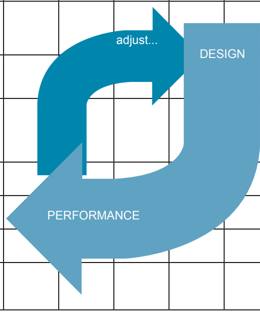
X: Subsidy Design Variables

Y(X): Subsidy Performance	Objective economy, environment, security, social equity	Funding tax, levy, windfall	Intititional Setup government tiers; auto-numeous fund; multi-player fund; ESCROW; private agent;...	Recipient and Beneficiary private sector firm(s); households; communities; children etc.	Type by targeting method; direct/ indirect, etc.	Selection Competition selection by fixed/variable economic/ social/finan-cial/polítical criteria etc. competition for/in market by project/ yardstick	Amount Timing Exit how much sequencing; paseout;...	Regulation who regulates; tariff schemes mirror regula-tory require-ments; mini-mum quality of service/pro-duct/reporting etc.	Monitoring & Adjust-ments who monitors output indicators; who evalua-tes impacts; baseline; M&E scheme cost, ...
Effectiveness Objective reached Targeting Scalability Speed?									
Efficiency minimal distortion $/Output Admin Costs									
Sustainability (user/provider/market) economical financial ecological social									
Resilience simplicity, stability flexibility, adjustability over time									
PSP FDI PSD									
Transparency monitorability predictability									
Politics visibility, constituency, votes (personal profits, power) (fast disbursements)									



Energy Subsidies: Why, When and How?

A Think Piece

gtz
International Water Policy
and Infrastructure

On behalf of
Federal Ministry
for Economic Cooperation
and Development

"And what is a man without energy?
Nothing – nothing at all."
Mark Twain (1860)

*"Regions conspicuously without service should be investigated for […] the **advisability** of Federal and/or State contribution toward the cost of rural lines […] and, if advisable, the **methods** to be followed in making such contributions."*
Morries Cooke (US Parliament's Electrification Fund Debate 1933)

This discussion paper was prepared by *ii*Development GmbH on behalf of Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH

Abbreviations and Acronyms

BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung
DGIS	Netherlands Directorate-General for International Cooperation
EC	Economic Cooperation
EnDev	Energising Development (DGIS/ BMZ-funded access program executed by GTZ)
ES	Energy Subsidies
ESCO	Energy Service Company
ESMAP	Energy Sector Management Assistance Program
FDI	Foreign Direct Investments
GEF	Global Environment Facility
GPOBA	Global Partnership for Output-Based Aid
GTZ	Gesellschaft für Technische Zusammenarbeit
GW	Gigawatt
IDB	Inter-American Development Bank
KfW	KfW Entwicklungsbank
kW	Kilowatt
kWh	Kilowatt Hour
LAC	Latin America and the Caribbean
LDC	Least Developed Countries
M&E	Monitoring and Evaluation
MDG	Millennium Development Goal
MFI	Micro-Finance Institution
MSC	Medium-term Service Contract
MSME	Micro, Small and Medium Enterprises
NGO	Non-Governmental Organization
OBA	Output-Based Aid
ODA	Official Development Assistance
PIAFF	Public-Private Infrastructure Advisory Facility
PPA	Power Purchase Agreement
PPI	Private (Sector) Participation in Infrastructure
PPP	Public-Private Partnership
PSD	Private Sector Development
PSP	Private Sector Participation
RET	Renewable Energy Technology
SHS	Solar Home System
SME	Small and Medium-Sized Enterprise
TA	Technical Assistance
UNDP	United Nations Development Program
Wp	Watt Peak
WSSD	World Summit for Sustainable Development, Johannesburg 2002
WTP	Willingness to Pay

Table of Contents

Summary

This report discusses the rationale and performance of energy subsidies, proposes a new tool for subsidy evaluation and design, applies this tool to the analysis of prominent subsidy schemes, and draws conclusions for GTZ.

Energy subsidies typically reduce welfare by creating massive market distortions and significant GDP losses. However, **subsidies can make economic sense in specific cases, which we discuss and quantify** by applying basic economic theory in illustrative examples.

