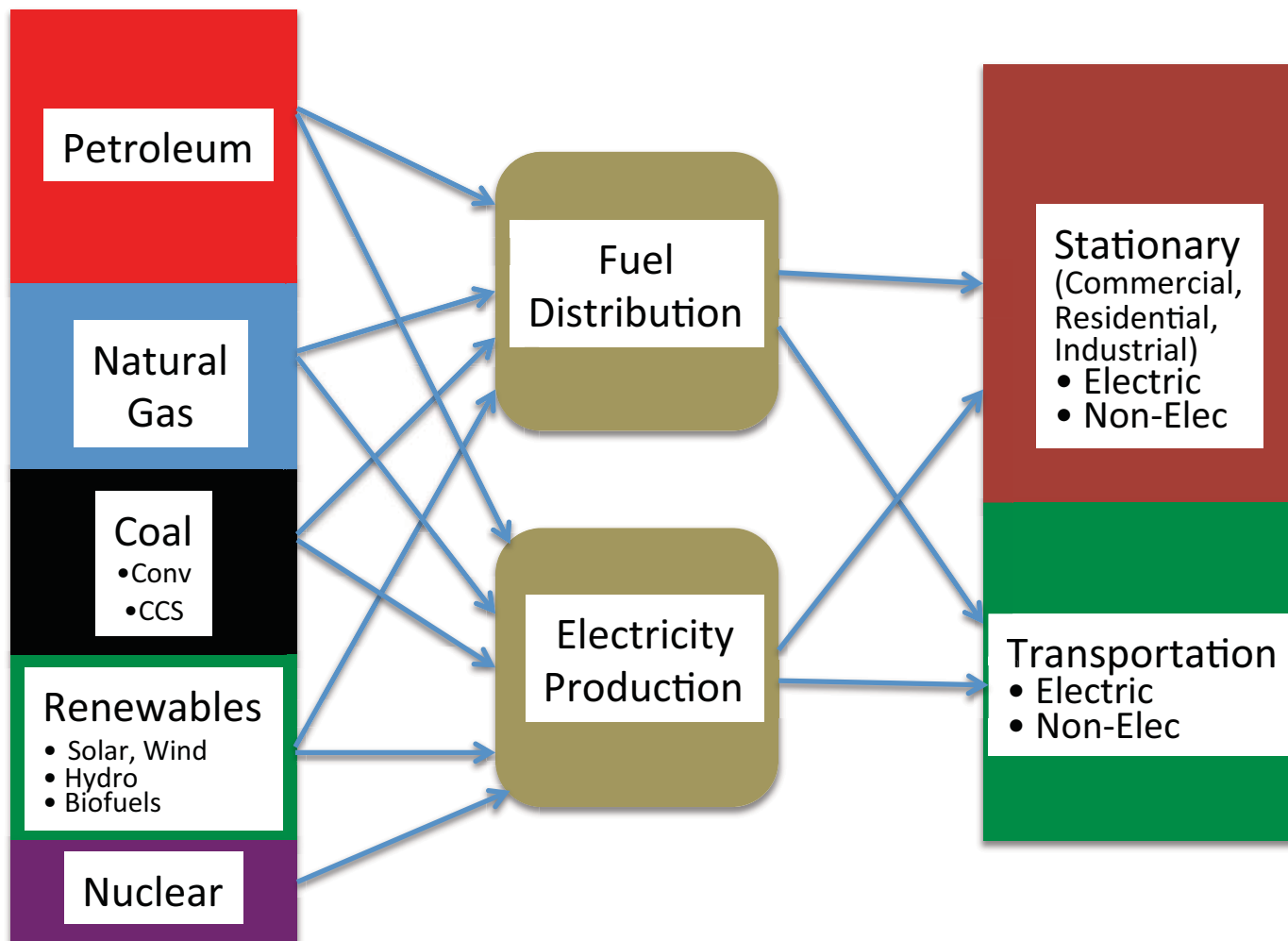


# En-ROADS Energy System Structure

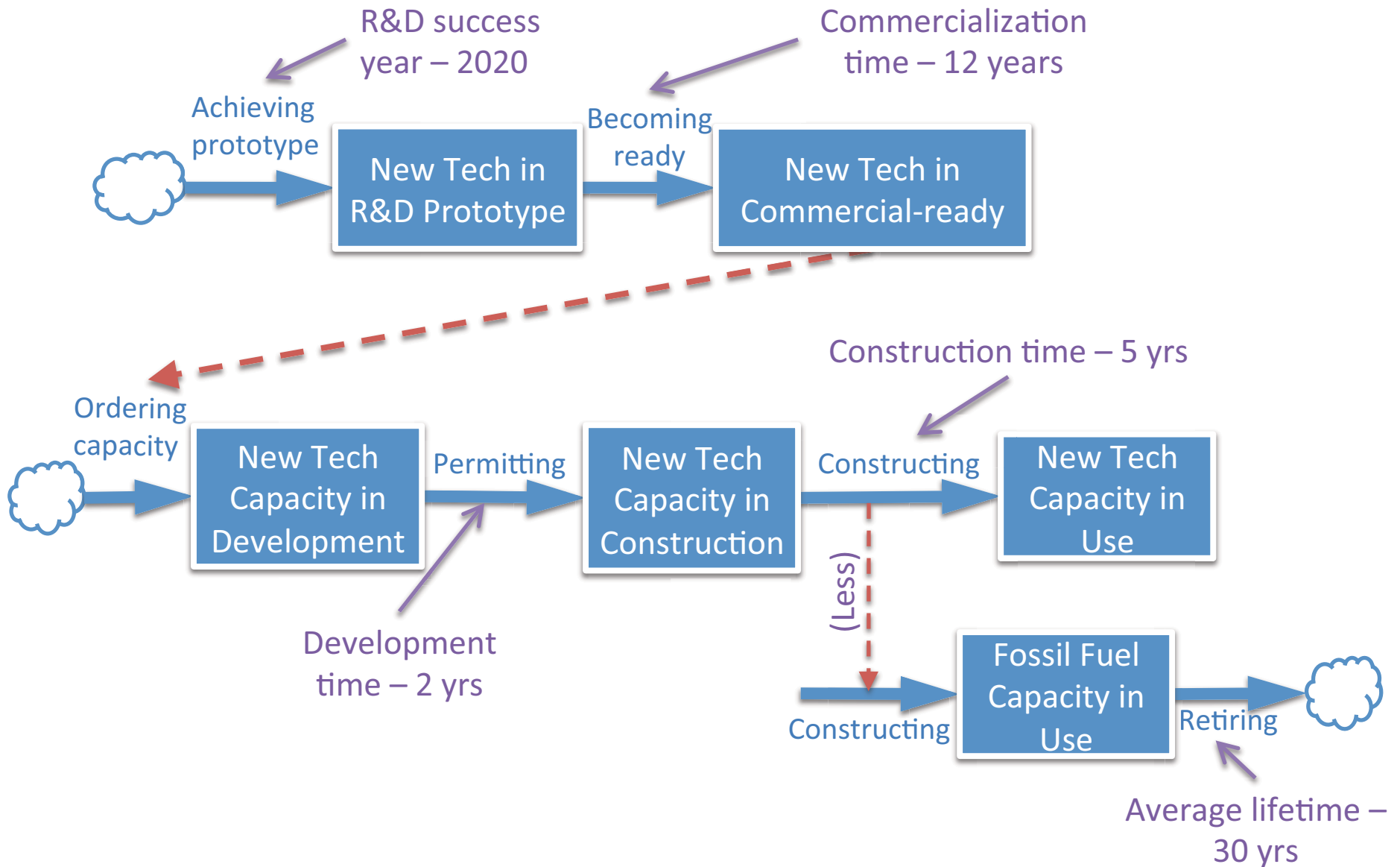
# En-ROADS Simulation Structure



# En-ROADS Energy Sources and Uses



Why? It takes time for New Tech to grow. There are long delays between R&D and displacement of coal, oil, and gas





