International Transport Energy Modeling (iTEM)
Third workshop

Organizing Team:
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iTEM3 day 1 — 26 October 2017

ITF-OECD, Paris, FR

Thank you to the International Transport Forum (ITF) Organisation for Economic Co-operation and Development (OECD) for hosting iTEM3!

Outline

Outline of the workshop / ground rules

The iTEM organization — review of purpose & objectives

Updates since iTEM2

- Key findings from iTEM2 model intercomparison
- Publications and outreach activities

Outline of the workshop

Workshop outline

Day 1

Session A: Transport historical data and methods for projections
Session B: New transport models
Session C: Beyond 2 degrees and NDCs
Session D: Electric vehicles and behaviour change
Session E: New trends I: Autonomous vehicles and shared mobility

Day 2

Session F: New trends II: Future declines in diesel markets — HDVs
Session G: Aviation, shipping, and regional studies
Session H: Communication, outreach, and reflections
15:30–17:00 iTEM organization meeting (modeling teams only).

Workshop logistics

Timing. Warning @ 12 min., interruption @ 15 min., hard cut-off @ 16 min.
Save questions—refer to slide numbers.

Discussion. Moderator controls the floor; tent card for their attention.
Keep focus on session topics: defer high-level issues to Session H.

Records. Chatham House Rule in effect. Minutes taken in Google Doc—please collaborate to record anything noteworthy.

Readings. Available via Dropbox link—please consult!
Speakers' permission required to redistribute any slides or reading.

iTEM organization

iTEM: International Transport Energy Modeling

A consortium of groups that:

- use models to project future transport activity,
- globally and inclusive of all modes,
- with a focus on energy use and GHG emissions (minimum), and other environmental impacts.

Groups contribute their model input assumptions and scenario results for inter-comparison and participate in interpretation.

`https://transportenergy.org`

iTEM databases

Per discussions at iTEM2, we now work collaboratively on two kinds of data:

Model data including projections from iTEM member teams' models.

Version 1: for iTEM1 workshop (2014).

Version 2: for iTEM2 workshop (2016).

Future: move to a continually-refreshed database.

Historical data of global transport & energy quantities as a foundation for common base years & comparison.

These databases are distinguished by their:

Purpose — Contents — Contributors — Users — Process

Moving to a continually–refreshed iTEM Model Database

`https://github.com/transportenergy/database`

Goals

- Expose assumptions & calculations in the iTEM intercomparison.
- Automate data exchange to lower overhead for participants.
- Enforce access control agreed by iTEM teams.

Uses: Model teams

- Maintain basic metadata: region maps, scenario descriptions.
- Format, check & upload new projections *at any time*.
- Retrieve, subset & use the full database.

Uses: iTEM org. committee

- Re-scale & -aggregate models' projections (§A).
- Prepare the full model database.
- Plot & analyze data.
- Maintain a historical database (§A).

Considerations: how should iTEM be oriented going forwards?

High-level issues to consider *throughout* today and tomorrow, with dedicated time to discuss in **Session H** and the **iTEM modeling teams' meeting**:

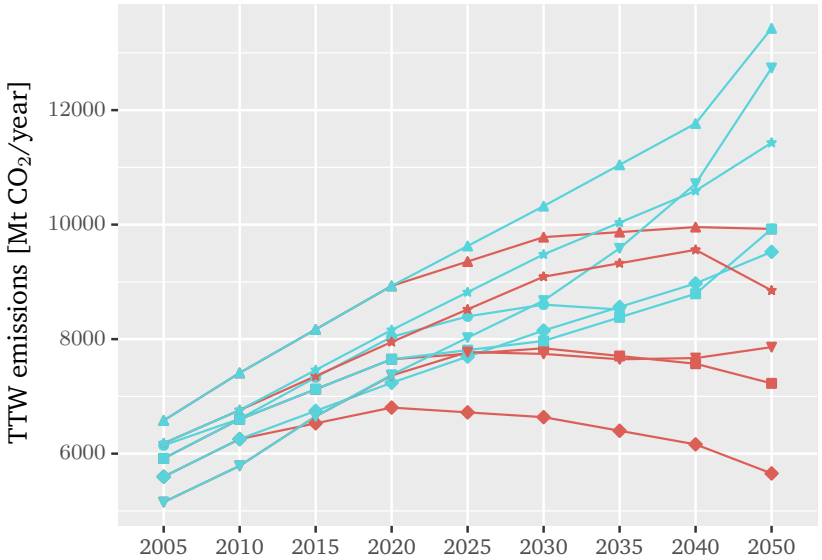
- The value of iTEM and ways to broaden impacts.
  - iTEM includes a diversity of groups with a diversity of core missions.
  - How to structure our process so that we are inclusive…
  - …bring in key non-model insights & perspectives…
  - have impact & add value to complementary activities & organizations?
- Reflections and next steps forward.
  - What additional data should we collect?
  - What questions should we ask?
  - Who should come to iTEM4; what audiences to seek for iTEM outputs?
- How should iTEM activities be supported & funded?

