Subsidies to Energy: A Review of Current Estimates and Estimation Challenges

International Workshop on Fossil Energy Subsidy Reform
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Key Themes

- Some positive trends.
- Scale of global energy subsidies.
- Subsidy measurement overview; price gap and inventory methods in detail.
- Tracking challenges for particular types of subsidies.
- Environmental externalities.

Developing Better Estimates

Subsidy Transparency is Improving

- **Visibility.** High level recognition on the scale and importance of subsidies.
- **Activity.** More international organizations (IOs), non-governmental organizations (NGOs), governments, and academics evaluating subsidy, subsidy reform.
- **Frequency.** Data sets more regular than in the past; consensus on measurement, metrics slowly growing.
- **Near-term challenges**
  - Political resistance to reporting; cost of doing nothing remains low.
  - Expanding coverage, measurement standardization, sharing of raw data.
  - Improved granularity (e.g., region, time of day) so key market distortions more visible.
  - Developing independent professional body to address most complex measurement issues (similar to International Accounting Standards Board).

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Developing Better Estimates

More Institutions, Countries, Transfer Types

Representative recent or ongoing work on energy subsidies

(list is not exhaustive)

Near Global Analysis

IEA (price gap) — OECD (PSE-CSE inventory) — IMF (price gap + externalities) — World Bank (hidden cost in power sector; petrol pricing) — Oil Change International (gross lending by ECAs) — GIZ (petrol price surveys).

Regional work, other than by national governments

Asian Development Bank (India, Indonesia, Thailand) — Asia-Pacific Economic Cooperation (Peru, New Zealand) — Earth Track (United States) — European Commission (Europe) — European Environment Agency (Europe) — Friends of the Earth (United States) — Global Subsidies Initiative (specific reviews in North America, Europe, Asia, Africa, Australia; Brazil) — Good Jobs First (United States, state and local level) — Green Budget Europe and the UN Office for Sustainable Development (Small Island Developing States in Indian Ocean and Africa) — Institute for European Environmental Policy (Europe) — Inter-American Development Bank (Latin America and the Caribbean region) — Oil Change International (United States) — Overseas Development Institute (developing world) — Oxford Energy Institute (Middle East and North Africa) — Pembina Institute (Canada) — Taxpayers for Common Sense (United States) — The Energy and Resources Institute (India) — United Nations Development Programme (Western Balkans, Middle East and North Africa, Vietnam)

National government involvement widespread, though often fragmented – US Example

Energy Information Administration (full review, though definitional problems) — Government Accountability Office (two separate requests for full study, though seem stalled; also conduct program-specific reviews) — Joint Committee on Taxation (tax expenditures) — Treasury and Office of Management and Budget (tax expenditures, partial tracking of credit subsidies) — Congressional Budget Office (prospective subsidies; ad hoc reviews of specific programs) — Congressional Research Service and Offices of the Inspector General for various agencies (ad hoc reviews of specific programs).

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Developing Better Estimates

Benefits of Reform Remain Very Large

Economic and Financial	• Hundreds of billions USD per year, even based on partial accounting. • Current estimates missing many countries, subsidies to producers, certain types of transfers. • Crowds out social spending.
Environmental	• Undermines GHG and other pollution control efforts. • Significant negative impacts on human health; and on air, water, and land quality. • Slows transition to cleaner energy.
Societal	• Spurs commercial malpractice and associated corruption.
Political	• Robust reform formulation is nearly impossible without detailed, timely, and broadly accepted data. • **Real progress by China and US would have tremendous positive spillover effects.**

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Subsidy Measurement

Methods Vary in Coverage, Data Requirements

- **Price gap**
  - Compares local prices to “reference” price for the same energy with efficient production and delivery with no subsidies.
  - Requires less data but still complicated, particularly for non- or thinly traded goods.
  - Provides overview of distortions, but missing many supports. Metric lacks the detail needed to map policy reforms.
- **Hidden cost approach**
  - Primarily applied to non-traded goods such as electricity, district heating, and gas in some cases.
  - Improves support estimates by capturing not only underpricing (which is picked up by standard price gap), but excessive losses (such as through theft) and nonpayment of bills.
- **Inventory**
  - Tallies gross value of all types of government interventions; coverage and quality of the inventories can vary widely across analyses.
  - Data intensive, though even partial inventories and qualitative can be helpful in mapping reform strategies and steps on a process to broader data assessment.
  - Quantified transfers, not net effects on prices.
- **OECD PSE-CSE framework**
  - Hybrid approach: organizes inventory into Producer and Consumer Support Estimates (PSE and CSE).
  - Looks at residual price gaps as well via Market Price Support metric.
  - Can capture commercial losses or gains resulting from government policies (“induced transfers”) as well.