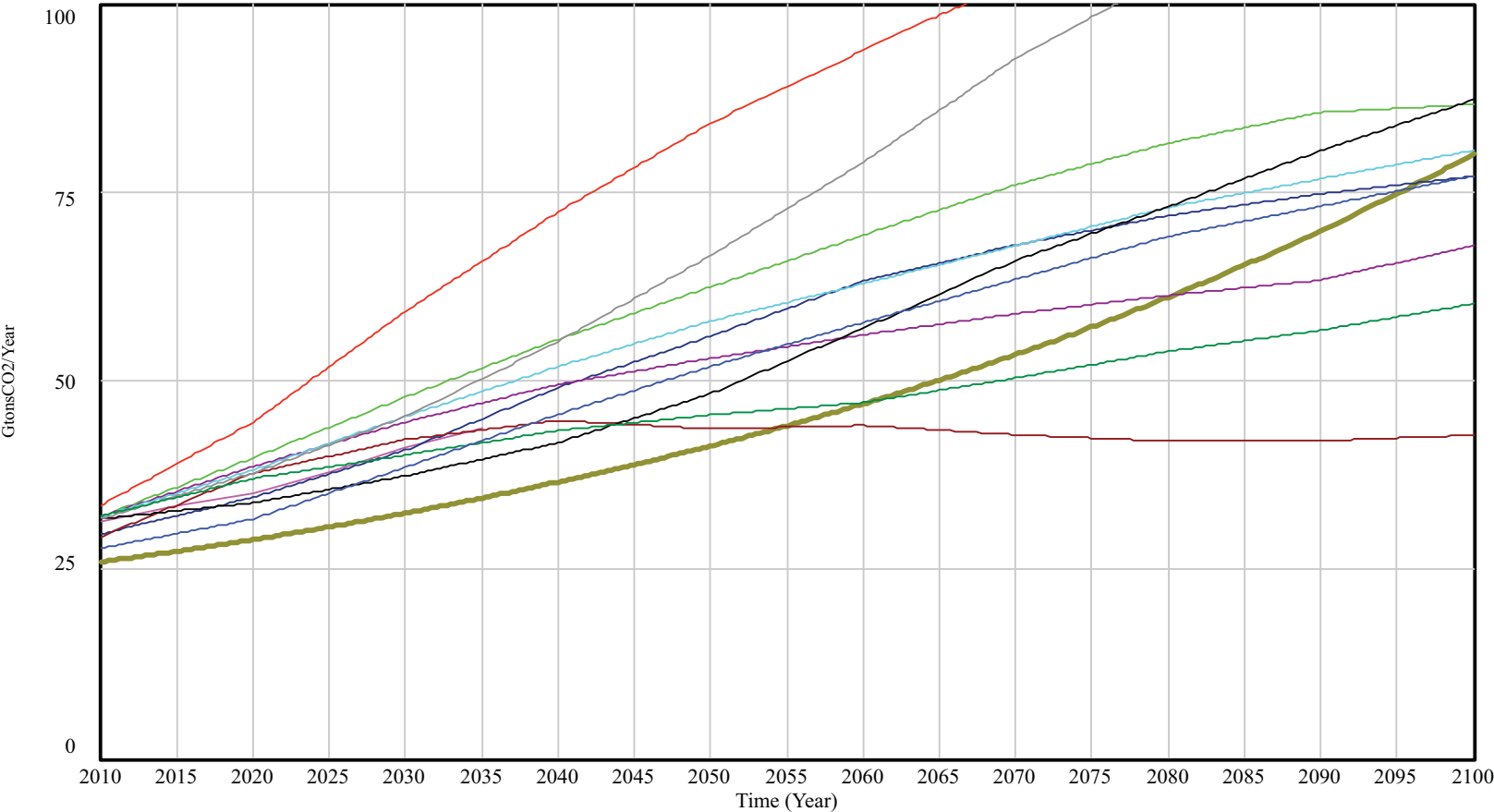
# Some Prominent IAMs We Seek to Complement

- IGSM – dynamic general equilibrium
- MERGE – intertemporal optimization
- MiniCAM – partial equilibrium, intertemporal optimization
- MESSAGE – energy system optimization
- ASF – hybrid
- AIM – hybrid top-down/bottom-up
- WorldScan – general equilibrium
- DEMETER – top-down optimization
- ENTICE – intertemporal optimization
- MIND – hybrid energy/endogenous growth
- RICE – intertemporal optimization

