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Energy Epidemiology: A New Best Practice Building Energy Model Report Guideline

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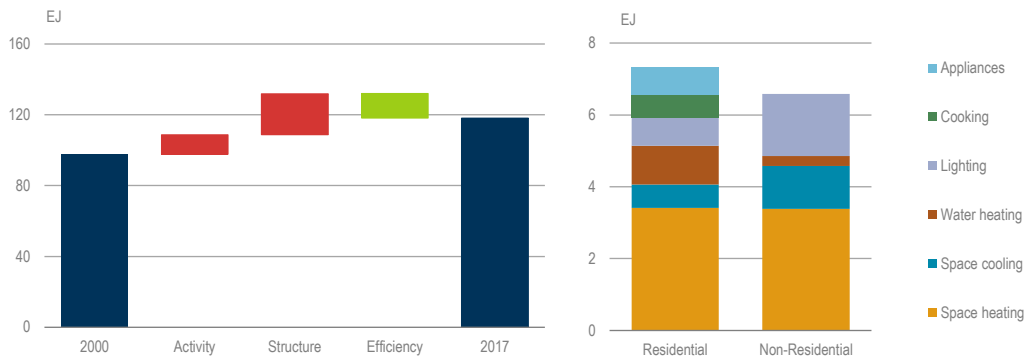
ExCo Technical Day, Belgium
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Shifting to a zero-carbon, efficient and resilient building stock

Buildings sector energy use continues to rise

Decomposition of buildings global final energy use, 2000-17 (left) and end-use contribution to efficiency savings (right)

Sources: Adapted from IEA (2018a), *Energy Efficiency Indicators 2018* (database) and IEA Energy Technology Perspectives Buildings model (www.iea.org/etp/etpmodel/buildings/).

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Growth in building sector energy use is linked to increasing floor space and appliance ownership. Space heating is driving savings across both all building types.

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Why change our current research and practice?

Many countries have plans to **significantly reduce energy use** or **improve energy intensity** from the building stock.

Much of this reduction needs to come through more **energy efficient built environments**, which are responsible for almost 40% of global emissions.

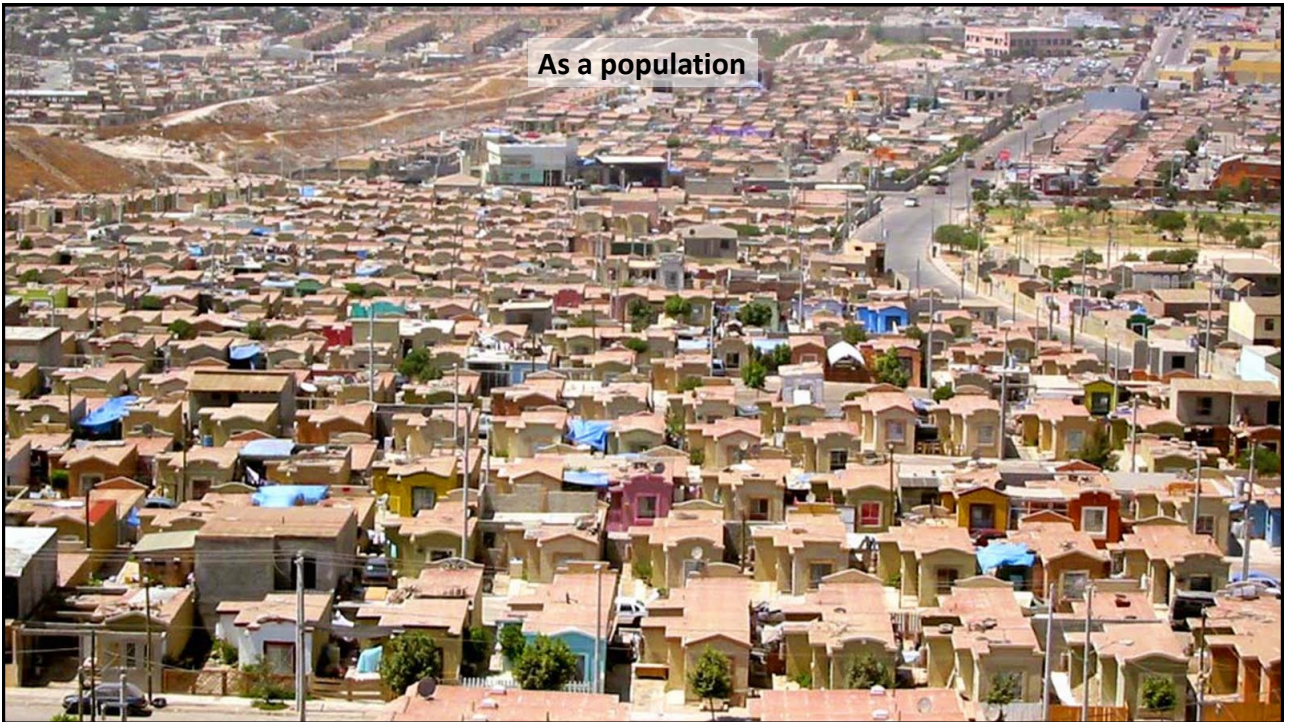Globally energy efficiency refurbishment is estimated to result in the **investments of trillions of dollars**.