Subsidy Measurement

Energy Subsidies Very Large, Even with Partial Accounting

Energy Type	**IEA** *(Primarily Price Gap)*	**OECD** *(PSE-CSE Inventory)*	**IMF** *(Price Gap)*	**IMF** *(Plus Tax and Externalities)*
	billions of USD			
Oil	285	59	220	728
Gas	104	15	116	709
Coal	3[a]	10	6[a]	376
Power (fossil)	132	Not estimated	150	179
Total fossil fuels	524	84	492	2,000
Power (nuclear)[b]	Not estimated	Not estimated	Not estimated	Not estimated
Power (renewable energy)	64	Not estimated	Not estimated	Not estimated
Biofuels, transport	24	Not estimated	Not estimated	Not estimated
Total all fuels	612	84[c]	492	2,000[d]

[a]**Coal** figures are small in part because subsidies counted within fossil-electric category.

[b]**Nuclear** not estimated by any IGO; midpoint of about $160b/year in GSI literature review.

[c]**OECD** data has little overlap with coverage in IEA or IMF; is largely additive. IEA + OECD adjusted for overlap + GSI nuclear midpoint yields ~$830 billion/year in subsidies.

[d]**IMF externality** figures quadruple their estimate. Include pollution and traffic externalities as well as an imputed tax.

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Subsidy Measurement

Big Numbers, But Still Many Gaps

Category	Coverage Gaps
Policy gaps	• Multiple-level subsidies in state-owned enterprises. • Government loans, loan guarantees. • Subsidized accident and liability insurance. • Market price support (e.g., purchase mandates). • Tax breaks outside of OECD. • Regulatory oversight and site remediation. • Energy security (e.g., stockpiling, oil defense). • Bulk energy transport infrastructure. • Subsidies of significant (though not sole) benefit to energy sector. • Selective regulatory exemptions.
Geographic gaps	• Producer subsidies outside of OECD. • State, provincial, or municipal subsidies of all types outside of a few OECD countries.
User fees	• Consistent evaluation of fee levels versus related services provided.

