Appendix 2 contents:

Introduction to Policy and Programme Evaluation

Introduction

- **Background**
- **What is evaluation**
- **How to conduct evaluation**
- **Resources**

About me

- 25 years evaluation experience
- Energy, waste, R&D
- UK, Australia, China, SE Asia
- IEPPEC planning committee and board
- Chairman of Databuild Research and Solutions

IEPPEC

- International Energy Policy and Programme Evaluation Conference
- Peer-reviewed papers
- 200 evaluation professionals
- Every two years in Europe
- Sister conference in North America
- Planning conference in Asia

Databuild

- Research and evaluation consultancy
- Established in 1985
- Birmingham, UK and Sydney, Australia
- 25 staff
- Specialising in energy, waste, enterprise, innovation and planning

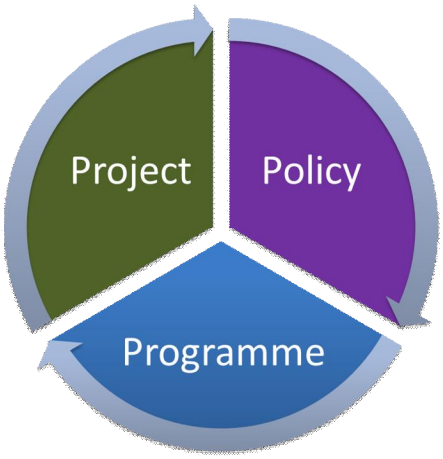
"I recognize that climate change is a complex subject with multiple causes, but this really isn't helping."

What?

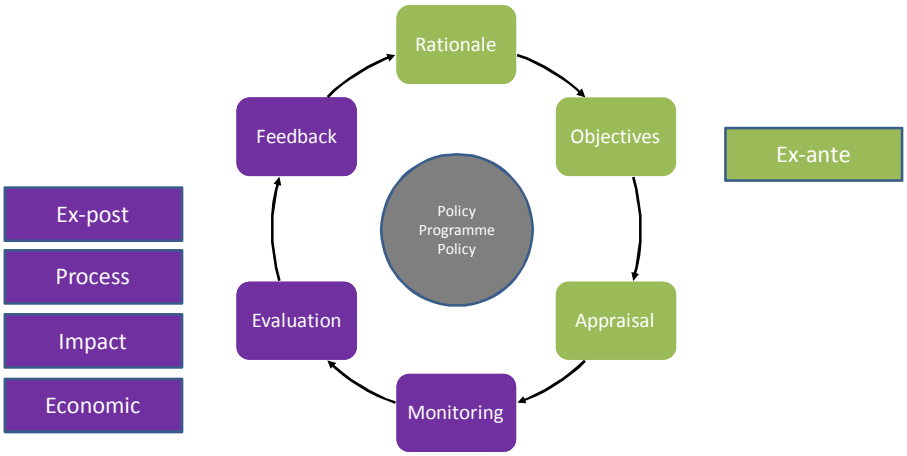
Evaluation is an objective process of understanding how a policy or programme was implemented, what effects it had, for whom and why

Leads to more effective policies and programmes

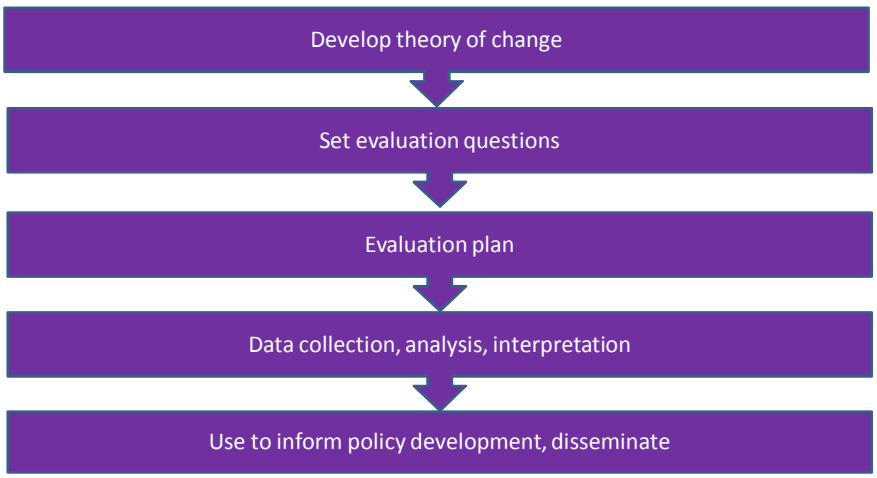
What?



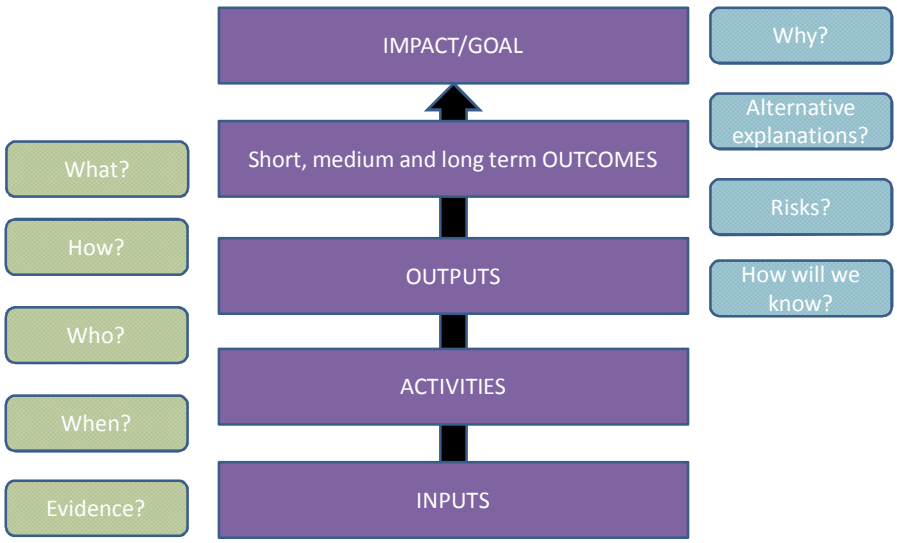
When?



Conducting evaluation



Theory of change



Typical evaluation questions

- **What** has happened to energy consumption?
- **What** difference did the policy/programme make?
- **How** well was the policy/programme implemented?
- **How** can we do things better/what can we learn?
- **Was** the policy/programme good value for money?

Developing evaluation plan

How will we answer the evaluation questions?

- What do we already know?
- What else do we need to find out?
- Where will the information come from?
- How will we analyse it?

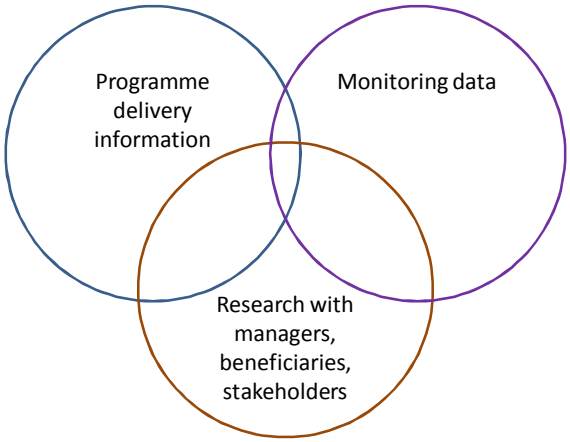
- Think about audience and dissemination
- Consult widely
- Document clearly

Evaluation

- Process, how did it go?
- Impact, what difference did it make?
- Economic, was it value for money?

Evaluation

Process evaluation



Impact evaluation

Did the programme make a difference?

Experiment e.g. randomised control trial	**Statistics** **e.g. comparing data about groups**
Case Studies **In depth understanding**	**Theory based** **e.g. contribution analysis**

Impact evaluation

Method	Strengths	Weaknesses
Experiment	Proof programme caused impact	Difficult in practice May not provide an answer Doesn't tell you: Å Why/how impact Å More? Å Work elsewhere
Statistical	Strong evidence	Data only available in some circumstances Needs a large sample Doesn't tell you: Å Why/how impact Å More? Å Work elsewhere
Case based	Rich understanding of outcomes Why and how outcomes are achieved	Hard to generalise Doesn't prove causality Seen as less rigorous
Theory based	Rigorous approach Considers alternative explanations Rich understanding of outcomes Why and how outcomes are achieved	Doesn't prove causality Seen as less rigorous

Economic evaluation

- **Cost benefit analysis**
  - Three levels – government, participant, society
  - Consider all additional costs and all additional benefits
  - Consider lifetime costs and benefits
- **Consider multiple benefits of energy efficiency**
  - Energy security/peak demand
  - Economic; jobs and growth
  - Health and wellbeing
  - Productivity
  - Air quality

Summary

- Evaluation leads to more effective policies and programmes
- Should be embedded in policy/programme design process
- Include process, impact and economic evaluation
- Structure around theory of change
- Use transparent process, engage stakeholders, integrate learnings
- Use IEPPEC resources

Thank you

Charles Michaelis

Databuild Research and Solutions

charles.michaelis@data-build.co.uk

+447813 799580

DATABUILD
Research & Solutions

www.data-build.co.uk
research@data-build.co.uk
21 Graham Street, Birmingham, UK, B1 3JR
0121-237-1144

Impact and Process Evaluation

Edward Vine
Lawrence Berkeley National Laboratory

APERC Evaluation Workshop

Taichung City, Chinese Taipei

April 12, 2016

About me

- 36 years evaluation experience
- Energy programs & R&D
- Primarily US, focus now is Asia
- IEPEC planning committee and board
- IEPPEC planning committee and board
- Rehired Retiree at LBNL

APERC Evaluation Workshop

Introduction

Program evaluation has been conducted for many years - it uses

- professional methods, protocols, and guidelines
- to quantify the impacts from energy efficiency programs,
- to improve program effectiveness, and
- to help resource planning.

APERC Evaluation Workshop

Program Research & Evaluation

Research Category	Program Phase Conducted	Research Type	Assessment Level
Formative	**Planning** (a priori)	Market assessment (includes market characterization and baseline studies)	Market or Program
		Potential or feasibility studies	Market or Program
	Implementation (post-hoc)	**Process evaluation**	**Program**
Summative	**Implementation** (post-hoc) or **Post-implementation** (ex-post)	**Impact evaluation**	**Program**
		Market effects	Program and Market
		Cost-effectiveness	Program or Portfolio

APERC Evaluation Workshop

Audience for Results

Who are the key stakeholders?