Independently of their economic rationale, energy subsidies can be expected to remain a mainstay of public policy and ODA in the medium term (in fact, it can be argued that any form of ODA is a subsidy with distortive potential). Therefore, it is crucial to (re)design subsidy schemes in a way that minimizes damage and maximizes performance. However, literature provides not much practical advice on this important question: **How to design sound subsidies?** The report provides guidance for practitioners, by practitioners.

A new practitioners' tool for sound (energy) subsidy design is proposed: the Subsidy Matrix. The matrix approach allows a structured process to identify design options and weigh typical performance trade-offs inherent to subsidy design. The Subsidy Matrix approach is applied to produce several scorecards for the evaluation of subsidy models and mechanisms with respect to performance. We compare the performance of (i) indirect versus direct subsidies, (ii) several consumption versus access subsidy types as well as (iii) thirteen recent SHS subsidy schemes. Our analysis illustrates that:

1. There is no “one-size-fits-all” subsidy instrument – appropriate solutions have to be fine-tuned for each country and market stage.

2. In practice, the two often quoted subsidy performance criteria (efficiency and effectiveness) should be complemented explicitly by several secondary, “pragmatic” performance criteria (such as implementation speed and resilience against unexpected country crises) as those greatly affect subsidies in real life.

3. There are unavoidable trade-offs between these performance indicators – for instance, fast implementation usually means sacrificing efficiency. Therefore, policy makers have to prioritize. This has to be distinguished from outright bad subsidy design, which unnecessarily sacrifices performance.

4. Where distortive subsidies cannot be avoided, practitioners should start from idealized, optimal subsidy recommendations (which are often incompatible with real life) – and then apply those to the given country reality to reach feasible improvements of the status quo (which may stray from the optimum).

5. Access subsidies can have better targeting performance than consumption subsidies, but experience and advice on access subsidy design is rare to date.

6. Solar Home System subsidies can potentially have stellar targeting performance, because they lend themselves to progressive self-selection schemes.

7. Where massive results are intended (for instance to reach MDGs in time), direct subsidies can be more effective (with respect to sheer scale) than TA measures in the short term (sic).

8. Where direct subsidies are applied, stand-alone small pilots can be risky, because their performance is limited by scale and long-term market sustainability (as exit strategies are difficult). Therefore, it has to be demonstrated that long-term gains from replication and learning outweigh the relatively high transaction costs.

9. Proper procedures for provider selection are a prerequisite for sound direct subsidies and successful private sector participation, but are sometimes neglected by small donors.

10. The BMZ/DGIS-funded Energising Development program is a promising new energy subsidy instrument. It scores high on efficiency, scale and sustainability (which are often antagonistic on donor level), by combining the advantages of a programmatic, long-term local presence (needed to build local private sector capacities) with a unique benchmarking process that allows to reassign funds from weak performers to stronger ones. This reduces portfolio risk and allows for shorter preparation time as well as flexible adjustment of operations during implementation.

Introduction

Energy is back on the development agenda. In light of climate change and stark social inequalities regarding energy access, massive scale-up of energy lending and new ODA instruments have been announced repeatedly over the last years. Sector reforms have stalled across LDCs, in search of locally adapted, pragmatic step-by-step improvements. Much needed sector investments and cost reductions require private sector participation – but the local private sector remains weak and legal and financial market frameworks remain adverse. The vast majority of energy utilities remain public.

In this difficult context, and considering the obvious importance of energy as input factor to growth and MDGs alike, policy makers and donors have "rediscovered" the topic of energy subsidies. On the one hand, subsidies need to be abolished, the sooner the better. They create massive price distortions and supposedly poverty-targeted consumption tariff schemes perform horribly, virtually independent of their design details. On the other hand, subsidies promise help to achieve urgent policy goals – and are likely to remain popular and ubiquitous for decades. So, we may as well try to limit the damage – and learn how to maximize subsidy performance.

Thus, the questions: **When (and why) are energy subsidies appropriate? And how can their performance be improved, via intelligent subsidy design?** This report provides some elementary, readily applicable recommendations for policy makers and practitioners, who ask these questions for their daily work (or should ask them). Doing so is a surprisingly rare endeavor: not much has been published on practical determinants of sound subsidies, beyond general "textbook economics".