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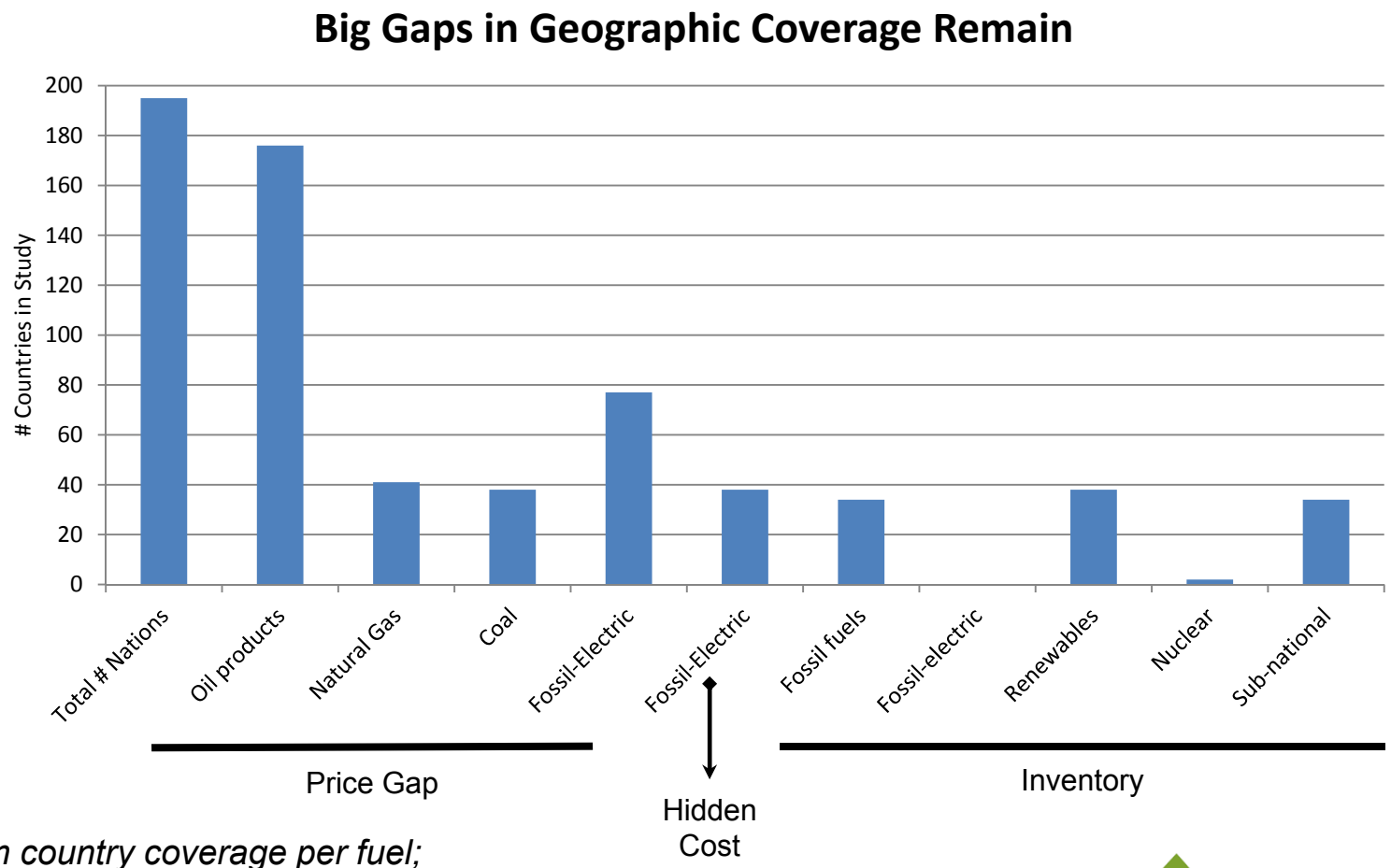
Subsidy Measurement

Geographic Coverage Drops off Quickly in Global Studies



Maximum country coverage per fuel; quality may vary within sample.

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Subsidy Measurement

Analytic Gaps Not Only Caused by Definitions

Organization	Definitions Include
WTO	Direct transfers, credit and insurance, tax breaks, subsidized energy goods & services, subsidies to key inputs. Must be "specific" and trade distorting to be actionable. *Reporting is sparse, inconsistent*.
OECD	WTO elements (irrespective of trade impacts) + market price support. *Reporting currently picking up direct transfers, tax breaks, both federal and subnational. Credit to be added in next version.*
IEA	Recognize transfer subsidies, but measure price gap for fossil fuels. Power sector estimates based on operating costs only. Renewable energy tracking appears more inventory-based.
IMF	Price gap + environmental externalities + imputed baseline taxes (quadrupling estimate). Power sector estimates also include some hidden costs (excessive theft, line losses) plus capital recovery.
G20	"Inefficient" fossil fuel subsidies if "encourage wasteful consumption." *Wide discretion by members on inclusion; little reporting.*
OPEC	Price-focused definition of subsidies, based on cost of extraction rather than value of the fuel on the open market (opportunity cost).

Measurement Methodology – Price Gap
Requires Less Data, but Limited View of Policy Details

Price Gap = (Reference Price – End User Price) x Units Consumed

- Global estimates developed by IEA, IMF; historically WB as well.
  - Goal: measure residual subsidy effects only; compare "like" with "like". Same fuel, same place, same time. Data not perfect.
  - Adjustments: quality differences, location (international margin to bring to border; domestic margin to bring from border to end user); need to capture correct timing of all price inputs.
  - Adjust for tax issues: VAT/GST either applied to both sides (IEA) or subtracted from both sides (IMF).
- Non-traded goods (e.g., electricity): need to impute what it "should" cost to generate reference price.
- Provides national "snap shot" of price distortions for particular fuels, but partial view of interventions and limited detail for policy planning, reform.