*Source: AR4 WG3 Technical Summary*

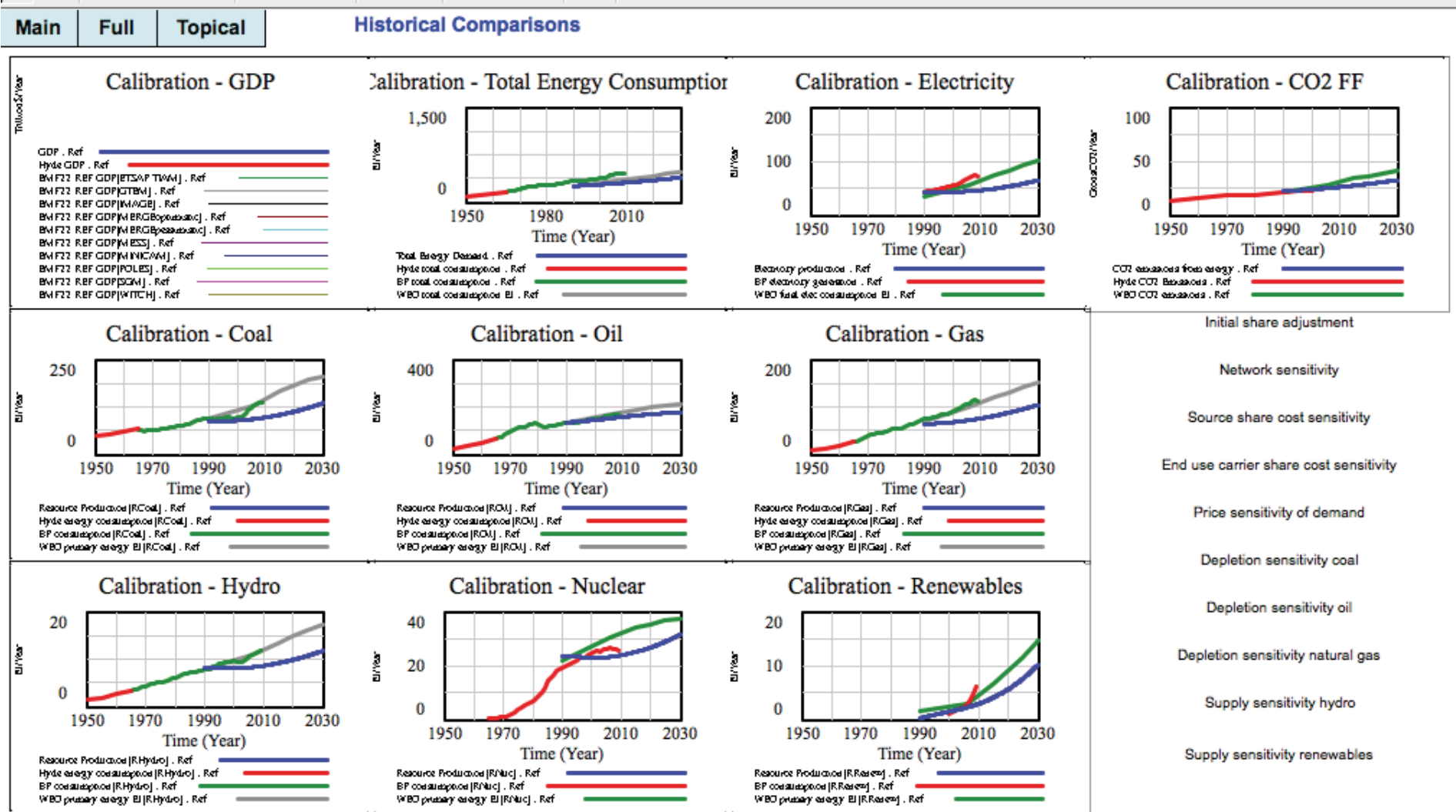
# We Compare our Future Scenarios to Those of Other Simulations