- Program implementers
- Funders
- Regulators
- Planners
- Elected and appointed officials
- Special-interest groups

APEC Expert Group on Energy Efficiency and Conservation (EGEE&C)
Under the APEC Energy Working Group

APERC Evaluation Workshop

Program Evaluation – Why we do it

- To Reduce Uncertainty
  - Provide the information necessary to make good decisions regarding investments in programs
- To Assess Impacts
  - Estimate the change in energy usage and other targets due to programs
- To Improve Program Design
  - Prioritize program & portfolio budgets, inform resource planning
- To Finalize Utility Incentive Payments (rarely)

APEC Expert Group on Energy Efficiency and Conservation (EGEE&C)
Under the APEC Energy Working Group

APERC Evaluation Workshop

What is Impact Evaluation?

- Purpose/Objective
  - Estimate the change due to programs
    - Change in energy use, greenhouse gas (GHG) emissions, the market share for efficient products, other benefits, etc.
- Methods
  - Data collection (measurement and verification ï M&V)
  - Engineering algorithms (deemed/stipulated savings), statistical/econometric analysis
  - Surveys, modeling, statistical analysis
- Key Outcomes
  - **Gross** energy and demand savings
  - **Net (attributable)** energy and demand savings
    - reflecting free riders & spillover

IEPPEC

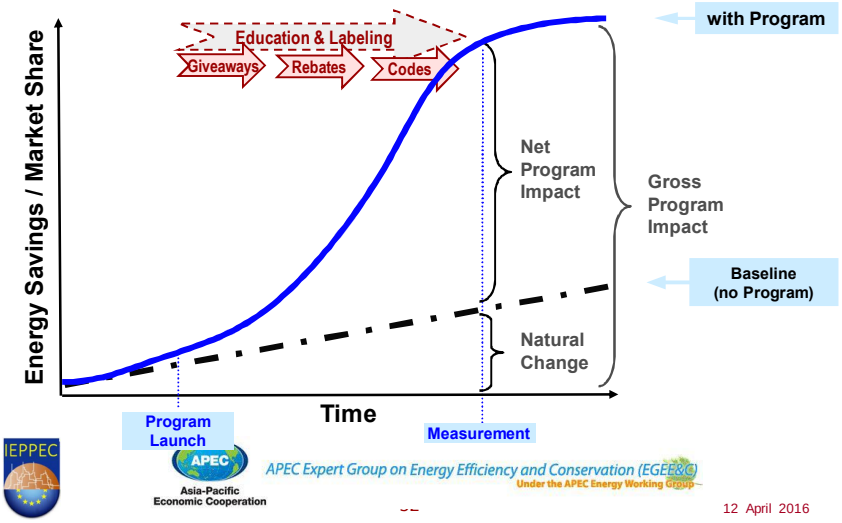
Asia-Pacific Economic Cooperation

APEC Expert Group on Energy Efficiency and Conservation (EGEE&C) Under the APEC Energy Working Group

12 April 2016

APERC Evaluation Workshop

What is Impact Evaluation?



IEPPEC

Asia-Pacific Economic Cooperation

APEC Expert Group on Energy Efficiency and Conservation (EGEE&C) Under the APEC Energy Working Group

12 April 2016

Which Impacts?

- Energy
  - Electricity: use (kWh) and demand (kW)
  - Natural gas
- Time period
  - Annually, seasonally, weekly, daily, hourly
- Increasing interest in multiple benefits
  - Employment, indoor and outdoor air quality, health, climate change, etc.

What is Process Evaluation?

- Process (formative) evaluation focuses on **how** a program is **implemented** and **operating**
  - Identifies **procedures** and program **logic**
  - Describes how it **operates**, the **services** delivered and the **functions** (roles and responsibilities)
  - **Assesses** reasons for success or problems
- Results in **recommendations** to improve program effectiveness and efficiency
  - Energy and GHG impacts, risk reduction and other multiple benefits, and cost-effectiveness

APERC Evaluation Workshop

Process and Impact Evaluation

- Distinction is often blurred
  - Impact evaluations typically focus on quantifying the energy and demand savings (resource characterization)
    - In aggregate
    - Customer by customer
    - End-use specific
  - Process evaluations typically focus on explaining why the program succeeds or fails to deliver savings (resource optimization)
    - Barriers to participation
    - Unanticipated behavioral response
    - Program operations

APEC Expert Group on Energy Efficiency and Conservation (EGEE&C)
Under the APEC Energy Working Group

APERC Evaluation Workshop

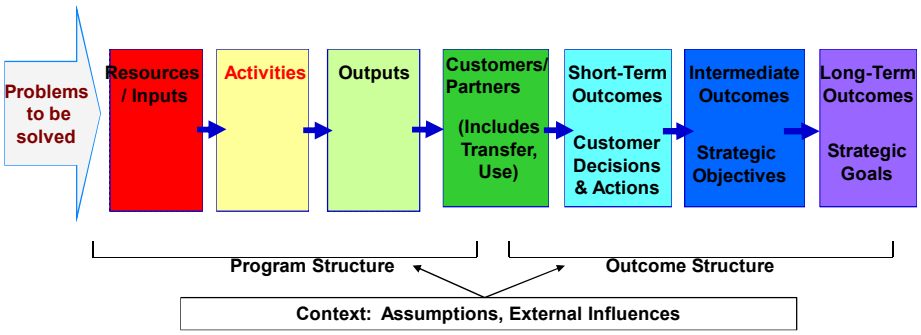
Value of Evaluation

- Evaluations provide a systematic way to learn from program experiences, both within a particular program over time and across programs being fielded simultaneously or contemplated for the future
- Evaluations provide assurance to interested parties that programs are being implemented effectively and modified or refined as necessary

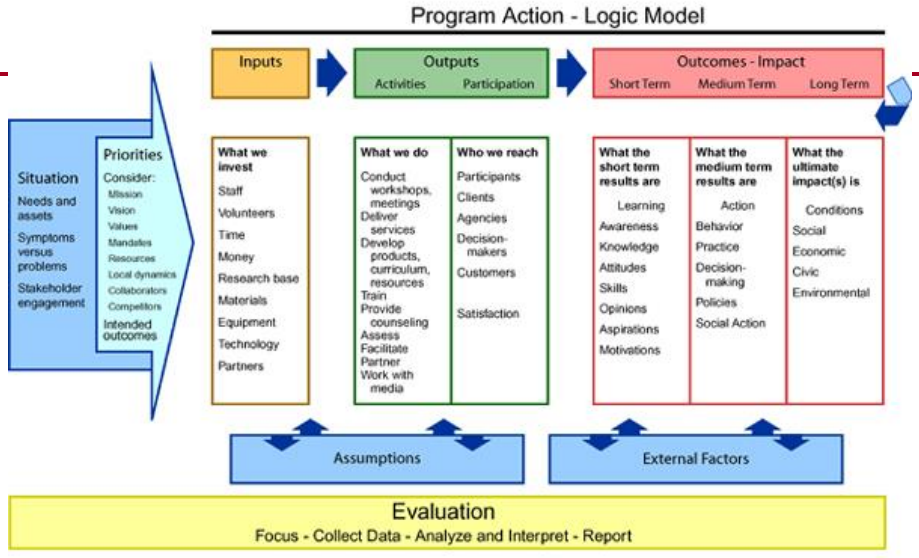
APEC Expert Group on Energy Efficiency and Conservation (EGEE&C)
Under the APEC Energy Working Group

APERC Evaluation Workshop

Program Logic Model



APERC Evaluation Workshop



APERC Evaluation Workshop

What Have We Learned from Evaluation?

- Evaluations show that well-established types of energy efficiency programs can save significant amounts of energy
- Good design and implementation plans matter because they influence the level of savings achieved
- Regulation and incentives programs work in different contexts, implying that a range of different energy efficiency policy instruments is needed
- Some newer types of policy instruments need to be thoroughly evaluated (e.g., behavior change and new financing mechanisms)

APEC Expert Group on Energy Efficiency and Conservation (EGEE&C)
Under the APEC Energy Working Group

12 April 2016

APERC Evaluation Workshop

Recommendations for Policymakers

- Continue to support energy efficiency policies and programs ï they work and are cost-effective!
- Support new approaches but they need to be piloted and evaluated
- Learn from program experience and evaluation in other countries and jurisdictions
- Encourage experimental design ï learn from successes and failures
- Support evaluation ï the benefits outweigh the costs!

APEC Expert Group on Energy Efficiency and Conservation (EGEE&C)
Under the APEC Energy Working Group

12 April 2016

APERC Evaluation Workshop

2016 IEPPEC

More details on: **http://www.ieppec.org/**

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

Governments Working Together to Save Energy.

Evaluating Recent Energy Efficient Achievements in SEAD member economies

APERC Energy Efficiency Policy Workshop, Taichung ï April 12 2016

Hans Alarcon, Coordinator, SEAD

Prepared by Lawrence Berkeley National Laboratory (LBNL)

www.superefficient.org

CLEAN ENERGY MINISTERIAL
Accelerating Transition to Clean Energy Technologies

ipeec International Partnership for Energy Efficiency Cooperation

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

Outline

Introduction to SEAD

BUENAS Tool Overview

Methodology of Recent Achievements Analysis

Minimum Energy Performance Standards (MEPS) Analyzed

Results

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

The SEAD Initiative

Governments working together to save energy

Australia	Brazil	Canada	Chile
European Commission	Germany	Indonesia	Japan
Korea	Mexico	Russia	South Africa
Sweden	United Arab Emirates	United Kingdom	China - Observer

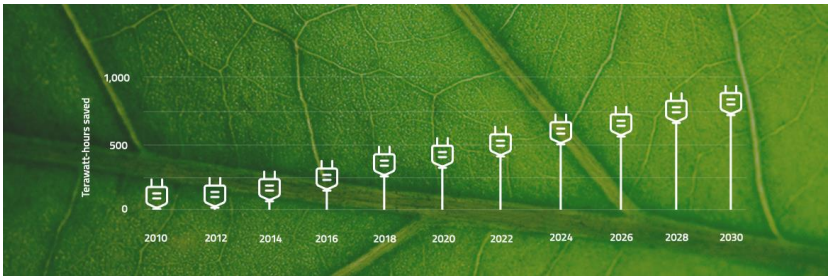
United States – Co-Chair **India – Co-Chair**

Visit www.superefficient.org for more information

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

Impacts of Standards in SEAD Economies

By 2030, policy measures adopted by SEAD's member governments between Jan. 1, 2010 and Dec. 31, 2014 are expected to save around 700 terawatt-hours of electricity each year — equivalent to the annual electricity production of over 230 coal-fired power plants.



SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

Appliance Efficiency Modeling ï Bottom-Up Energy Analysis System (BUENAS)

Purpose and Scope

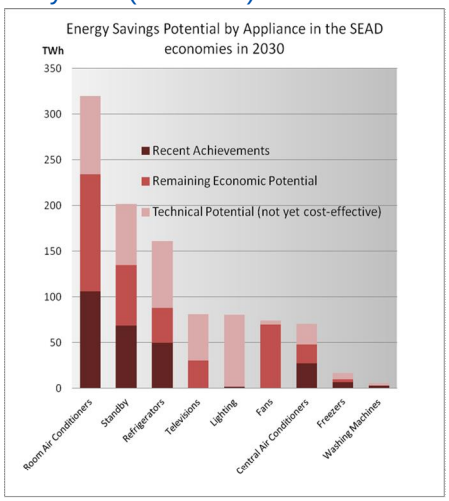
- Global projection of appliance energy demand and greenhouse gas emissions through 2030
- By economy - Currently covers 13 major economies that account for ~80% of global energy demand
- Covers 15 building and industrial appliances and equipment ~200 equipment / economy combinations

Policy Scenarios

- Best Practices ï Identifies óachievableô efficiency targets based on alignment of MEPS across regions to model harmonization potential
- Cost-Effective Potential ï Integrates BUENAS and Global Energy Efficiency Cost (GEEC) Database developed at LBNL to model economic potentialô
- Best-Available Technology ï Most Aggressive scenario represents technical potential

Recent Applications

- Analytical Framework for Super-Efficient Appliance Deployment (DOE/Clean Energy Ministerial Initiative)
- Input to IEA World Energy Outlook 2012
- Featured in IIASA Global Energy Assessment, IPCC 5th Assessment
- IEA ï Tracking Clean Energy Progress report



Source: Letschert et al. 2013
Includes Australia, Brazil, Canada, China, EU, India, Indonesia, Japan, Korea, Mexico, Russia, South Africa, USA

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

SEAD Recent Achievements Analysis

- Each year, SEAD analyzes impacts of recent efficiency regulations using LBNLôs Bottom Up Energy Analysis System (BUENAS).
- The goals are to:
  - Go beyond an enumeration standards activity toward a quantitative assessment of the strength and scope of standards by evaluating energy savings through 2030.
  - Track progress towards achieving energy savings and associated benefits for meeting energy conservation goals of energy security, reduction of capital investments and air pollution and climate goals.
  - Allow comparison across impact and sector in a consistent way, and compare progress to remaining EE potential in these areas.
- The Recent Achievements analysis covers minimum energy performance standards announced since Jan 1, 2010 through December 31, 2014. The 2015 analysis is coming soon.

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

BUENAS Model

- Bottom-up strategy includes sales, usage, efficiency and costs for specific technologies.
- End uses include residential lighting, appliances, HVAC, commercial HVAC, lighting, water heating, refrigeration, industrial motors and transformers.
- Policy case driven by increased efficiency of new sales.
- Recent Achievements implemented as a ñscenarioò within BUENAS, like BAU, Cost-Effective Potential and BAT scenarios.

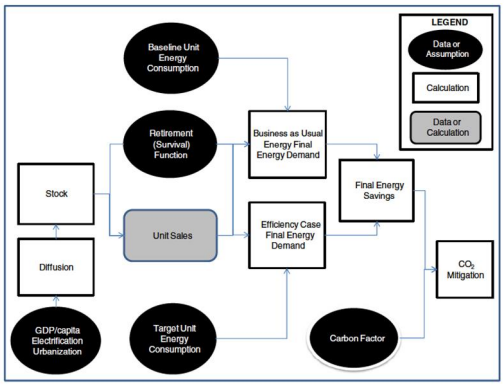


Fig. 1 Flowchart of BUENAS calculation. Note: Stock and Diffusion can be entered directly into the model as data, but this is rare

Source: M.A. McNeil, V.E. Letschert and S.A. de la Rue du Can. *"Bottom–Up Energy Analysis System (BUENAS)—an International Appliance Efficiency Policy Tool." Energy Efficiency 6 (January): 191–217.*

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

Regulations Analyzed

Sector	Residential						Commercial*				Industrial			Grand Total
Country	Appliances	HVAC	Lighting	Electronics	Water Heating	**Subtotal**	HVAC	Refrigeration	Other	**Subtotal**	Motors and Pumps	Transformers	Subtotal	
Australia		2		1	1	4			1	1				5
Brazil											1		1	**1**
Canada		3		3	1	7		1		1	1		1	**9**
Chile	1		1			2								**2**
European Union	6	3		2	1	12	1			1	1	1	2	**15**
India	2	2	1			5						1	1	**6**
Japan	1	1		1	1	4		1		1	1		1	**6**
Korea	2			2	1	5		1		1				**6**
Mexico	2	1			1	4					2		2	**6**
South Africa	4	1			1	6	1			1				**7**
United States	6	5	1	1	1	14	1	3	2	6	3	1	4	**24**
Total	**24**	**18**	**3**	**10**	**8**	**63**	**3**	**6**	**3**	**12**	**9**	**3**	**12**	**87**

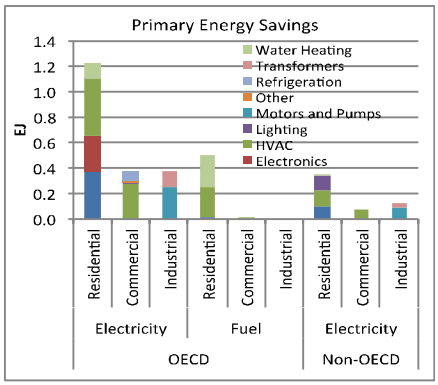
87 MEPS analyzed
+ 27 ñno dataò
+ 9 ñno impactò

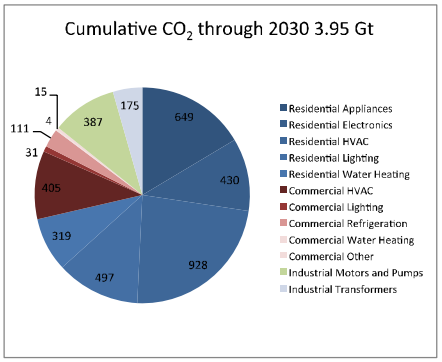
- U.S. and E.U. (FR, GER, SWE, UK) continue to be leaders in number and scope of coverage of MEPS
- Level of analysis and availability of data is highly variable ï a major limitation
- Not uncommon to see published MEPS with below-market efficiency levels
- China not a member of SEAD, so not included, but have been analyzed by LBNL

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

Results

Standards in SEAD member countries could reduce emissions by 4 Gt by 2030, much of which is in residential electricity

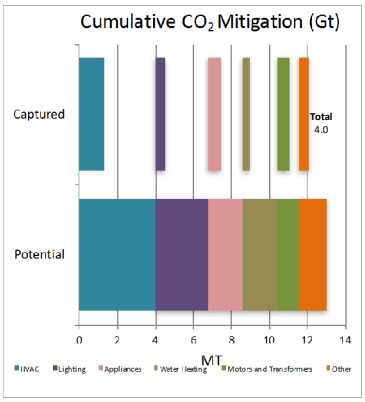


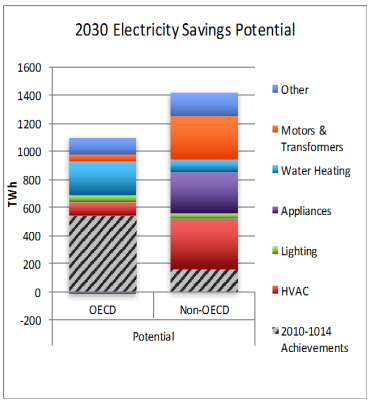


Savings still moderate in fuel-burning equipment, in the commercial / industrial sectors and in Non-OECD countries (***China analysis In Press***)

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

Achieved vs. Potential (BAT)





- Only about a quarter of savings from Best Available Technologies has been achieved, while technology keeps advancing and cost of efficiency is decreasing
- Electricity growth will occur in developing countries, where most savings is untapped

Source: M.A. McNeil, et al. *SEAD Member Economy Recent Achievements: Projected Savings from Energy Performance Standards since 2010.* Forthcoming. LBNL

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

Key References

- Kalavase, Puneeth, Michael A. McNeil, Virginie Letschert, Jing Ke, and Ana Maria Carreño. 2012. ñProjected Impacts of Global Energy Efficiency Standards for Appliances Implemented in SEAD Countries since 2010.ò In .
- Letschert, Virginie, Louis-Benoit Desroches, Jing Ke, and Michael McNeil. 2013. ñEnergy Efficiency ï How Far Can We Raise the Bar? Revealing the Potential of Best Available Technologies.ò *Energy 59: 72–82.* doi:http://dx.doi.org/10.1016/j.energy.2013.06.067.
- Lowenthal-Savy, Danielle, Michael A. McNeil, and Lloyd Harrington. 2013. ñEvidence of Progress - Measurement of Impacts of Australiaôs S&L Program from 1990-2010.ò In . Coimbra, Portugal.
- M. A. McNeil, and V. E.Letschert. 2010. ñModeling Diffusion of Electrical Appliances in the Residential Sector.ò *Energy and Buildings* 42: 783ï 90.
- McNeil, MichaelA, VirginieE Letschert, Stephane Rue du Can, and Jing Ke. 2013. ñBottomï Up Energy Analysis System (BUENAS)ð an International Appliance Efficiency Policy Tool.ò *Energy Efficiency 6* (January): 191ï 217. doi:10.1007/s12053-012-9182-6.
- Zhou, Taylor, and Michael A. McNeil. 2014. ñMeasuring Market Transformation: Quantitative Analysis of Appliance Energy Efficiency Labeling Program Impacts in the European Union, Australia and India.ò In . Asilomar, CA.

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

Governments Working Together to Save Energy.