Updates since iTEM2

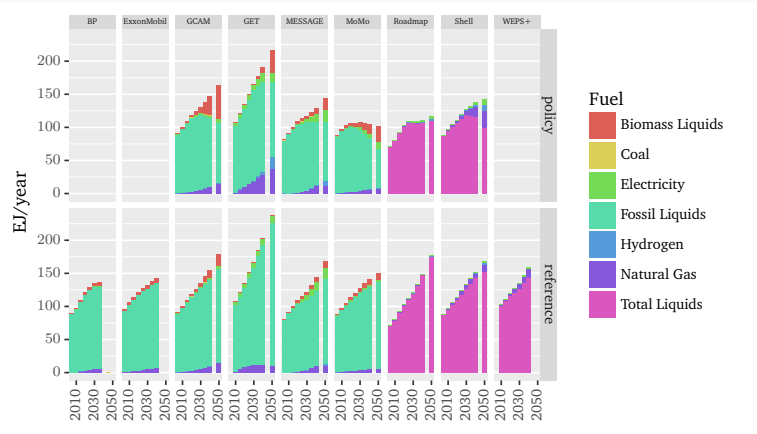
Key findings from iTEM2 model intercomparison

- iTEM2 database collected in 2016 (with new submission from ITF Oct 2017)
- Energy: largest variation across models for China, followed by U.S. and Middle East.
- Little decarbonization of fuels under business-as-usual.
- Policy scenario reductions become noticeable after 2030–2035; fossil fuels continue to dominate.
- CO_2 levels higher than those identified by IEA ETP 2017 as necessary for global 2°C stabilization.
- Aviation, shipping and truck modes grow faster than LDVs.
- Very wide variation in projections of per-capita vehicle ownership.

Global: Transport CO_2 emissions remain high even in policy (2°C) scenarios



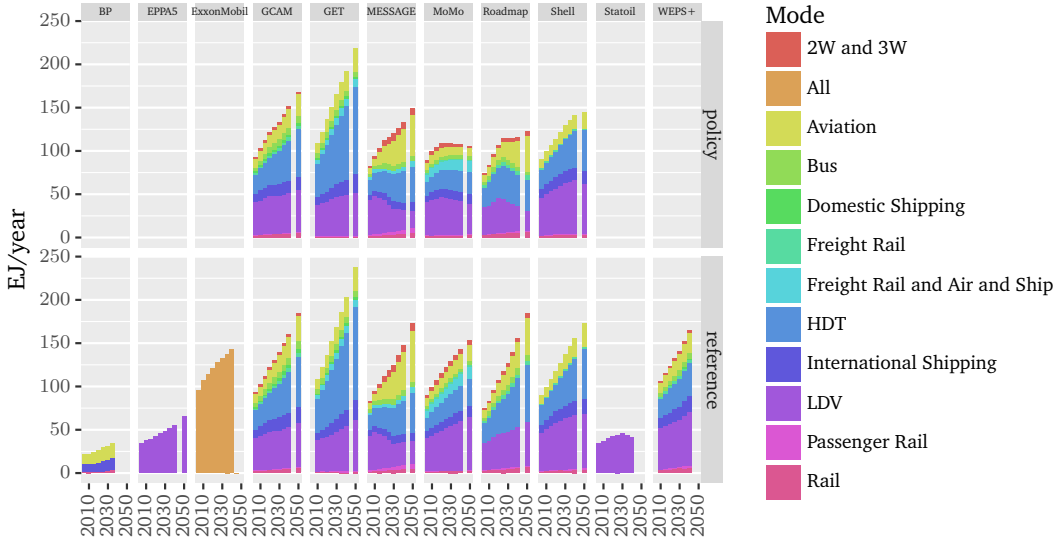
Global: Fossil liquids still the dominant fuel even in policy scenarios