This knowledge gap is relevant: while preparing this report, we have encountered a surprising number of puzzled (sometimes non-energy) practitioners who need to address subsidy design issues in the field (be it donor or government staff) and cannot find readily usable guidance. We also found a prevalence of "half truths" and "policy myths" about subsidy design which hold true only in very specific contexts but are all too often applied across the board. Here's a list of real-life sound bites we have assembled:

Real-life sound bites around energy subsidies:

- "Lifeline tariffs are just because energy is a public good."
- "Any project that provides subsidies needs to have an exit strategy showing that no more subsidies are needed by project end."
- "When meeting the utilities for the first time, I erroneously suggested 15$ instead of 50$ subsidy per household – they accepted it and the project works well ever since."
- "Guatemala's electrification program was extremely successful as it has subsidized 120,000 new grid connections in only three years."
- "Chile's access program selects projects to be subsidized exclusively based on economic and social merits."
- "We don't subsidize in our component, instead we use the full grant for TA to local SME"

While most of the methods and analyses presented in this report (namely chapters 2 and the subsidy matrix approach) are valid and meant for all types of energy subsidies (and infrastructure subsidies in general), **our primary focus in chapter 3 is on direct subsidy schemes for electricity access.** This is because (i) access subsidies have the best poverty targeting potential, (ii) access subsidy schemes vary more with country conditions than other subsidy types, increasing practitioners' demand for practical answers and tools; and (iii) there is even less literature on the practical design of access subsidies than for other energy subsidy types.

Chapter 1 provides the context of our discussion and introduces the nexus between PSP, PSD and subsidies.

Chapter 2 presents economic theory's answers on **why**, **when** and **how much** to subsidize. While much has been written about the general question of why subsidies are (or are not) warranted in idealized model cases, virtually no published information exists that would help practitioners and policy makers on the decisive **"How To"** design sound subsidy schemes in a given country, responding to given boundary conditions and national policy goals. This paper provides first elements for a **"How To"** manual, with a specific focus on access subsidies, because this is where the greatest need of practitioners and the clearest potential for subsidy design solutions are.

Chapter 3 proposes a tool to bridge theory and practice: The Subsidy Matrix. This is a new framework for systematic design, analysis and evaluation of subsidy schemes in practice. Subsidy design variables and performance criteria that matter in real life are presented and discussed. This tool is then applied to score and discuss prominent subsidy models and mechanisms.

Chapter 4 draws conclusions for practitioners and provides an outlook towards future work on energy subsidies.

1 CONTEXT: Private Sector Participation – Means or End?

"Only a fraction of the world's 500m impoverished "micro-entrepreneurs" have access to the financial system. There is not enough donor or "socially responsible" money in the world to meet the demand. That's why microfinance needs private-sector capital. Aid agencies, philanthropists and well-meaning "social" investors can help attract it by investing only where commercial outfits will not. When the children come of age, the best parents step aside."
The Economist: (3-17, 2007)

1.1 From PSP to PSD

1.1.1 Why Start with Private Sector Participation (PSP)?

Why should a paper on energy subsidies start with a chapter on Private Sector Participation (PSP)? Any discussion of the advisability, performance and design of energy subsidies necessarily needs to be placed in the context of today's energy sectors, which (a decade after hot debates around sector reform and the "rise and fall of PPI"[1]) in developing countries as well as G8 states (i) have returned to a more pragmatic, locally adapted, step-by-step optimization of the crucial interaction between private and public functions (with notable exceptions), (ii) rely on the private sector as the main driver for allocative and administrative efficiency, creativity and much needed sector investments and (iii) recognize that the public sector faces the twin challenge of (a) providing appropriate frameworks for functioning markets while (b) improving its own efficiency.

1.1.2 Market-based Economies

Basic economic theory shows that market-based approaches allow for optimal allocation of resources and maximum welfare in a given system (assuming perfect competition, no externalities, no public goods, etc.), as they maximize benefits from comparative advantages via specialization and trade. Competing firms strive for innovation and efficiency gains: by rewarding good performers (ideas) and sorting out underperforming firms ("creative destruction"), this optimization process leads to growth and reaches consumers via lower prices and improved quality.