For more information or questions please contact:

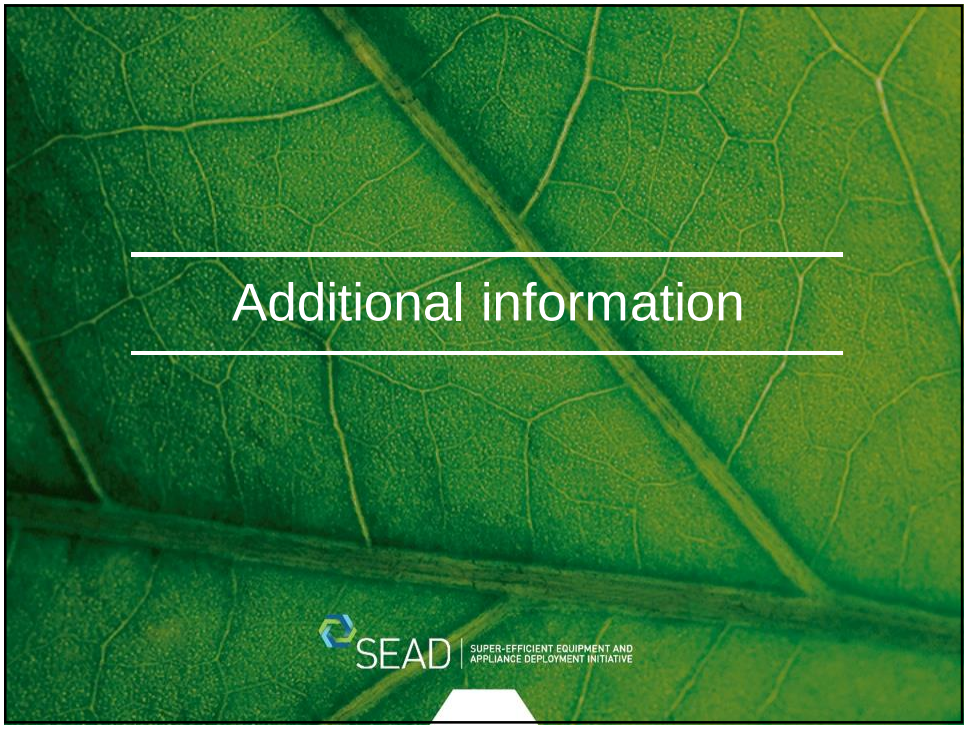
Michael McNeil, mamcneil@lbl.gov
Jenny Corry, jcorry@clasp.ngo

SEAD ï www.superefficient.org
LBL-BUENAS tool ï https://ies.lbl.gov/research-area/appliance-energy-efficiency
CLASP - www.clasp.ngo

www.superefficient.org

CLEAN ENERGY MINISTERIAL
Accelerating Transition to Clean Energy Technologies

ipeec International Partnership for Energy Efficiency Cooperation



SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

Sources of Data Forecasting

- 1st priority - ñComplexòSales Forecast ï Forecast of product taken from secondary source, such as U.S. TSD or EcoDesign Preparatory Studies, takes into account economic growth, population, housing and technology shifts
- 2nd priority - ñSimpleòSales Forecast ï Forecast of product taken from recent historical trends and then trended with growth rate, either constant, or tapering.

Sales-based activity 60% of branches

- 3rd priority - Stock Forecast (rare) ï Stock forecast taken from secondary documents, sales derived from stock.

Stock-based activity 9% of branches

- 4th priority - Saturation Forecast (esp. dev. countries) ï stock from ownership rates forecast according to macroeconomic parameters (GDP, urbanization, electrification). See McNeil & Letschert Energy & Buildings paper. Applies to refrigerators, washing machines, lighting, televisions, air conditioners & ceiling fans.

Saturation-based activity 31% of branches

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

BUENAS Model Approach

- Bottom-Up ï BUENAS is Bottom-Up Energy Analysis System
- Demand Side ï Projects need for energy services by energy carrier, regardless if if/how demand will be met
- Appliances Equipment and Lighting ï Includes both electricity and fuel. Mostly buildings end uses + motors and transformers
- Efficiency Policy Oriented ï Emphasis on calculating savings from EE scenarios
- Planning Tool Applications ï Especially for developing countries

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

Econometric Modeling for Appliance Ownership

Ownership per HH of Ref, WM, AC, TV, Fans, and lighting bulbs – or use sales data

Logistic Function:

Refrigerator Model

Aggregate model for: lighting, space heating, standby power. Climate dependent

$$Diff_c = \frac{\alpha}{1 + \gamma \exp\left(\beta_{inc} I_c + \beta_{elec} E_c + \beta_{Spe} SPE_c\right)}$$

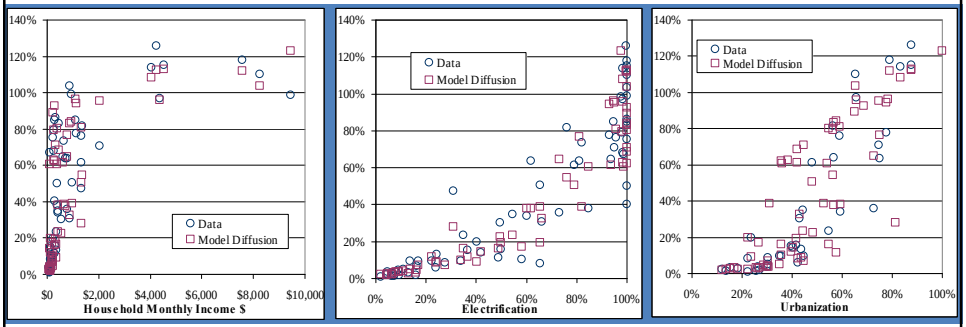
maximum diffusion

diffusion of the appliance for the economy *c*

monthly household income

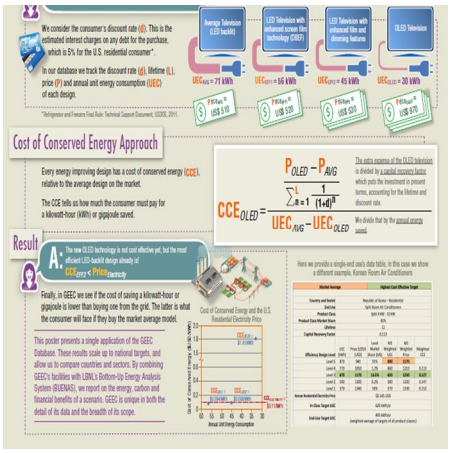
electrification rate

Appliance-specific variable



SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

BUENAS Technology Database

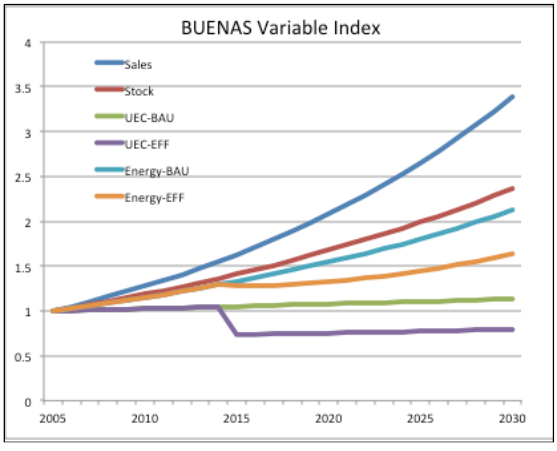


See McNeil and Bojda, Energy Policy 2012

SEAD | SUPER-EFFICIENT EQUIPMENT AND APPLIANCE DEPLOYMENT INITIATIVE

BUENAS Methodology

- Consistent framework to analyze standards using data from:
  - Pre-standards studies performed as part of the regulatory process (preferred)
  - Secondary sources on baseline efficiency, use patterns, sales and market growth
  - Assumptions (unusual)
- Data for ~450 products differentiated by economy and sub-class, including: macroeconomic parameters, sales, lifetimes, unit energy consumption (UEC), equipment prices, fuel prices



SENER
SECRETARÍA DE ENERGÍA

CONUEE
COMISIÓN NACIONAL PARA EL USO EFICIENTE DE LA ENERGÍA

Impacts Evaluation of Appliance EE Standards in Mexico since 2000

Energy Efficiency Policy Workshop April 12, 2016

SENER
SECRETARÍA DE ENERGÍA

CONUEE
COMISIÓN NACIONAL PARA EL USO EFICIENTE DE LA ENERGÍA

What is Conuee?

Ministry of Energy´s technical branch on energy efficiency.	It coordinates the efforts coming from the federal government on on EE.	It supports EE in the public and private sectors.

Conuee's Most Representative Programs

Buildings

SMEs

Large Energy Users

State-owned Companies

Residential Sector

States and Municipalities

Conuee's Most Representative Programs

International Cooperation

Solar Water Heating

Transport

Standardization

Conuee's MEPS Program

Mexico´s most effective EE program.

It now covers 30 major appliances, equipment and building components.

Began in early 1990´s with 4 standards.

Few times there is opportunity to evaluate its impact: LBNL (2006) and LBNL & CLASP (2015).

Impacts Evaluation of Appliance EE Standards in Mexico since 2000

- Developed by **LBNL** and **CLASP** upon request from CONUEE.
- It **analyzes the impacts from MEPS** for **domestic refrigerators**, and **window AC** (harmonized with U.S. standards in the early 2000s), plus the standard for **mini-split AC** (implemented in 2011).
- It provides us with information on the **benefits and impact** of these standards, as well as **other relevant information**…

Energy Savings / Environmental Benefits

Improvement in the **average efficiency** of these appliances as a result of the standards.

- Refrigerators: 17% or 27%, depending on product class.
- Window AC: about 4%.
- Split system AC: over 7%.

Savings of about 6 TWh of electricity in 2014.	Equivalent to two 500 MW power plants.	24 million metric tons of CO2 avoided through 2014.

Economic Benefits

For consumers / industry

- Savings of about **$3 billion USD** due to electricity saved by these standards between **2002 and 2014**.
- While efficiency increased, **prices did not increase** more than the rate of inflation.

For the domestic economy

- Implementation of standards **reduced peak generation capacity needs** by 1.36 GW, equivalent to **saving** the need for **$180 million USD in capital investment**.
- Savings to the treasury by **avoided subsidies**.

Other Benefits

Awareness

- Introduction of these standards and associated energy lavels has led to **increased awareness of EE** among consumers (it makes the **top 3**).

Private sector support

- The study shows private sector support to the MEPS program as it allows **manufacturers to compete under similar conditions**.

Another Relevant Conclusions

- A clear **efficiency shift** in major appliance markets in Mexico **attributable to implementation of efficiency standards**.
- Savings of about **6TWh in 2014**, making appliance standards program **Mexico´s most effective energy efficiency programs**.
- **Harmonization** with U.S standards has been successful, moving the **efficiency of the domestic market** and **benefiting manufacturers** allowing them to compete in the U.S market.
- Recent updates to refrigerators and AC standards were virtually identical to the previous version, therefore **there are savings potential to aligning our standards to U.S. MEPS**.

Why is this study important for us?

- It strengthens the **culture to evaluate** our programs.
- For future evaluations, it highlights the importance to **include stakeholders directly involved** in the programs we are evaluating.
- It provides us with **accurate information** to share with relevant government agencies (**Ministry of Finance**).
- It was particularly important for the **private sector** (chambers and associations) to be **well positioned** in the very competitive North America market.

Methodology and Data Requirements

- Bottom-up Model used for the **quantitative assessment.**
- Interviews with stakeholders for a **qualitative assessment.**

→

- Energy savings, monetary savings for consumers, improvements in the average efficiency, changes in average product price.
- Other non-energy benefits: awareness of EE, improvements in conformity assessment infrastructure.

- **Data sourced** primarily from **Mexican government agencies**, gathered by **IIE** with **CONUEE** support.
- Model-level data on product capacity and energy consumption from certification agency's product registry (**ANCE**).
- Baseline selection: market trends before MEPS were revised.