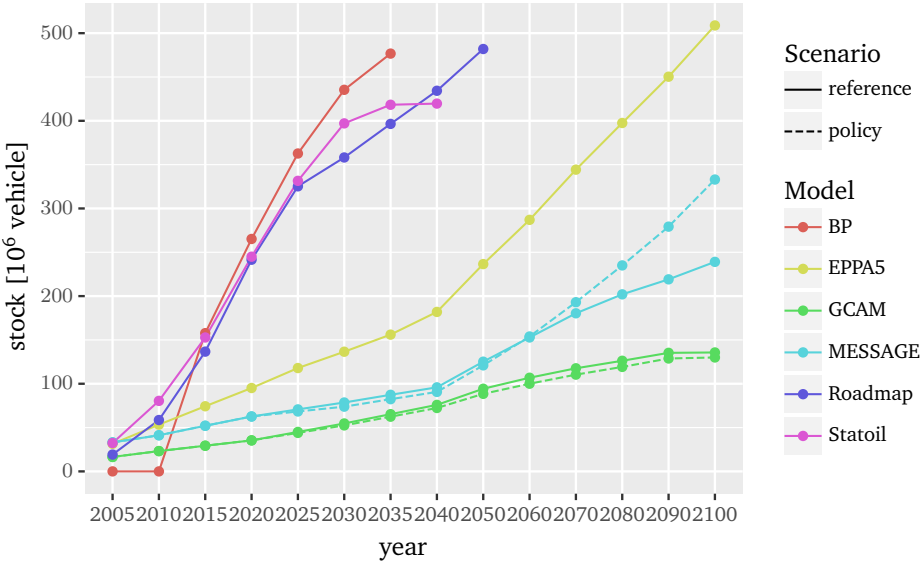
- Reference scenarios to 2035 around 130–160 EJ/yr;
- Reference scenarios to 2050 around 150–180 EJ/yr;
- Policy cases: 100–200 EJ through 2050; none get below 2010 levels of energy use.

- Three situations with policy cases:
  - Some show only small energy reductions relative to baseline (GCAM, GET, Message) but greater share of alt. fuel use
  - Liquids (including biomass liquids) still dominate in the policy scenario

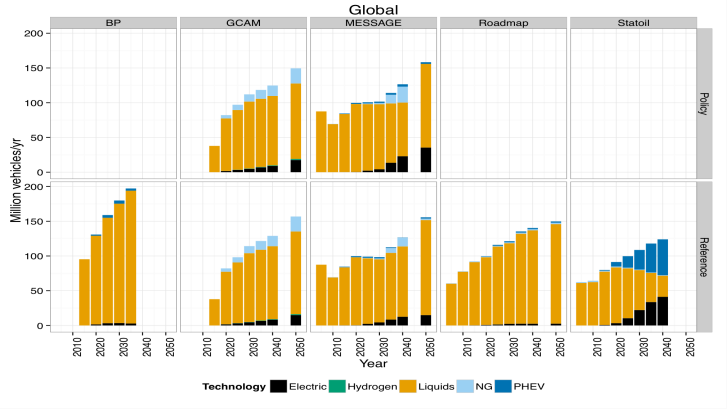
Global: Aviation and freight are the fastest growing modes



Regional: China LDV stock projections show two patterns



Global vehicles by type (2035)



M vehs	Ref	Policy
Sales - all	112–197	114–118
Sales - PHEV	1.1–41.6	2.6
Sales - EV	2.6-33.7	6.9-13.6
Stock - all	1120–2340	1140–1593
Stock - PHEV	10.8–89.6	26.4
Stock - EV	35–101	68–135

- BP has overall high LDV stock (> 2b cars by 2035).
- Statoil has high PHEV and EV estimates.

- PHEV+EV sales share: BP (3.0%), GCAM (5.3/5.9%), MESSAGE (8.5/14%), Roadmap (3.2%), Statoil (64%).