In practice, however, markets may divert substantially from the ideal textbook model and result in inefficient outcomes. Regulation and appropriate market frameworks can thus play an important role in assuring optimal growth and sustainable distribution of benefits in real-life market-based economies.[2] This general truth is of special importance in the context of infrastructure in developing countries, where markets are often miles away from ideal (not least because there are services with declining average costs, which creates the situation of a natural monopoly), capacities of both the private and the public sector are very limited, distortions abound and institutional, financial, legal and regulatory frameworks are often inappropriate. In fact, where markets fail so that a case can be made for regulation and government intervention, there is also significant scope for government and public sector failures. This is why reforms that are targeted at the private sector (competition, transparency and accountability, etc.) are also relevant to the public sector.

1.1.3 PSP to Solve Budget Constraints and Improve Performance

To address severe shortcomings of public utilities throughout the second half of the 20th century, a wave of structural reforms to infrastructure sectors initiated in many countries in the 90s, involving the vertical and horizontal unbundling of sector functions and privatization, with the general aim to increase (i) transparency, (ii) sector efficiency, and (iii) to attract foreign direct investments (FDI) (and sell public infrastructure assets) in order to decrease

[1] Harris 2003
[2] Stiglitz 2008

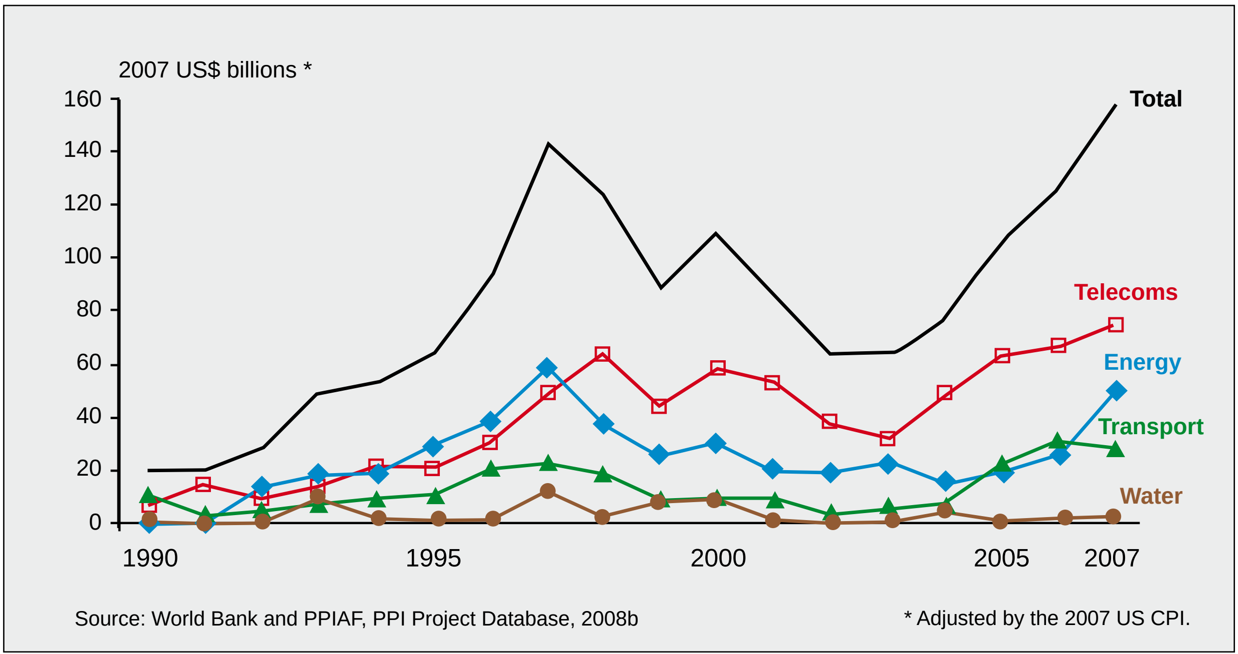
drains on public budgets while allowing for much-needed new infrastructure investments.[3] An often unspoken additional consideration was (iv) the de-politization of infrastructure: private sector players would invest based on profit considerations (and thus follow demand) instead of votes and might be able to raise tariffs to sustainable levels (a daunting task on which state utilities have a miserable track record).