SENER
SECRETARÍA DE ENERGÍA

CONUEE
COMISIÓN NACIONAL PARA EL USO EFICIENTE DE LA ENERGÍA

(+52 55) 3000 1000 (1035)
eduardo.ramos@conuee.gob.mx

www.conuee.gob.mx

@CONUEE_mx

facebook.com/CONUEE

Developing Evaluation Capacity
How to conduct an evaluation

Process

1. Develop theory of change
2. Identify the evaluation use and audience
3. Identify the evaluation objectives and questions
4. Identify the type of evaluation required
5. Identify evidence requirements
6. Secure the resources
7. Conduct/commission the evaluation
8. Use the evaluation findings

Theory of change checklist

Context and issues	What are the stated objectives of the policy? What contextual factors may influence the outcomes and impacts? Who will the policy affect – directly and indirectly? What do we know already? What else might affect the outcomes – policies/other?
Impacts	What is the overall goal of the policy? What is the policy aiming to achieve in the long term? What policy objectives will it address?
Outcomes	What is the policy expected to achieve in the short/medium term? What changes would you expect to see?
Outputs	What will be delivered as a direct result of the policy? What activities will directly result from the policy? Who will participate as a direct result of the policy?
Inputs	Financial, activities, other – government and partners

Theory of change checklist

Assumptions	How will inputs => outputs => outcomes =>impacts? What is necessary/sufficient? Effect of different contexts?
Risks	What could go wrong?
Alternative explanations	What else could lead to the outcomes that are seen?
Unintended consequences	What else might happen?
Bias	Known unknowns Addressing confirmation bias

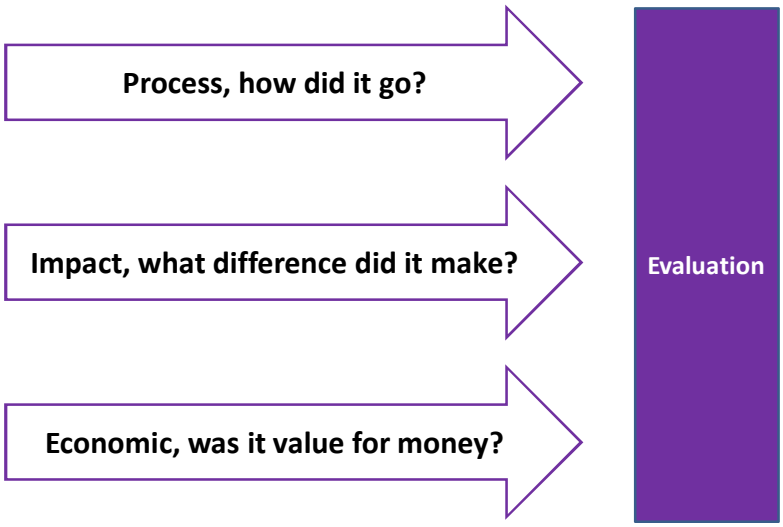
Evaluation use and audience

- **Who** will use the findings? What for?
- **When** do they need them?
- **What** evidence do they need?
- **How** is it best to communicate findings so that they make an impact?

Typical evaluation questions

- **What** has happened?
- **What** difference did the policy/programme make?
- **How** well was the policy/programme implemented?
- **How** can we do things better/what can we learn?
- **Was** the policy/programme good value for money?

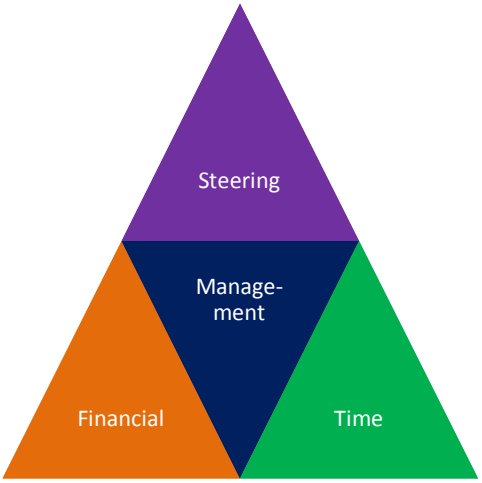
Type of evaluation required



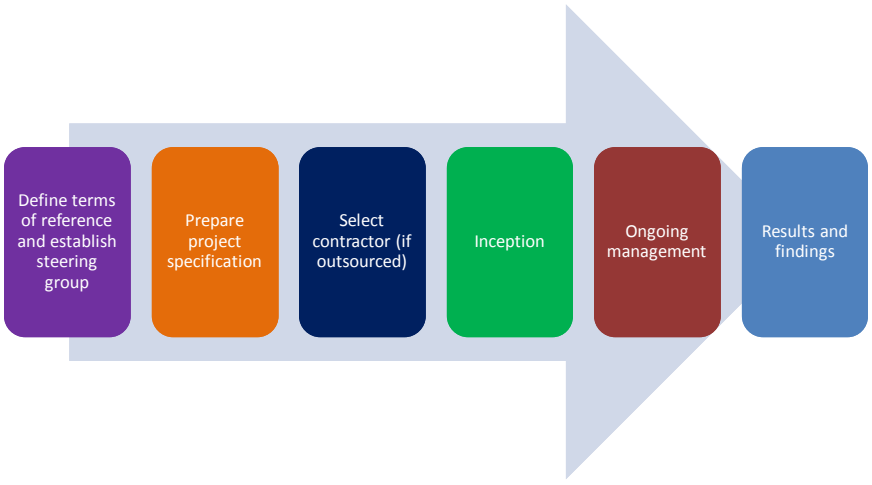
Evidence requirements

- **Monitoring;** activities, outputs, outcomes, impacts
- **Baseline;** what was the position before the policy was announced/implemented?
- **Counterfactual;** what would have happened without the policy – is there a comparison group?
- **Understanding/insight;** who, why, how, what works, drivers, barriers, etc
- Consider:
  - What do we know already, how reliable is it?
  - How can we obtain the evidence we need?
  - What tools and techniques are appropriate? Experimental, statistical, case study, survey, etc.
  - Who should be responsible for collecting evidence?

Secure the resources



Conduct the evaluation

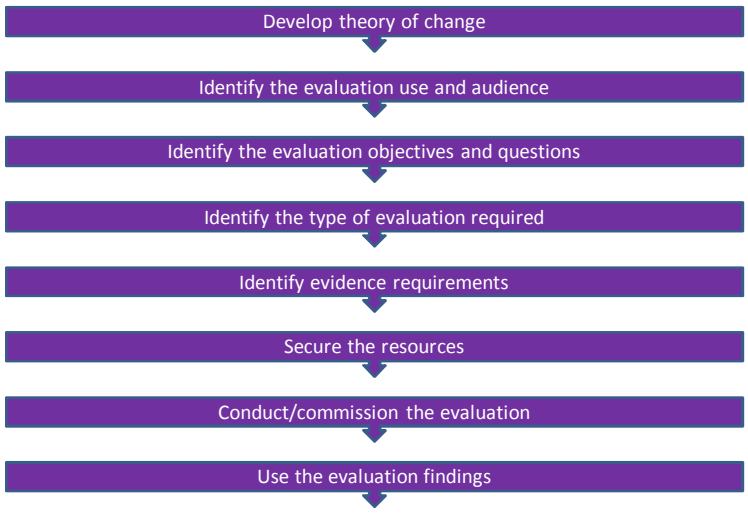


Using the findings

- Inform current and future policy development
- Provide value for money evidence to funders
- Secure stakeholder engagement

- Plan from the start
- Use early results
- Disseminate:
  - Outcomes and impacts
  - Specific and general lessons learned
- Share with evaluation community

Summary



Thank you

Charles Michaelis

Databuild Research and Solutions

charles.michaelis@data-build.co.uk

+447813 799580

DATABUILD
Research & Solutions

www.data-build.co.uk
research@data-build.co.uk
21 Graham Street, Birmingham, UK, B1 3JR
0121-237-1144

Evaluation Checklist

Checklist

1. Develop Theory of Change	
Impacts	What is the overall goal of the policy? What is the policy aiming to achieve in the long term? What policy objectives will it address
Outcomes	What is the policy expected to achieve in the short/medium term? What changes would you expect to see?
Outputs	What will be delivered as a direct result of the policy What activities will directly result from the policy Who will participate as a direct result of the policy
Inputs	Financial, activities, other – government and partners
Assumptions	How will inputs => outputs => outcomes =>impacts? What is necessary/sufficient? Effect of different contexts?
Risks	What could go wrong?
Alternative explanations	What else could lead to the outcomes that are seen?
Unintended consequences	What else might happen?
Bias	Known unknowns Addressing confirmation bias

Checklist

2. Evaluation use and audience	
	Who will use the findings?
	What will they use them for?
	When do they need them?
	What evidence do they need?
	How is it best to communicate findings so that they make an impact?
3. Set evaluation questions	
	What has happened?
	What difference did the policy/programme make?
	How well was the policy/programme implemented?
	How can we do things better, what can we learn?
	Was the policy/programme good value for money?

Checklist

4. Decide on the type of evaluation required	
	Process?
	Impact?
	Economic?
5. Consider the evidence requirements	
Monitoring	Activities, outputs, outcomes, impacts
Baseline	What was the position before the policy was announced/implemented?
Counterfactual	What would have happened without the policy?
Understanding/insight	Who, why, how, what works, drivers, barriers
Consider	What do we know already, how reliable is it? How can we obtain the evidence we need? What tools and techniques are appropriate? Experimental, statistical, case study, survey, etc. Who should be responsible for collecting evidence?

Checklist

6. Secure the resources	
	Determine a steering group/review process
	Identify management responsibilities and processes
	Secure financial resources
	Allocate time to staff responsible

7. Conduct the evaluation	
	Define terms of reference and establish steering group
	Prepare a project specification
	Select a contractor (if outsourced)
	Hold an inception meeting
	Ongoing management
	Results and findings

Checklist

8. Using the findings	
	Mechanisms to feed into policy making process
	Communicate to funders and stakeholders
	Capture generic lessons and mechanisms to communicate
	Share with evaluation community

International Energy Agency

Secure • Sustainable • Together

Energy Efficiency Indicators

Melanie Slade

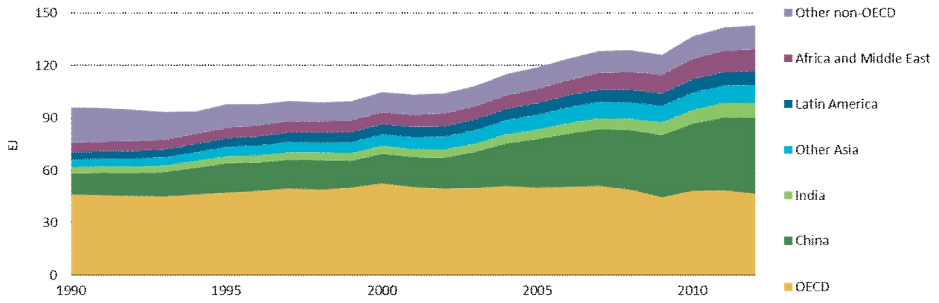
International Energy Agency

Secure • Sustainable • Together

What do we use indicators for?