Discussion

Shared transport data: considerations, process, & options

Paul Natsuo Kishimoto <pnk@mit.edu>

iTEM3 day 1 — Session A — 26 October 2017

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Shared transport data

- iTEM2 ended with a recognition that *divergent base-year values*—either from conceptual differences or different data sources—impeded identification of methodological differences.
- A call to develop shared data as a starting point for comparison.
  - Allow iTEM modelers to re-calibrate (or have an alternate calibration) on common historical data.
  - A precursor to adopting common projection baselines or assumptions; or common policy scenarios (as in modeling consortia from other disciplines).
- Pierpaolo Cazzola & David McCollum led a data subgroup over Winter 2017:
  - Convened several substantive calls on data collection & sharing issues.
  - Surveyed iTEM participants and birds-of-a-feather on data 'haves' and 'wants'.

This is a summary of those issues raised. Please consider throughout for discussion in **Session H** and **iTEM modeling teams' meeting**.

General considerations

1. Concepts & measures differ by model… and consequently so do data of interest. Example: EPPA separation of household from non-HH LDV stock, fuel use.
2. Data provenance is complex. Primary collection → treatment by national statistical agencies and/or private firms → harmonization into larger databases → modelers' input calculations → (iTEM) models. (Process sometimes chains; errors are introduced & 'fixed' along the chain.)
3. Cost are non-negligible. Some data only available by subscription/special arrangement; limits on republishing; labour costs in cleaning, checking, adjustment. Costs repeat roughly annually.
4. Data have multiple uses. Data that would be used by iTEM & teams for intercomparison also has business value to non-participants → shared public goods; concerns about free-riding.

Features & principles for a process that produces shared data

1. Assumptions & calculations should be made clear & explicit, even where the source/output data cannot be made public.
   - Where public, anyone can substitute alternate assumptions/calculations and check sensitivity to these.
   - Where private, participants with access can perform sensitivity checks and share the results only.
2. All iTEM modeling teams should be able to easily produce data suitable for input to their particular models.
   - A prerequisite for any shared-baseline exercise.
3. Maintenance should be sustainable: participants should have incentives to devote resources to keeping the database current & error-free. Users should have incentive to contribute or support.
4. Any others?

(at least) Three models

IGO-led. e.g. IEA MoMo partnership offers discounted membership to iTEM participants, in return for in-kind contributions (data quality feedback).

Private. e.g. A. Schäfer venture described in this Session A.
Other data sets from private firms.

Open/iTEM. Proposal to assemble the best-possible data set from a combination/pool of public/open sources. Seed from a GCAM-Transport collection by G.S. Mishra; open source code in `transportenergy/database`.

Where are these complementary, and where do they compete?
How to bridge them in a manner inclusive of iTEM teams?

Thanks!

The values of iTEM and ways to broaden impacts

Open discussion

iTEM3 day 2 — Session H — 27 October 2017

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Values of iTEM & broadening impacts — framing questions

- What is the *shared* vision, mission and values of iTEM?
- How to structure our activities so that we...
  - are inclusive of all teams that meet our basic parameters?
  - bring in key non-model insights & perspectives?
  - have impact, or add value to broader or complementary activities & organizations?

Activities - Academic

- Comparison of projections, as collected in a shared database,
- Discussion of methodological approaches of existing models,
- Analysis of the fundamental drivers, new technologies, and projected impacts of proposed and existing policies, and
- Exploration of novel methods in the transport energy area.

Activities - Relevance to policies and decisionmaking

- Impartial analysis and benchmarking of strategies
- Compare modeling results with planned policy targets to gain insights
  - possible policy gaps
  - feasibility of modeling results
- Insights to policymakers and decisionmakers about future trends of development in the baseline and policy scenarios
  - For future policy development
  - For strategic planning and investment decisions
- Shed lights on major sources of uncertainties and how they affects the outcome of the projections

Discussion

Reflection & next steps forward

Open discussion

iTEM3 day 2 — Session H — 27 October 2017

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Reflections & next steps forward — internal to iTEM

- What additional data should we collect?
- What research questions should we ask?
- Who should come to iTEM4?
- What audiences to seek for iTEM outputs?
- How should iTEM activities be supported & funded?