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Studying the building... as a group

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As a population

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What is 'Epidemiology' and why is it relevant to energy use in buildings?

Epidemiology…

Is **data driven**, emphasis is on empirical evidence, distribution of a condition, understanding of underlying / driving factors

Focuses on understanding what is affecting the **spread and severity** of a condition

Uses research findings to inform **past/future practices and policy**

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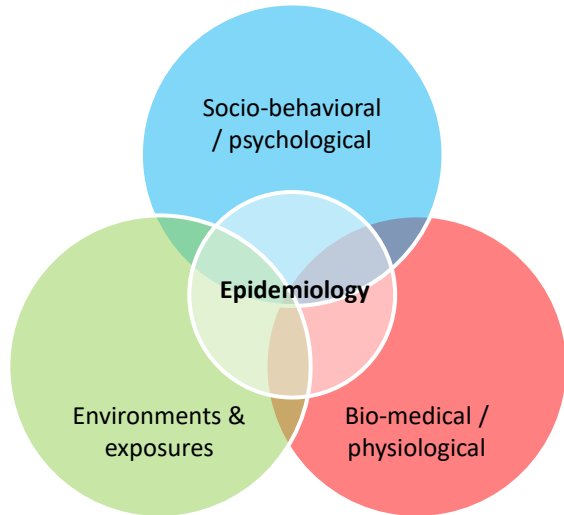
What is energy epidemiology?

epidemiology "epi" - upon; "demos" - the people; "ology" - logic, study. The study of what is upon the people – normally applied to the study of health.

energy epidemiology
The systematic study of the distributions and patterns of energy use and their causes or in luences in populations.

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How would the research landscape change, if excessive energy demand were treated like a health risk?

Framework for **interdisciplinary** research

Large-scale **population studies** on the distributions of *prevalence and incidence,* and identifying and understanding the factors affecting theses distributions, using **empirical data**!
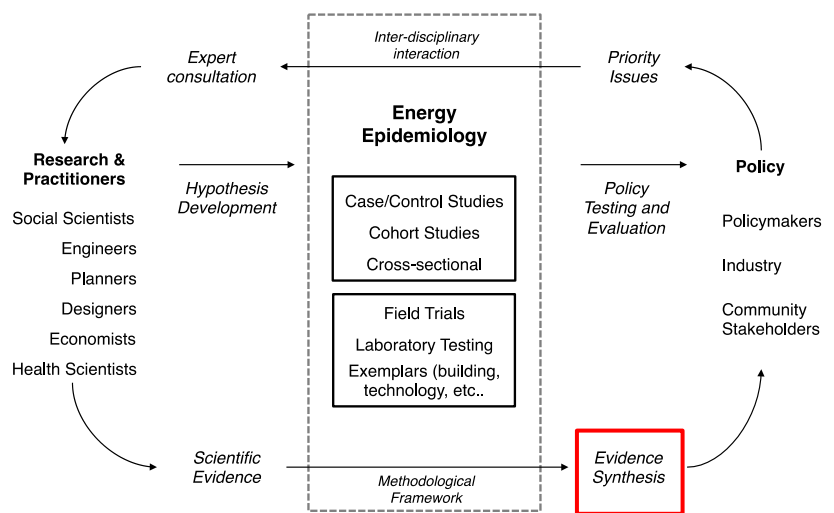
Have established data collection **protocols**, analysis, and archiving as a shared resource, and place detailed studies in context.

Protocols for **feedback of findings** (e.g. failure rates, adverse outcomes, unintended consequences) and **systematic reviews** of evidence

Emphasis on **research translation and engagement** with policymakers and industry as part on an on-going progressive research programme.

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Central paradigm of energy epidemiology is:

That the **shift to a low-carbon society** along with the alleviation of energy-related social and environmental phenomena, such as fuel poverty and climate change, can be **improved through population-based methods** that analyse patterns and systems of energy demand services in order to better understand the practices, drivers, causes and differences of energy demand outcomes.

Inter-disciplinary interaction

Expert consultation

Energy Epidemiology

Priority Issues

Research & Practitioners

Social Scientists
Engineers
Planners
Designers
Economists
Health Scientists

Hypothesis Development

Case/Control Studies
Cohort Studies
Cross-sectional

Field Trials
Laboratory Testing
Exemplars (building, technology, etc..