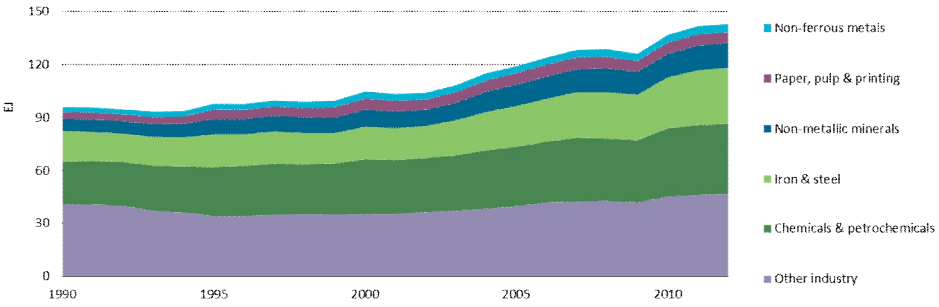
- We use indicators along with evaluation to design better policies
- We use indicators along with evaluation to track progress against targets

Industrial energy use, 1990-2012



- Decrease in OECD share (from 48% to 33%) due to absolute increase in energy use in non-OECD countries
- Significant growth in non-OECD, particularly in China

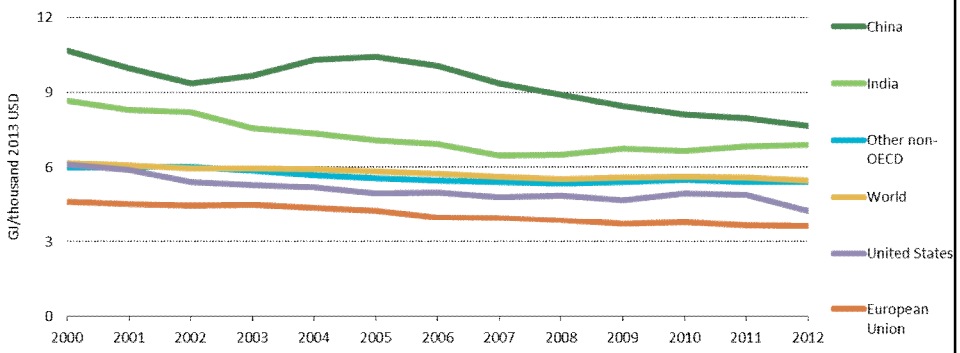
Industrial energy use, 1990-2012



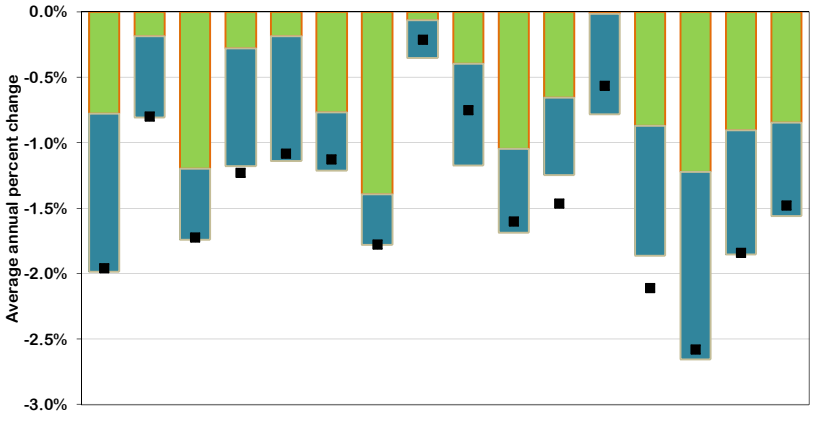
- Gain in share of 5 energy-intensive sub-sectors since 1990, from 57% to 67% globally

Energy Intensity Indicator

Energy intensity per unit of value added by region, 2000-2012

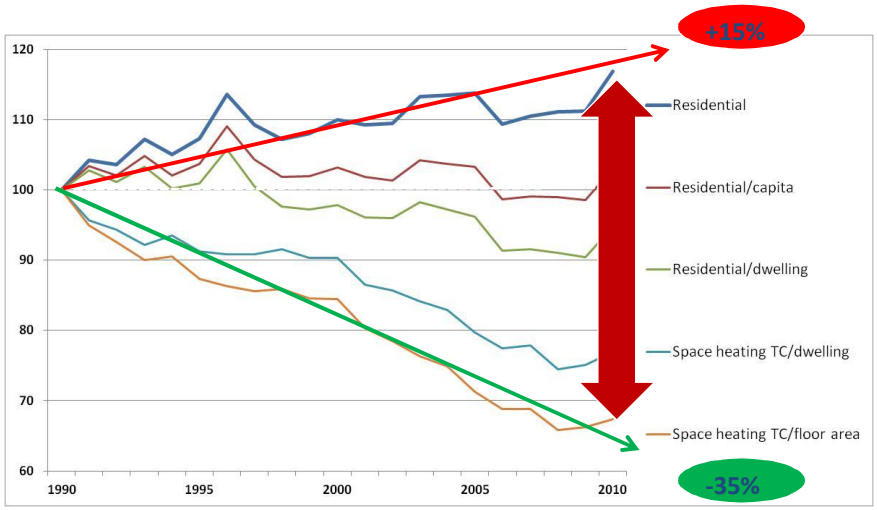


High level indicators can be misleading



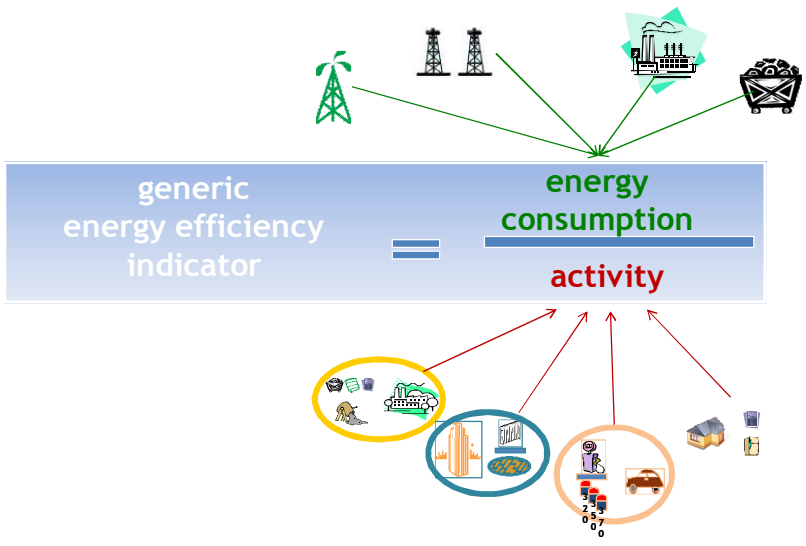
Energy intensity ≠ Energy efficiency

Data need to be specific to your need



Index: 1990=1. Data for IEA18 (Australia, Austria, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, Netherlands, Norway, Slovakia, Spain, Sweden, Switzerland, UK, USA). Source: IEA energy efficiency indicators database.
TC: Temperature Corrected. Source: IEA, 2014.

What is an energy efficiency indicator?



Residential sector indicators

energy efficiency indicator = energy / activity

For each end-use:
- Space heating*
- Space cooling*
- Water heating
- Cooking
- Lighting
- Appliances (energy use, stock, diffusion)
  - Refrigerator
  - Freezer
  - Dishwasher
  - Clothes washer
  - Clothes dryer
  - TV
  - Computers

* Temperature corrected, using HDD

# of dwellings

floor area (m²)

Service sector indicators

energy efficiency indicator = energy / activity

For each end-use:
- Space heating*
- Space cooling*
- Lighting
- Other building use
- Non-building use

* Temperature corrected, using HDD

Value added ($)

Floor area (m²)

# of employees

Transport sector indicators

- Transport segments
  passenger / freight
- Transport modes
  Road / rail / air / water

energy efficiency indicator = energy / activity

Passenger-km or tonne-km

Vehicle stock ×

Distance travelled ×

Occupancy

Load

Industry sector indicators

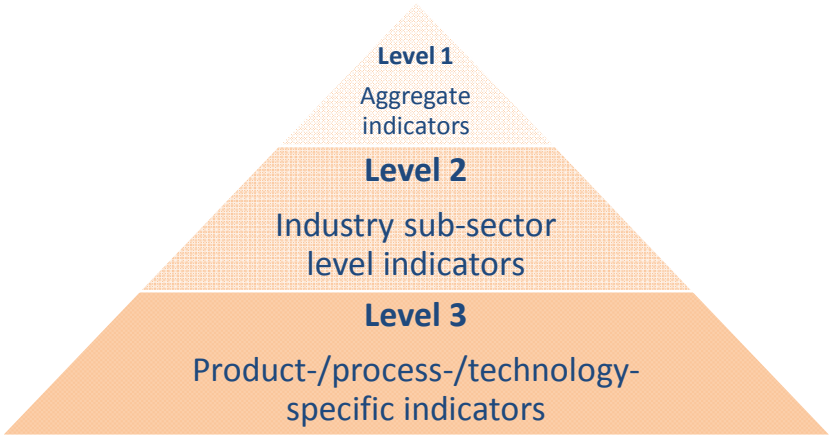
For major sub-sectors and some key product types

energy efficiency indicator = energy / activity

Value added ($)

Physical production (t)

Indicators pyramid



Level 1 – Aggregate indicators

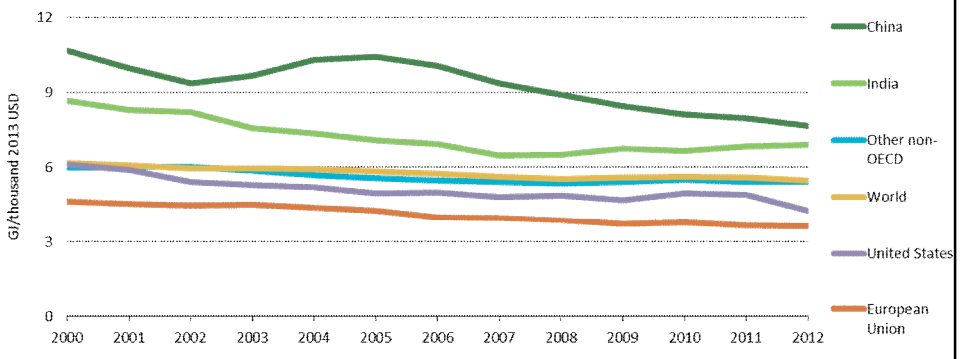
- **Industry sector-level energy intensity**
- **Measures the amount of energy needed to produce one unit of economic output**
- **Energy intensity for industry can provide a general trend of the relationship between energy and economic output**
  - Should not be used for cross-economy comparison
  - Affected by other factors, such as structure of the industry sector (i.e. share of production/energy use in energy-intensive sub-sectors), quality of resources, and even weather conditions
  - Could indicate general trend of energy efficiency only if other factors have not significantly changed