However, these reform objectives were often mixed up, rarely prioritized, and sometimes only one of the objectives became the overriding aim (often the need for funding), barring the way for well-balanced reforms which need to optimize all these objectives at the same time.

The term PSP(I) has emerged from the first wave of reforms that started in the UK and Chile. It initially referred mainly to the degree of private sector investment in a given sector – and FDI was often used as the single most important indicator for the degree and success of PSP in a given country.

Measured by this indicator, PPI has been a mixed success over the last two decades, as shown by the graph below: Initial success was followed by sharp downturns; with a healthy revival over the last years.[4] It is interesting to note that much of the recent rebound in FDI actually stems from non-G8 countries: PPIAF (2008) shows that almost half of the 2006 investments to PPI projects in LDCs came from investors from developing countries – roughly half of that from the respective country itself.

Figure 1.1.3: *Investment commitments to infrastructure projects with PPI in developing countries by sector; 1990 - 2007; source: PPIAF 2008b*



3 Bacon 2002, World Bank 2004, Besant-Jones 2006 and Estache 2006, amongst others

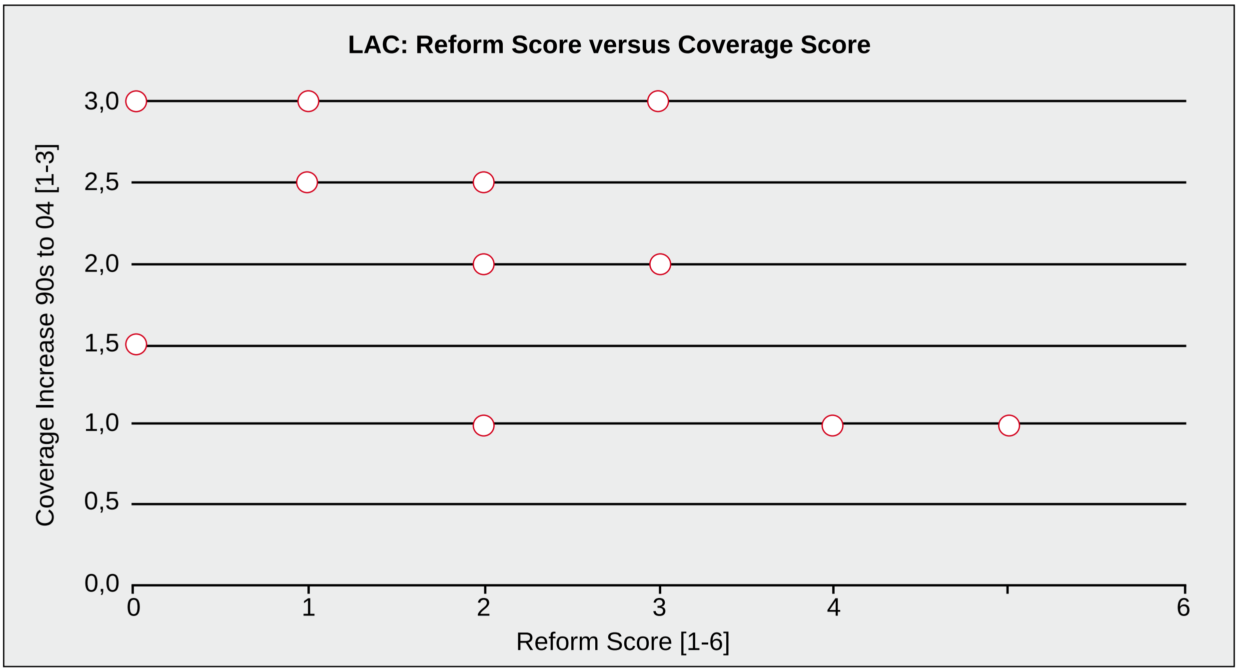
4 "Relative to GDP, inflows of foreign direct investment to developing economies have increased sevenfold since the 1980s. In some countries, such as Hungary and Brazil, foreign firms account for half or more of all R&D spending by companies. This has had dramatic demonstration effects. Local French-language call centres in Morocco and Tunisia got going only after French operators began outsourcing to the Maghreb. A quarter of Czech managers said they learned about new technologies by watching foreign companies in the Czech Republic." (The Economist February 9th 2008 and World Bank 2008)