Policy Testing and Evaluation

Policy

Policymakers

Industry

Community Stakeholders

Scientific Evidence

Methodological Framework

Evidence Synthesis

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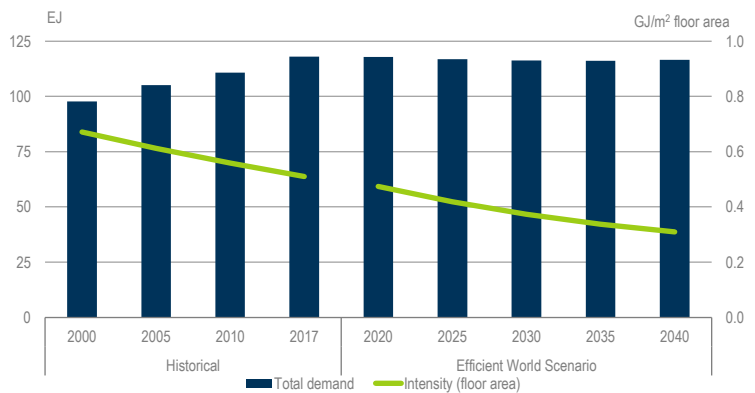
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Model reporting guidelines

Buildings energy efficiency has been improving

Key policy actions

- Comprehensive efficiency policies, targeting both new and existing building stock and appliances.

- Incentives to encourage consumers to adopt high efficiency appliances and undertake deep energy retrofits.

- Improved quality and availability of energy performance information and tools.

Buildings energy use and energy intensity, 2000-40

EJ — GJ/m² floor area

Historical — Efficient World Scenario

■ Total demand ── Intensity (floor area)

Buildings energy use has been rising, but could stay flat to 2040, despite 60% more floor space.
Buildings energy intensity has been improving at 1.6% per year, but this could be 2.2% per year.

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How can we better understand building stock models?

Building stock energy models (BSMs) offer a tool to assess the energy demand and environmental impact of building stocks, and can demonstrate and evaluate pathways for reducing their energy demand and respective GHG emissions.

The problem:
The heterogeneity of BSMs, together with a lack of consistency in the description and reporting of the models often hinders the understanding of the model, impeding an accurate interpretation 15 and/or comparison of the results.

The proposal:
Annex 70 have developed reporting guideline in order to improve reporting practices in the field of building stock energy modelling.

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How can we better understand building stock models?

The aim of the reporting guideline is to **structure the information** for a given BSM in a consistent manner

The **reporting guidelines** will enable modellers to consistently structure the information about their models and **help reviewers and other interested parties find relevant information** about a model and thereby facilitate interpretation of model results.

The guidelines can be used to generate stand-alone reports describing a model (e.g., to be used as supplementary information to a publication using a model or as internal model documentation) or as a guidance on how to structure the information about a model in the main manuscript of a publication.

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Building Stock Model reporting guidelines

Topic	Subtopic	Guiding questions
Overview	Aim and scope	What is the overall aim and scope of the model? What are the main use cases addressed?
	Modelling approach	What is the general modelling approach and how is it structured? What are the main model parts and components included in the model and how do they relate to each other? What are the key steps in the modelling workflow?
	System boundary	What are the system boundaries (temporal, geographical, building types, energy services, economic sectors, etc.) of the model?
	Spatio-temporal resolution	What is the spatio-temporal resolution of the model?

Model topics

Detailed descriptions of the model

Key model features

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How can we better understand building stock models?

Topic	Subtopic	Topic	Subtopic
Overview	Aim and scope	Quality assurance	Calibration
	Modelling ap- proach		Validation
	System boundary		Limitations
	Spatio-temporal resolution		Uncertainty
Model Components	Building stock		Sensitivity
	People Environment	Additional information	
	Energy		Implementation Access
	Costs Dynamics		Funding and contributors
	Other aspects		Areas of application
Input and outputs	Data sources		Key references
	Data processing		
	Key assumptions		

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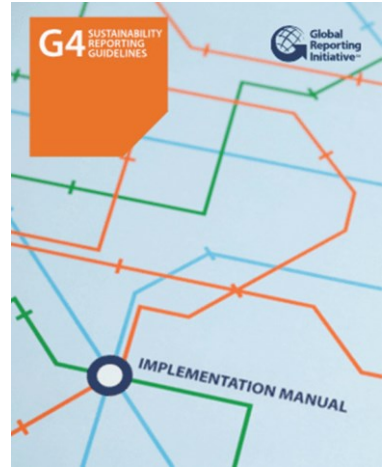Energy

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How to use the model reporting guidelines?

Used as a tool by authors, reviewers, and journal editors, in order to promote best practices in reporting building stock models and their results.

The application of the guidelines can improve the transparency and understanding of BSMs and their results and their reliability are better understood.

Guidelines offers benefits to modellers in terms of providing a clear framework for how they describe and report their models and easier to write and read model documentation through a consistent form.

Using the guideline as a checklist will ensure that important information is not omitted in the reporting.

Standardised format for model documentation will make reporting modelling results in future publications more straightforward.

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THANK YOU

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Annex 70 – Building Energy Epidemiology

Welcome to the website for the International Energy Agency (IEA) for Energy in Buildings and Communities (EBC) *Annex 70 – Building Energy Epidemiology: Analysis of real building energy use at scale.*

Annex 70 was approved to enter into the Operation phase by the Executive Committee in November 2017.

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