CO2 FF Comparisons to EMF and EIA



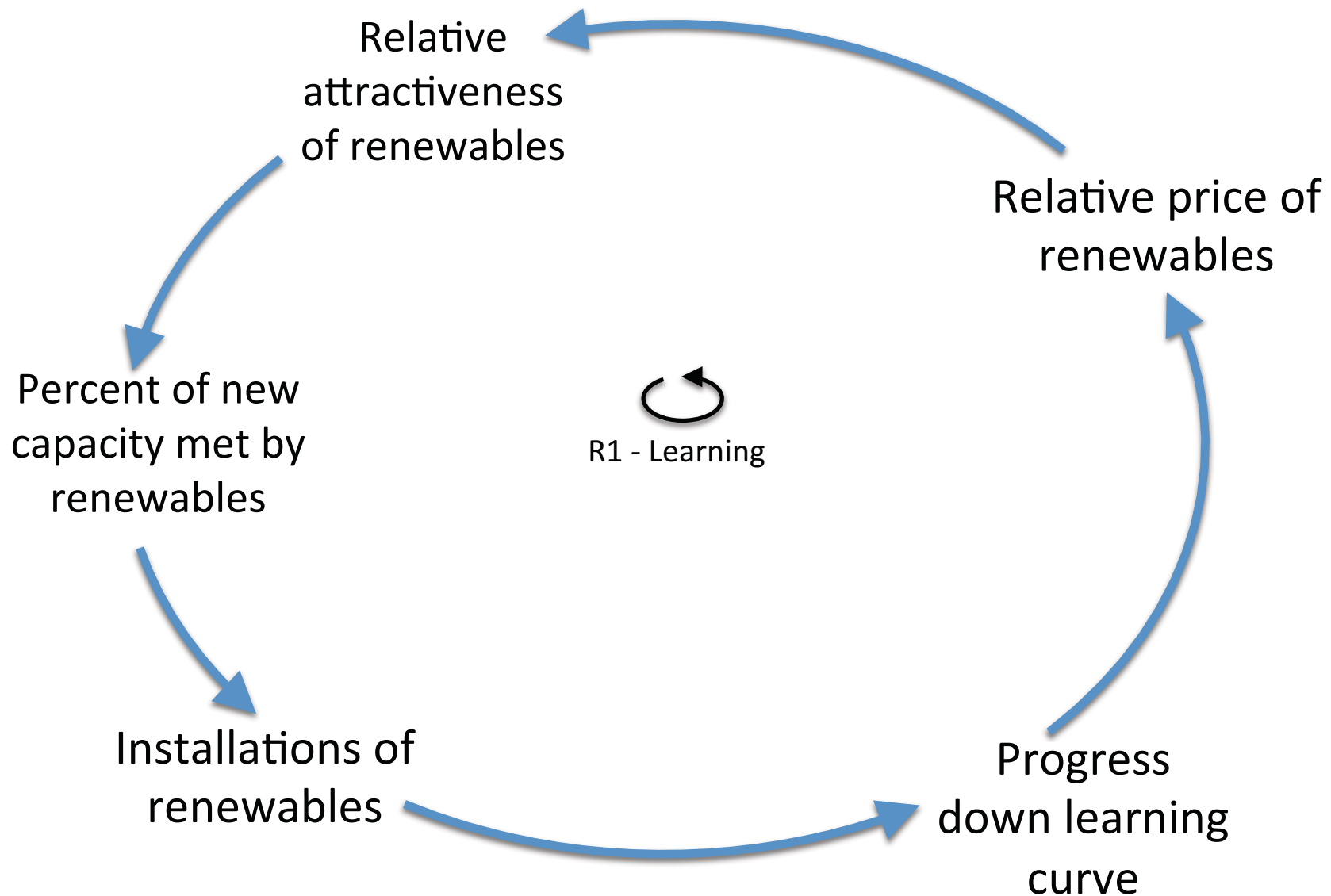
- Calibration CO2 Emissions[ETSAP TIAM] : Ref
- Calibration CO2 Emissions[GTEM] : Ref
- Calibration CO2 Emissions[IMAGE] : Ref
- Calibration CO2 Emissions[MERGEoptimistic] : Ref
- Calibration CO2 Emissions[MERGEpessimistic] : Ref
- Calibration CO2 Emissions[MESS] : Ref
- Calibration CO2 Emissions[MINICAM] : Ref
- Calibration CO2 Emissions[POLES] : Ref
- Calibration CO2 Emissions[SGM] : Ref
- Calibration CO2 Emissions[WITCH] : Ref
- EIA CO2 emissions : Ref
- En-ROADS CO2 Emissions from Energy