1.1.4 Why Sector Reforms Failed on Some Accounts

Due to a variety of reasons, the original sector reform process (pushed to a large extent by the donor community) did not deliver on all promises in most of the countries as fast as expected (though empirical evidence shows that benefits have usually outweighed costs), and has meanwhile stalled in many LDCs.[5] One of the more prominent evidence-based criticisms is the underperformance of most reforms regarding distributive effects – the poor often did not profit at all![6] In Latin America, for instance, where reforms have started earliest, one can show that progress in reform was not correlated to electricity coverage increase on regional level (see figure below), in spite of some impressive results regarding efficiency gains and improved quality and coverage on micro level.

Arguably the most important reason for the failures of sector reform was a tendency to push for fast adoption of too many reform steps at once in too many countries at once (with the obvious danger of ”one-size-fits-all” cookie-cutter repetitions) – without giving due consideration to the differences in country conditions, market stages, and the often limited absorptive capacities of the local public and private sector.[7] Some publications pointed to this issue very early on.[8]

Figure 1.1.4: *Progress in Energy Sector Reform was not correlated with increased coverage in LAC; source: Adapted from Teplitz (2006)*



Therefore, most recent publications on the way ahead for sector reforms and improved private sector participation in infrastructure explicitly acknowledge a need for increased attention to sequencing and timing of the reform steps, to locally adopted solutions and to capacity building. Sector reform has to be seen as an ongoing process, with well-balanced optimization criteria and a set of tools at hand.[9] This process (and the local capacity needed for it) needs to be slowly built, country by country, and hinges on the degree to which capacity building can improve the local absorption capacity.

[5] Estache 2006 provides a balanced discussion of the problems encountered in reforming infrastructure sectors and provides a good review of recent research.
[6] Estache 2002, Estache 2005
[7] Besant-Jones 2006
[8] Teplitz 1990
[9] This need of balancing several objectives and the lack of practical advice on how to do so is very similar to the requirements of properly designed energy subsidy schemes, as shown by the present report.

1.1.5 PSP Requires PSD!

In this context, the efficiency/know-how objective of PSP deserves attention: If infrastructure sectors are to profit from creativity, flexibility and efficiency of private sector players, and if actual (local) private sector capacity and public sector governance are preventing success on this account, then the aim for PSP translates into a need for PSD on local level! This notion is gaining ground amongst policy makers and opens up new opportunities for more sustainable sector reform processes.

Developing a functioning local private sector, in turn, requires building capacity on micro, meso as well as macro level.[10] Moreover, if improved efficiency, accountability and creativity are the primary goal of reform, then PSP – in a broader sense – would even include the improvement of public utilities by applying private sector-based management best practices (covering issues such as salary structure; transparent incentives; competition; and benchmarking) to public entities in addition to passing on as many responsibilities as possible to a functioning private sector.[11]

Like infrastructure, PSD is a major bottleneck for most donor interventions across all sectors. And just like infrastructure sectors are currently looking for practical advice on how to improve sector structures and provider performance in the new, public-private settings described above, PSD now needs to answer new questions in a new context: How to keep the focus, now that non-profit organizations and public agencies fall under PSD in the broadest sense?[12] Should donors fund weak private and/or weak public utilities – and if so, what would pragmatic safeguards look like? How can the financing needs and risk allocations of local private sector players be improved (e.g. via dedicated credit facilities or partial risk guarantees) without distorting the market? How can donors efficiently blend their funds with increasing funding from philanthropic sources and via "new FDI" from non-G8 countries, such as the BRIC countries?

[10] PSD covers issues as diverse as the sustainable provision of business development services, the strengthening of business associations, the improvement of local financial markets and regulatory frameworks, investment climate surveys and trade-talks.