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Measurement Methodology – Price Gap
Different Input Assumptions Affect Comparability

International Energy Agency Estimates	International Monetary Fund Estimates
End-user price -IEA surveys, plus other public and commercial data. -IEA internal data normally lags 2 years, so important price gap data relies on outside sources.	-Public sources for OECD countries; data from officials to IMF for other countries. -Also use GIZ biennial survey and imputed pass-through to generate prices. **Potential concerns include data depth, frequency (often once a year), and matching with dates of reference prices.**
Reference price before adjustments for transport -Oil: Actual data from terminal or proxy from regional terminals. -Coal & natural gas: **transactional data (though thinly traded).** -Electricity: fuel-weighted cost of production, with CCGT plant as cap **(short-term** breakeven price, capped at **long-run marginal cost).**	-Oil: OECD pretax price data; spot price data from IEA. -Coal & natural gas: mostly use IEA price gap calculations. -Electricity: ½ flow through from IEA; ½ cost of production with cap recovery, adjustments for fuel subsidies, theft, nonpayment **(long-term breakeven price)**.
International transport margin -Actual data from terminal or proxy from regional terminals, adjusted for mileage. Applied to all fuels. -Little detail on data depth. -Added for net importers, subtracted for net exporters.	-**Flat rate of US$0.10/liter applied globally** to gasoline & diesel. -Added for net importers, subtracted for net exporters.
Domestic transport margin -Oil: flat rate of US$0.08/liter **applied globally** (USA as proxy). -Coal & natural gas: actual shipping data (no details). -Electricity: US$15/MWh for industrial customers; US$40/MWh for residential. **Applied globally.**	Oil: flat rate of US$0.10/liter **applied globally**. Coal & natural gas: flow-through from IEA price gap. -Electricity: not stated; may be embedded in reference price cost estimates.
Taxation -VAT added to reference price; all other taxes excluded.	-VAT subtracted from local prices; counted in IMF's "post-tax" figures (that also include externalities).
Other issues -Dual exchange rates (wide dispersion between official and black market rates). -How are quantities diverted (e.g., to black market) picked up in national price gap tallies? -Quality adjustments as necessary, though little detail.	

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Measurement Methodology – Price Gap

Data Sharing, Disclosure to Improve Estimates

- **Data sharing across international organizations.** Variability in transport margins, local and reference prices should be narrowed.
  - Data sharing and disclosure of inputs can help.
  - If data confidentiality, secure platform at least for IOs would be possible.
- **Meta data on coverage.** Data quality needs more disclosure.
  - Reliance on transactional data for coal, natural gas; key assumptions on power costs.
  - Indications of few data points behind calculations.
- **Reconcile material differences in calculation methods.** Significant issue with power sector.
  - Both IEA and IMF approaches have supporting logic, but make results harder to compare.
  - Scenarios approach could boost coordination, retain different framing.

Measurement Methodology - Inventory

OECD PSE-CSE Framework for Inventory

- Subsidy inventories start as a list, often mixture of qualitative and quantitative data.
- OECD framework highly structured:
  - Groups supports to producers and consumers (PSE and CSE), and adjusts for any residual Market Price Support (similar to a price gap).
  - Adds supports of benefit to the sector rather than a specific producer or consumer as the General Services Support Estimate (GSSE).
  - Generates a Total Support Estimate metric.
- Can handle complicated interventions (e.g., subsidize producers via above-market prices on consumers or commercial losses resulting from government mandates).
- Data intensive; tracking gaps result in understating support levels.

Measurement Methodology - Inventory

Subsidy Capture Lags Capabilities of the Approach

Intervention Category and Description	OECD Inventory
Direct spending (e.g., grants, energy R&D)	Yes
Tax expenditures	Yes, as reported by member country
User fees (energy-related fees applied to fund, often only partly, sector-related activities)	Partial
Terms of access to resources (auction competitiveness, royalty rates)	Some royalty reductions
Below market loans, loan guarantees	Possibly in next version
State-owned enterprises (often multiple levels of subsidy)	No
Below market insurance or indemnification	No
Cross-subsidies	No
Induced transfers (e.g., purchase mandates, price controls, import or export restrictions)	No
Special regulatory exemptions	No

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Tracking Challenges

Direct Spending: Not Always Easy

- Tracking cash flows should be easy. Positive trend: more budget data being released, often on Web.
- Quality and degree of current disclosure varies.
  - Program level details, released on a timely basis, often audited (many developed countries).
  - More aggregate data only, with limited ability to attribute to specific government programs (many developing countries).
  - Long time lags greatly reduce oversight benefits of transparency.
- None of the countries offered easy way to do topical searches of disaggregated spending across all programs.
- Sub-national information fragmented, of widely varying quality.