Description of Level 1 indicators

Indicator	Data required	Purpose	Limitations
Total energy consumption by unit of industrial value-added	Å Total industrial energy consumption Å Total industrial value-added (in constant currency)	Å Reflects trends in overall energy consumption relative to value-added	Å **Does not DIRECTLY measure energy efficiency developments** Å Changes over time can be influenced by factors not necessarily related to energy efficiency Å Cannot be used for cross-economy comparison

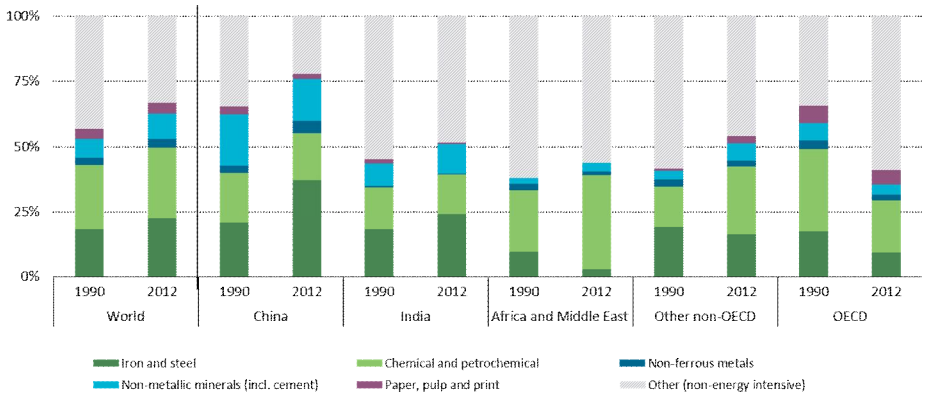
Level 1 indicator – example

Energy intensity per unit of value added by region, 2000-2012



- Should not be used for cross-economy comparison, though it seems comparable.
- Can provide a picture of the evolution within a economy's industry sector

Energy-intensive industry



- **Energy-intensive sub-sectors have gained prominence in most regions**

Level 2 – Sub-sector level indicators

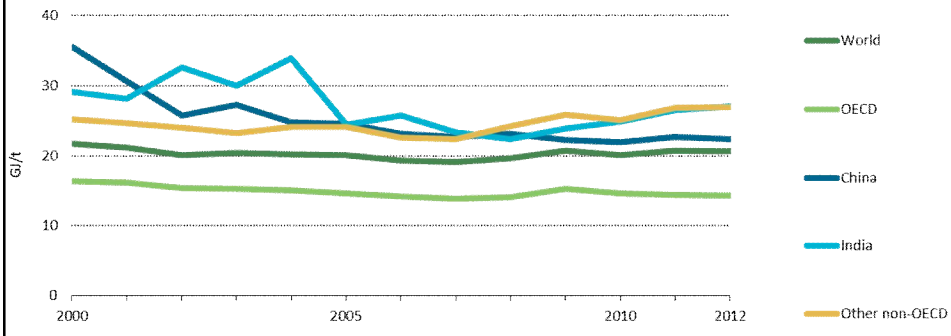
- **Specific indicators depend on data available.** Include indicators at the sub-sector level that measure energy use per unit of production (either in value-added or physical terms)
- **Energy intensity for industry can provide a trend of the relationship between energy and economic output within a sub-sector**
  - Can be influenced by structural shifts within a sub-sector (i.e. changing shares of products/process routes)
  - Can be influenced by pricing effects
  - Cannot be used to compare intensity across sub-sectors

Description of Level 2 indicators

Indicator	Data required	Purpose	Limitations
Sub-sector energy consumption by unit of value-added	Å Energy consumption by sub-sector Å Corresponding value-added (in constant currency)	Å Indicates the relationship of energy consumption to economic output in a particular sub-sector	Å May hide important structural shifts in a sub-sector Å Value-added is influenced by a range of pricing effects unrelated to physical production or energy efficiency
Sub-sector energy consumption by unit of physical production (specific or unit energy consumption)	Å Energy consumption by sub-sector Å Corresponding physical production	Å Indicates the relationship of energy consumption to physical production	Å Not possible to compare across sub-sectors because of differences in process and units Å Cannot provide an aggregate picture of efficiency in industry Å May hide important structural shifts in a sub-sector Å Difficult to apply for industrial sectors where a wide range of products exist and energy consumption cannot be allocated to a specific product

Level 2 indicator – example

Energy intensity per tonne of crude steel, 2000-2012



Source: IEA Energy Balance and IEA analysis.

Note: Energy consumption derived from IEA Energy Balance and therefore may include some energy used for non-core processes, such as some energy for captive heat/CHP.

Level 3 – Product- or process-level

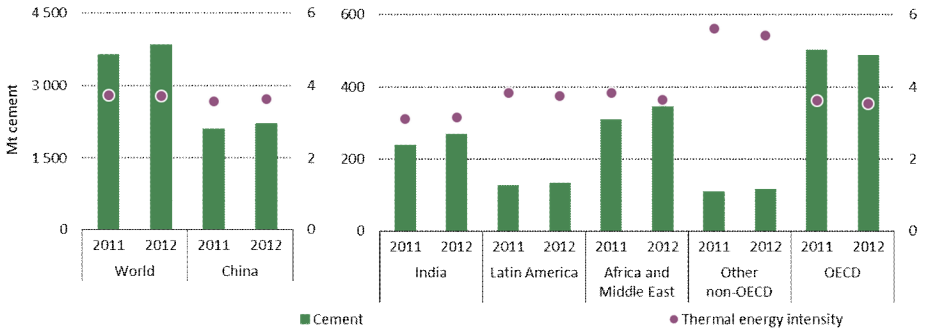
- **Specific indicators depend on data available.**
  - Indicators at the product or process-route level that measure energy use per unit of production for a particular product, technology, or process-route
  - Can also include indicators for a particular fuel or set of fuels
- **Can provide a trend of the relationship between energy and production for a particular process or product**
  - Cannot be used to compare intensity across sub-sectors

Description of Level 3 indicators

Indicator	Data required	Purpose	Limitations
Product or process level energy consumption by unit of physical production (specific or unit energy consumption)	Å Energy consumption by product or process Å Corresponding physical production	Å Indicates the relationship of energy consumption to physical production Å Indicates energy efficiency improvements within a process or product	Å Not possible to compare across sub-sectors because of differences in process and in units Å Cannot provide an aggregate picture of efficiency in industry Å Use care when interpreting to ensure consistent boundaries and definitions Å Can be influenced by changes in process technology

Level 3 indicator – example

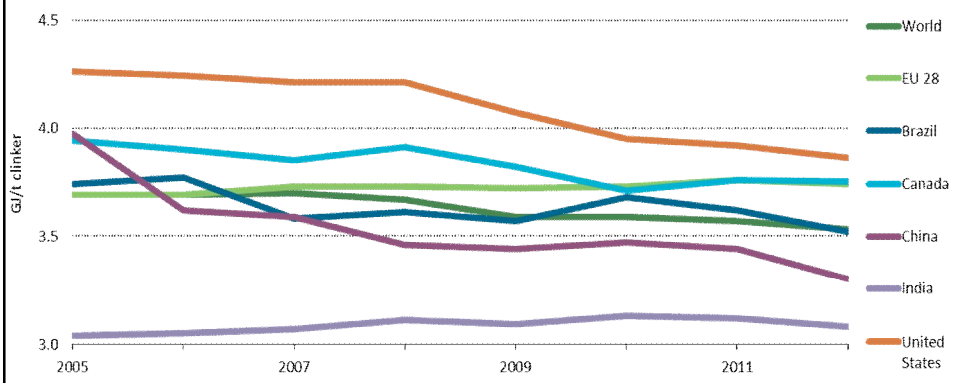
Thermal energy intensity per tonne of clinker



- Decrease largely due to conversion of wet-process kilns to more efficient dry-process kilns with preheaters and precalciners
- Use care when interpreting to ensure consistent boundaries and definitions

Level 3 indicator – example

Thermal energy intensity per tonne of clinker

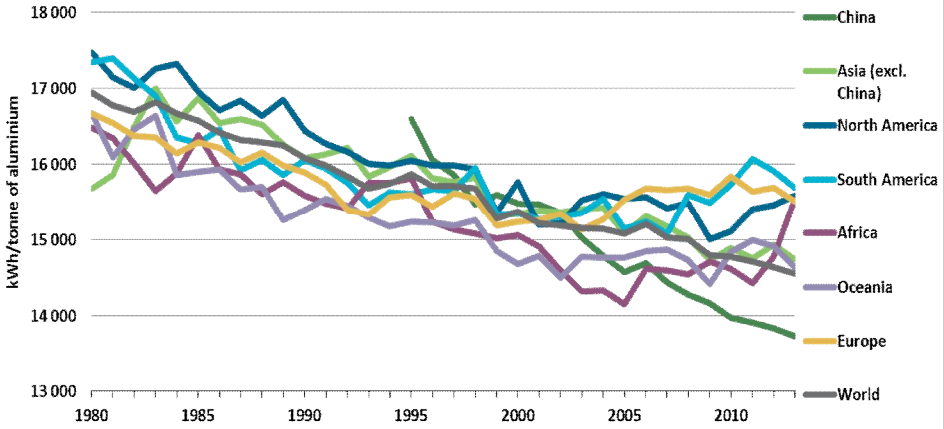


Source: Cement Sustainability Initiative (CSI), Getting the Numbers Right Database (GNR), 2015, www.wbcsdcement.org/GNR-2012/index.html.

Note: Covers 30% of global capacity, and may not have equal coverage in each region.

Level 3 indicator – example

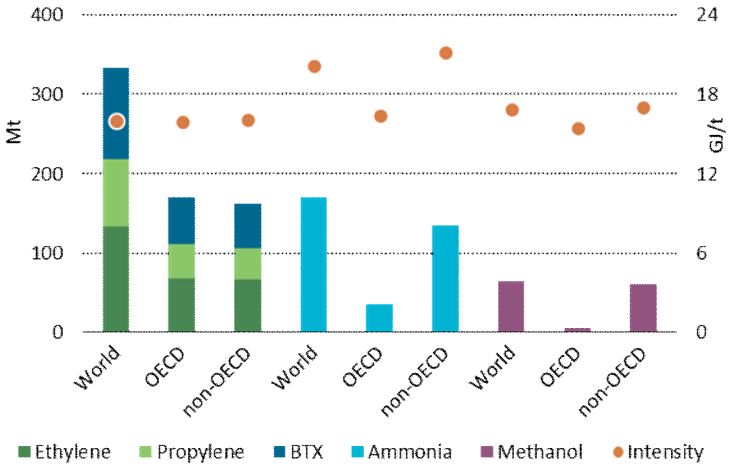
Specific electricity consumption in aluminium smelting



Source: International Aluminium Institute (IAI) Statistics, 2014, www.world-aluminium.org/statistics/.
Note: Estimates used for some regions, and may not have equal coverage in each region.