[11] World Bank 2004 for energy; and Morduch 2005 for a similar situation in the microfinance sector: "Profitability does not equal efficiency. New data show that efficiency (lean management structures, low unit loan costs, and high numbers of loans per staff member) depends largely on giving staff the right incentives and using information well. The Microbanking Bulletin, for example, shows highly efficient institutions that are subsidized, as well as some that are profit-making. It also shows profitmaking institutions that are not particularly efficient."

[12] T. Hart, March 19, 2007, PSD BLOG, World Bank Group. "New currents in water supply. As we head towards World Water Day this Wednesday, we here at the World Bank Group are still mulling over our annual Water Week, held at the end of February. We heard about some emerging issues of importance such as the role of water in climate change adoption, as well as the need to focus more on groundwater as well as water quality. However, in terms of the intersection between water and the private sector, we also took stock of the landscape in water supply and sanitation public-private partnerships (PPPs). The total number of countries with water PPPs in operation has been growing every year. Sixteen countries have introduced for the first time private sector participation in water since 2000, including Russia. However, 20 countries which had water PPPs have reverted to public-management-only models. These trends show a more distributed role for public and private actors, as well as for civil society, in the water supply arena. We have been seeing lots of "hybrid" models which work in terms of distributing risks more realistically.

1.1.6 PSD: Byproduct or Means?

For this report, Private Sector Development has a cross-cutting character, and the nexus between private sector, energy and subsidies is therefore multi-pronged:

(i) Efficient energy markets are an important determinant of economic growth. In this context one of the concerns is the limiting role of modern energy as an input factor to competitive private sector-led growth: without energy at adequate price and quality, private sector productivity is hampered.[13]

(ii) As we have seen above, PSP is a condition for well functioning energy markets, and successful PSP requires adequate private sector capacity and market frameworks, so that PSD is a necessary element of programmatic energy sector interventions. In that sense, providing PSD services is a means for energy sector improvements. Where such targeted PSD services are provided with support from donor projects or government, this is a case of indirect subsidies, which benefit the energy sector. This includes PSD for non-energy businesses, such as local FIs to address local capital market shortcomings or rural farmer coops to increase the impact – and margins – of universal access strategies. It can be difficult for energy interventions to draw the line in order to stay manageable.[14]

(iii) At the same time, PSD in energy sector operations is an end in itself (or at least a desired side-effect): where private sector performs well, income and employment are generated in the sector. In addition, improved sector efficiency generates multiplier effects outside the energy sector.

(iv) The Private sector needs to be profitable. Therefore, politically and/or socially desired functions (such as increasing electricity access or supporting climate-friendly technologies) that state utilities often cover in traditional power sectors (albeit with mixed results, due to vast inefficiencies) are of interest to the private sector only if the return on equity is better than from other opportunities (after including soft factors for long-term company performance, such as corporate responsibility considerations). Therefore, unprofitable market segments will be shed quickly. If a government or society prioritizes such an unprofitable aim (say, electrification), it needs to provide subsidies (say, to buy down the affordability gap of rural connections) or oblige private sector to meet performance targets (which in turn requires cross subsidies via tariffs if no explicit subsidy fund is provided). Indeed, this is one of the objectives of sector reform: to make unprofitable sector functions visible – and the previously hidden government subsidies more transparent (see budget drain argument in section above), so that governments (and ultimately voters) can decide about their prudence (or priority). In that sense, and in light of the strive for a socially more acceptable energy reform process (which gives way to claims for universal access and lifeline rates), ironically, PSP has been a main driver for bringing the topic of subsidies back to the table – leading to an ongoing quest for better designed, "smart" subsidies.

(v) Finally, one of the most frequent arguments in favor of direct subsidies in energy interventions is that it would help attain scale economies (infant industry argument): weak private sector players in nascent segments of national energy markets receive pump-priming subsidies (if accessible to the whole sector) or start-up subsidies (if given to individual companies) with a view to initial market entry barriers, mid-term, cost reductions (which allow the subsidy to be phased out) and increased competition (due to more players active in the sector).[15]

Because of this cross-cutting character, we have upgraded PSD to the level of a separate subsidy performance criterion in the analysis chapters of this report (see energy subsidy matrix in chapter 3.5).