Tracking Challenges

Tax Breaks: Valuation and Benchmark Issues

- Generally recognized as subsidies.
  - However, disagreement on “energy-related” versus “baseline” provisions remains.
  - Even on same energy-related provisions, estimate variance is high: $7.2 billion absolute value difference between Joint Committee on Taxation and Treasury estimates in United States.
- Overlapping tax systems
  - National, subnational; differing benchmarks.
  - High VAT on energy in Europe versus no national sales tax at all in United States.
- State-owned enterprises often operate tax-free, though may compete with firms that are taxed.
- User fee tracking, attribution not always clear.

Tracking Challenges

Credit and Insurance Subsidies: Distortionary but Often Invisible

- Best-case: U.S. credit programs required to estimate expected subsidies under Federal Credit Reform Act of 1990.
  - Excludes program administration.
  - Cannot be attributed to specific loans (or even energy type in many cases).
  - Ignores intermediation value.
  - Not applied to many federally-owned energy ventures.
- Should be benchmarked vs. market rates of comparable risk.
  - Too often evaluated only on default or sovereign credit rates.
  - Even gross lending patterns not always available (export credit agencies)
  - State-owned enterprises often get free ride.
- Newly-created Center for Finance and Policy at the Massachusetts Institute of Technology aims to improve valuation methods in this area.

Tracking Challenges

State-owned Enterprises (SOEs)

- Large, complex institutions, often in high risk areas.
- Layers of government intervention hide real price of goods or services produced.
  - **Cost decreasing.** Operating subsidies, tax-exempt bonds and operations, access to low-cost public debt, no return on investment to taxpayers, improper accruals for insurable risks.
  - **Cost increasing.** Political inference with operations, sale prices, sourcing, hiring, noncore business burden (schools, hospitals); lack of competition leading to inefficiency.
- PSE-CSE framework can map cost impacts in both directions; useful tool for SOEs.

Externalities

Too Big to Ignore, but Estimate Range and Where to Capture Them Remain Challenges

Fuel	# Assessments	Range across studies		High estimate as multiple of low	
		Low-end, (c/kWh)	*High-end (c/kWh)*	*Across studies*	*Within study*
Per unit of electricity [1]					
Coal	4	0.14	21.00	155x	63x
Oil	3	0.03	15.38	463x	7x
Gas	4	0.001	5.59	5,380x	578x
Global total		*bil USD/yr*	*bil USD/yr*		
All fossil electric [2]		90	3,070	34x	
High/low spread			2,980		
Highest estimate for fiscal subsidies to fossil fuels [4]			607	5x	

Sources and notes

(1) Burtraw, Krupnick, and Sampson (2012).

(2) Kitson, Wooders, and Moerenhout (2011).

(3) Composition of literature reviews differ, and global total estimates will not necessarily align with scaling the per kWh values by global energy production. Data have been scaled to 2012 USD.

(4) Indicative value by adding 2011 IEA price gap to OECD's producer subsidy values, despite some overlap for KOR and MEX.

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Externalities

Address External Costs of Transport Separately

- Examples: accidents, congestion.
- Societal costs linked to how, what, and where we drive.
- They should be paid for, but where to capture them (fuel pricing, vehicle tax, pollution tax, congestion pricing) depends on how the externalities are created.
- The cost of CO_2 should be captured in fuel pricing.
- For many others, may be better to address within externality category than as a part of fuel subsidy estimates.

Leveraging Global Subsidy Reform

Desired End Points for Subsidy Tracking

- **De-politicization of valuation, disclosure**.
  - International Accounting Standards Board model of independent professional standards setting body might help.
  - Specialized focus on particular subsidy types can work through measurement challenges.
  - Make mandatory reporting truly mandatory.
- **Decision-making relevance.** Near-real time data on subsidy policies that distort or undermine trade and climate commitments.
- **Policy alignment.** Fiscal spending supports environmental objectives; climate policy and subsidies not at cross-purposes.
- **Policy contestability.** Ability to evaluate promised outcomes versus actual; and to propose more varied options with better fiscal and environmental trade-offs.
- **Financial savings** and improved economic efficiency.

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