Level 3 indicator – example

Energy intensity by product and region, 2012

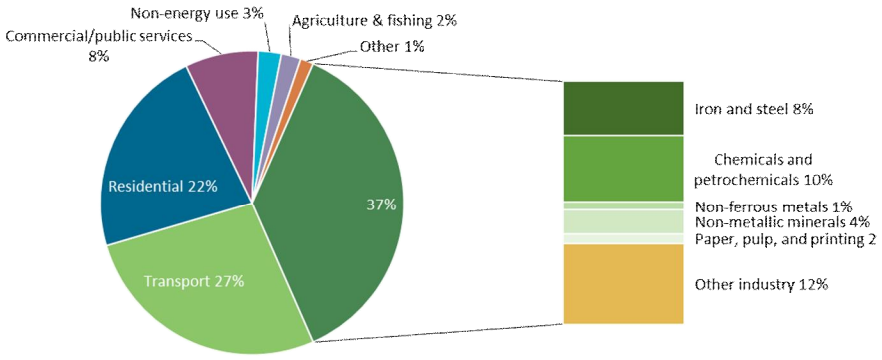


Source: IEA analysis and modelling.

Where do I start?

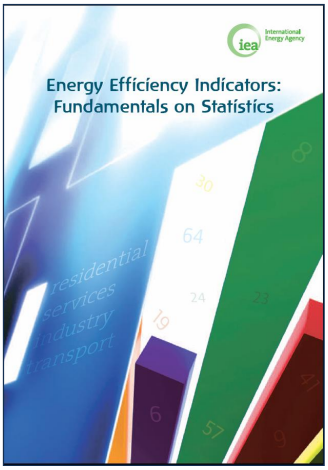
- Prioritising the sectors important to your economy

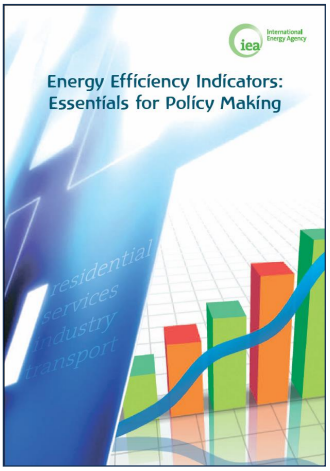
Breakdown of energy use energy use



About 2/3 of industrial final energy consumption comes from 5 major energy-intensive sub-sectors.

IEA Energy Efficiency Indicators Manuals





Policy, analysis and monitoring:
together to ensure successful implementation

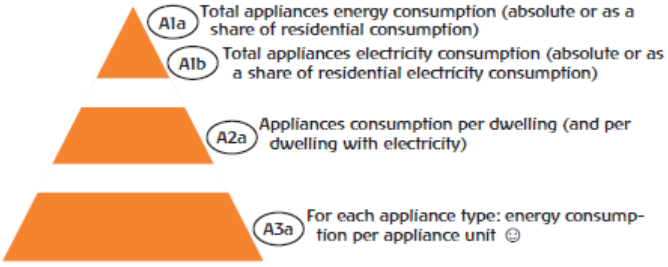
Presenting a set of indicators for each end use

4 Residential

Appliance indicators

The top of the pyramid groups all the appliances into two indicators, the first one showing total energy use for appliances either in absolute value or in relative terms compared to total energy consumption of the residential sector (A1a); and the second one, as in the case of cooling and lighting, showing the same indicator but just for electricity since electricity is almost the only energy source used for appliances

Figure 11 • Pyramid of residential appliances indicators



For each indicator of levels 2 and 3, the table gives the name, its coverage (overall or by specific type), the energy data and the activity data to be used. The column before the last gives the code number for the indicator and, when it applies, the last column highlights if the indicator is considered as the preferred indicator for a particular end-use.

20

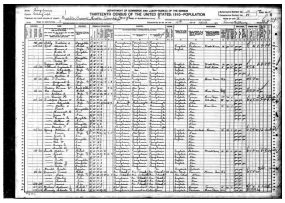
Describing possible sources for data

Table 7.3 • Summary of the main data needed for transport indicators and examples of possible sources and methodologies

Data	Source	Methodology
Energy data		
Total transport consumption	National energy balance National energy statistics	Administrative sources Modelling
Consumption by sub-sector	National energy balance National energy statistics	Administrative sources Mobility surveys Modelling
Consumption by segment		Mobility surveys Modelling
Consumption by vehicle type		Mobility surveys Modelling
Activity data		
GDP, population	National statistics offices	Administrative sources
Vehicle-km (vkm)	Vehicle registers/ Roadworthiness testing services/ Inspecting organisations Municipalities/Transport authorities National and international databases Transport ministries	Measurements: odometer readings Measurements: road traffic count Administrative sources Mobility surveys Modelling
Passenger-km (pkm)	National and international databases Transport ministries	Administrative sources Mobility surveys
Tonne-km (tkm)	National and international databases Transport ministries	Administrative sources Mobility surveys, freight surveys

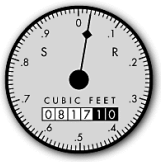
Methods used to collect data for indicators

- **Administrative sources**

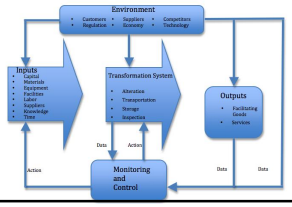


- **Surveys**

- **Metering and measuring**

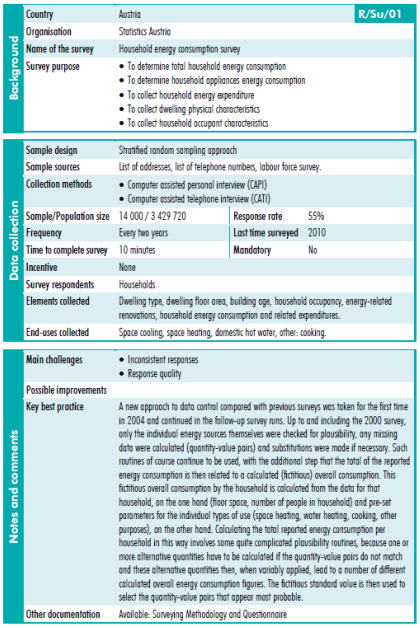


- **Modelling**



Sharing expertise from countries

160 economy practices presented by sector and by methodology



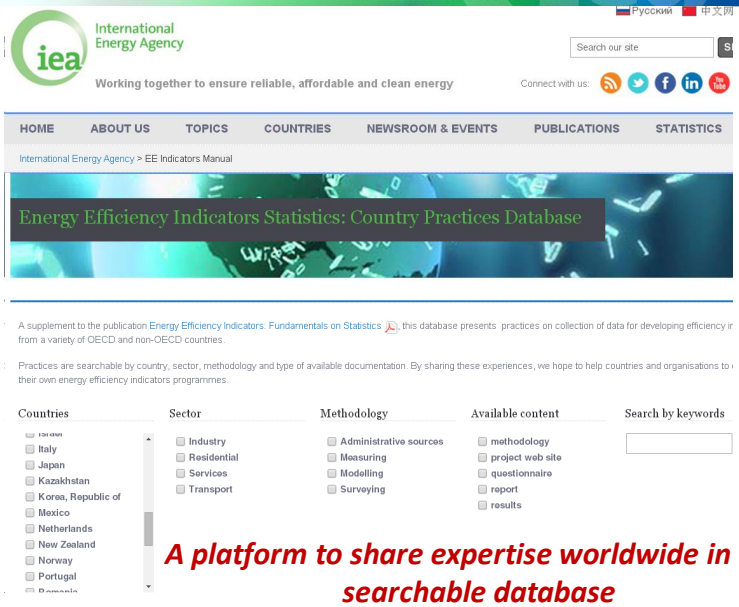
Background	Country	Austria	R/Su/01
	Organisation	Statistics Austria	
	Name of the survey	Household energy consumption survey	
	Survey purpose	• To determine total household energy consumption • To determine household appliances energy consumption • To collect household energy expenditure • To collect dwelling physical characteristics • To collect household occupant characteristics	
Data collection	Sample design	Stratified random sampling approach	
	Sample sources	List of addresses, list of telephone numbers, labour force survey.	
	Collection methods	• Computer assisted personal interview (CAPI) • Computer assisted telephone interview (CATI)	
	Sample/Population size	14 000 / 3 429 720	Response rate 55%
	Frequency	Every two years	Last time surveyed 2010
	Time to complete survey	10 minutes	Mandatory No
	Incentive	None	
	Survey respondents	Households	
	Elements collected	Dwelling type, dwelling floor area, building age, household occupancy, energy-related renovations, household energy consumption and related expenditures.	
	End-uses collected	Space cooling, space heating, domestic hot water, other: cooking.	
Notes and comments	Main challenges	• Inconsistent responses • Response quality	
	Possible improvements		
	Key best practice	A new approach to data control compared with previous surveys was taken for the first time in 2004 and continued in the follow-up survey runs. Up to and including the 2000 survey, only the individual energy sources themselves were checked for plausibility, any missing data were calculated (quantity-value pairs) and substitutions were made if necessary. Such routines of course continue to be used, with the additional step that the total of the reported energy consumption is then related to a calculated (fictitious) overall consumption. This fictitious overall consumption by the household is calculated from the data for that household, on the one hand (floor space, number of people in household) and pre-set parameters for the individual types of use (space heating, water heating, cooking, other purposes), on the other hand. Calculating the total reported energy consumption per household in this way involves some quite complicated plausibility routines, because one or more alternative quantities have to be calculated if the quantity-value pairs do not match and these alternative quantities then, when variably applied, lead to a number of different calculated overall energy consumption figures. The fictitious standard value is then used to select the quantity-value pairs that appear most probable.	
	Other documentation	Available: Surveying Methodology and Questionnaire	

Background:
Institution
Purpose …

Technical information:
Sample
Frequency
Data collected…

Comments:
Challenges
Tips
Documents
Links…
(e.version)

How are countries collecting data?



A platform to share expertise worldwide in a searchable database

A few concluding remarks

- Indicators are an important tool for improving the effectiveness of energy efficiency policy and tracking progress
- Varying levels of detail are needed across sectors depending on economy-specific priorities, policy needs, data availability, etc
- A global community of experts and a database of practices used across countries in support of developing programmes is available at: www.iea.org/statistics/topics/energyefficiency