Groups and models participating in iTEM2

BP	BP plc.	“Energy Outlook” model
GCAM	PNNL, U.S. DoE	Global Change Assessment Model
MESSAGE	IIASA	Model for Energy Supply Strategy Alternatives and their General Environmental impact
MoMo	IEA	Mobility Model
Roadmap	ICCT	Roadmap
EPPA	JPSPGC, MIT	Economic Projection & Policy Analysis
Exxon	ExxonMobil Corp.	“Outlook for Energy” model
GET	Chalmers University	Global Energy Transition model
Shell	Royal Dutch Shell plc	“Scenarios” model
Statoil	Statoil ASA	“Energy Perspectives” model
ITF	ITF	multiple models
WEPS+	EIA, U.S. DoE	World Energy Projection System Plus

Updates since iTEM2

- Peer-reviewed papers:

  iTEM1 S. Yeh, G. S. Mishra, L. Fulton, P. Kyle, D. L. McCollum, J. Miller, P. Cazzola, and J. Teter. “Detailed assessment of global transport-energy models’ structures and projections”. In: *Transportation Research Part D. Transport and Environment* (2016). ISSN: 1361-9209. DOI: 10.1016/j.trd.2016.11.001

  iTEM2 Draft in progress.
- Conference presentations:
  - COP22 Transport Day, Marrakech, November 2016.
  - International Association for Energy Economics (IAEE) European Conference in Vienna, September 2017.
- Communications: `transportenergy.org`, `transportenergy` Github org, mailing list, Slack team.

iTEM2 model types and system boundaries

	Transport only	Energy-economics	Climate-energy-land use
CGE-hybrid		MIT–EPPA	
Optimization			Chalmers–GET IIASA–MESSAGE
Simulation		EIA–WEPS+	PNNL–GCAM
Accounting/Stock-turnover model	▪ Statoil ▪ ICCT–Roadmap ▪ BP ▪ Shell ▪ ExxonMobil ▪ ITF-LDV ▪ IEA–MoMo		

iTEM2 model database

Model	Scenario	Transportation Sector Coverage	Regional coverage	Variable coverage	Final year
BP	Ref only				2035
EPPA5	Ref only	LDV only			2100
ExxonMobil	Ref only	Whole sector only		Energy only	2040
GCAM					2100
GET			Global only	Energy only	2100
ITF		Passenger modes only	Urban*		2050
MESSAGE					2100
MoMo					2050
Roadmap					2050
Shell	Ref only				2060
Statoil	Ref only	LDV only			2040
WEPS+	Ref only				2040

iTEM2 model variables

Variable	BP	EPPA5	ExxonMobil	GCAM	GET	ITF	MESSAGE	MoMo	Roadmap	Shell	Statoil	WEPS+
CO2 Concentration				2	7		2					
CO2 Emissions (all sectors)		17	17	34	7		34			2		
GHG Emissions (all sectors)		17		34			34					
PPP-GDP	17	17	17	34	119		34	28	34	34		17
Population	17	17		34	119		34	28	34	34		17
ef_bc				672					136			
ef_co2	17	34		2070		2109	2006		1190	4		
ef_co2_fuel	17	34		3414		198	3662	3864	1598	24		
ef_co2_service	33			2342		254	2278	2600	1836	4		
energy	977	51	19	4296	1001		4614	4786	4114	188	320	703
intensity	170	51		2688		339	2584		3264	102	320	85
intensity_new		17		318			340				48	
intensity_service	133			2876		309	2856	3172	4658	68		184
load_factor	149			3748		426	3672		3808	34		102
pkm	185			2422			2992	2620	3332			117
sales	714			1158			1530		1190		176	
stock	714	34		1158			1530		1190		176	
tkm	128			1326			680	1352	1326	68		67
ttw_bc				2016					544			
ttw_ch4				472					544			
ttw_co2	17	34		3414			3662	4964	1598	24		
ttw_co2e	17	34		3414			3662	4964	1598	24		
vkt	238	51		3492			3332		3264	102	352	85
wtt_co2e				3414				4964				
wtw_co2e				3414				4964				

Additional variables? → **Session H** and **iTEM modeling teams' meeting**.

FORMAS proposal

- The Swedish Research Council for Sustainable Development
- Aim: Knowledge about and for climate efforts in society.
- Shaping and Communicating Climate Mitigation Opinions and Policy Choices using Model Projections: A Case Study of the iTEM Consortium
- 9 million Swedish SEK (0.9 million Euros) for 3 years