# We Also Compare our Simulation Output to Historical Data

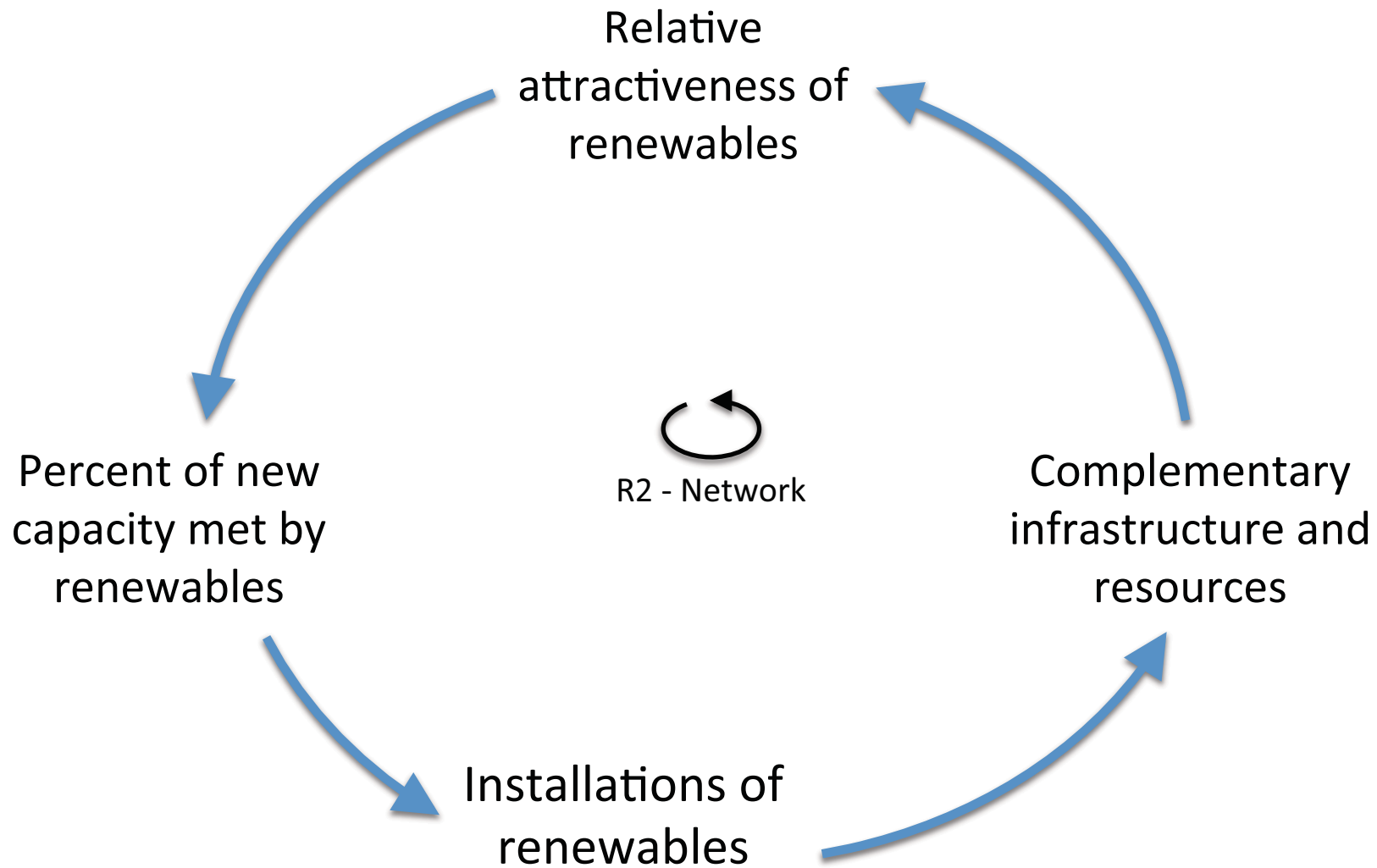


(in this case, BP analysis and WEO data)

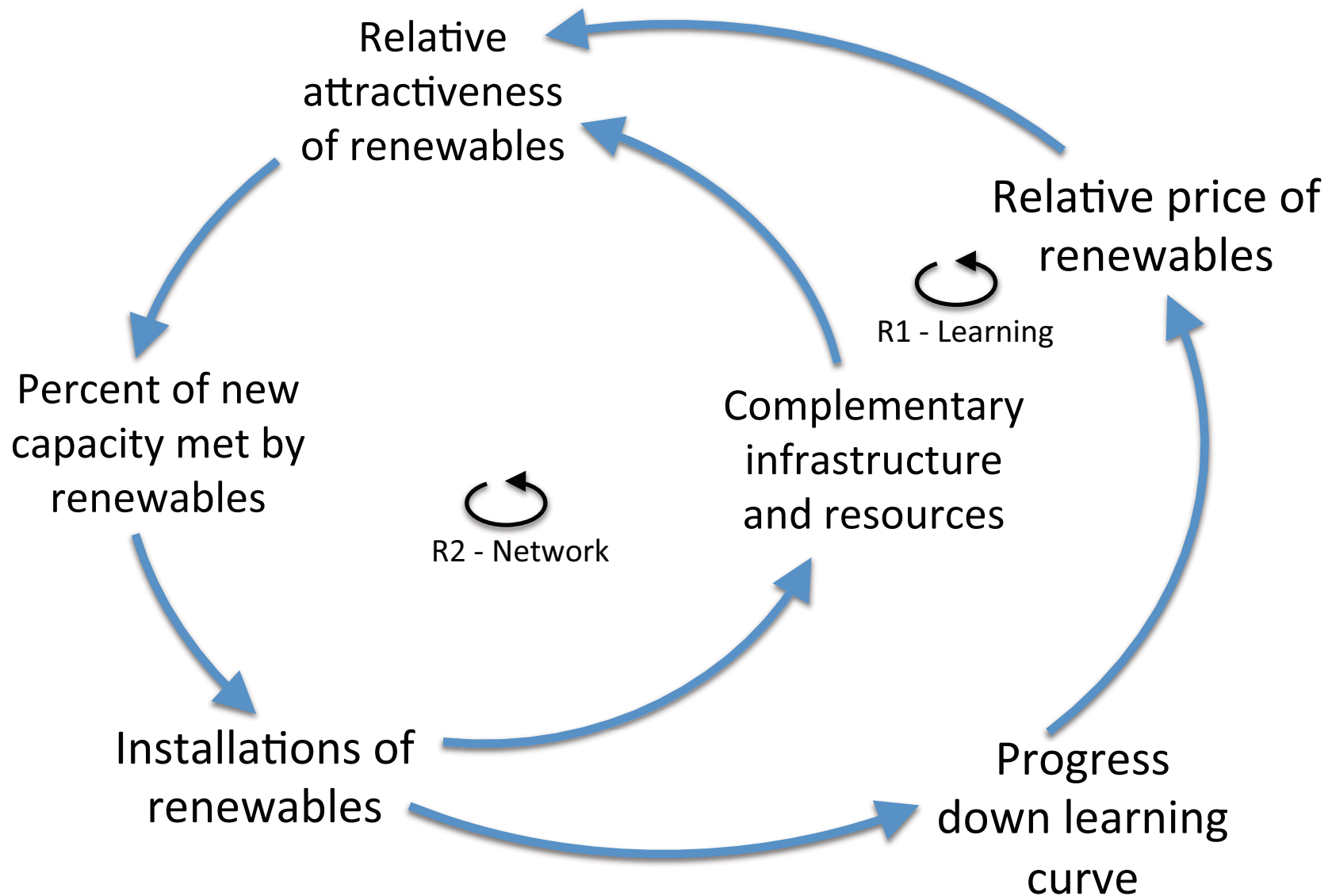
Even more troubling, the gas boom starves the reinforcing learning process for Zero – C energy



# Renewables don't get the chance to build up complementary infrastructure



# Both Reinforcing loops together



# Thank You – Q&A

**For more information:**

[www.ClimateInteractive.org](http://www.ClimateInteractive.org)

**For follow-up, please contact:**

**Travis Franck**

**On Twitter: ClimateInteract**

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