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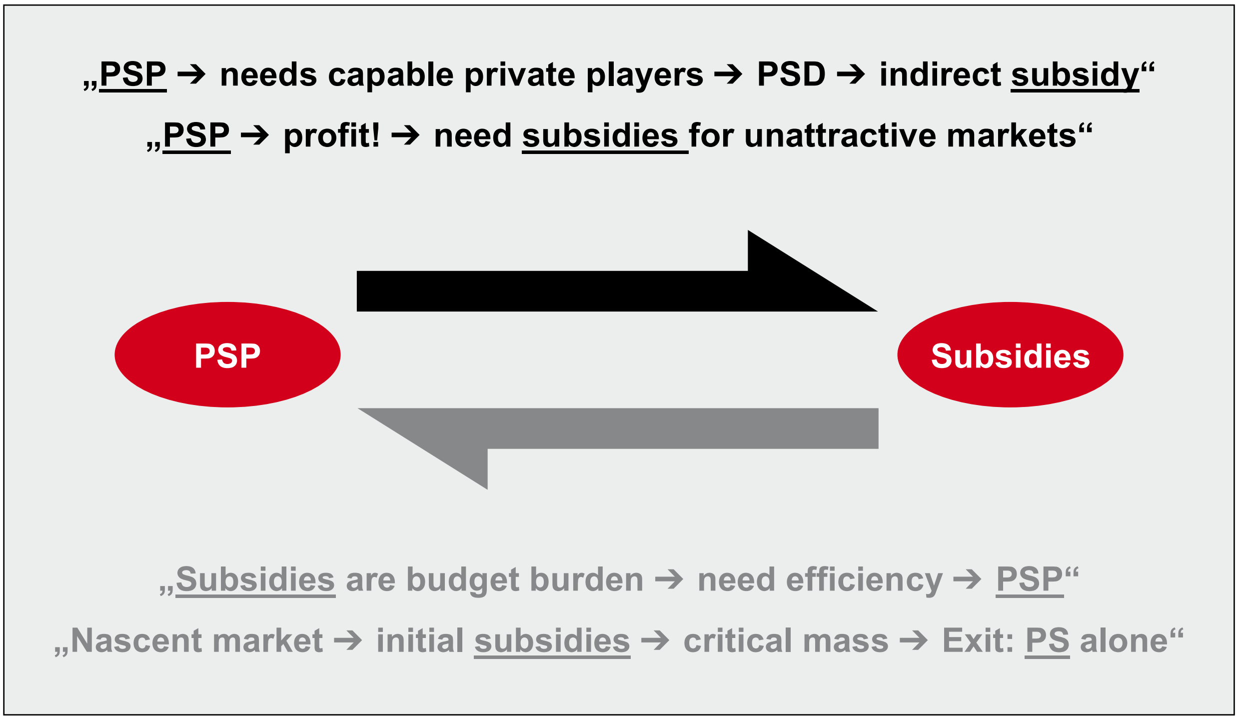
[13] World Bank 2008 suggests an interesting causality chain that identifies the availability of basic infrastructure as a main bottleneck to the absorption and diffusion of new technologies, which in turn hampers private sector-led growth through innovation (see also Economist February 9th, 2008)

[14] See Reiche et al. 2006 with an example in Nicaragua.

Figure 1.1.6: The Relation between PSD and Subsidies; source: Own elaboration



1.2 Definitions: PPP and PSP

Definitions for PPP and PSP can be confusing, as they differ between countries and agencies, depending on the historical context. This reflects the fast development of the PPP agenda over the last two decades. Definitions used within Germany seem especially diverse, maybe reflecting the fact that Germany lags behind in PPI.[16]

For the purpose of this report, PSP refers to ventures where both private sector and government assume a significant share of equity or risk, while PPP refers to public-private partnerships in a broader sense. The latter includes PSP, but also cases where governments facilitate PPI in general or provides services normally performed by private sector.

[15] More on these subsidy types see chapter 3
[16] Hirschhausen 2002

2 THEORY: Fundamentals and Objectives of Energy Subsidies

"I am opposed to the Federal Government's going into the power business or lending money for the purpose of generating electricity"
Senator William H. King during the debate of USA's first REA (1936)

2.1 Definitions and Introduction to the Problem

2.1.1 Subsidy Definition

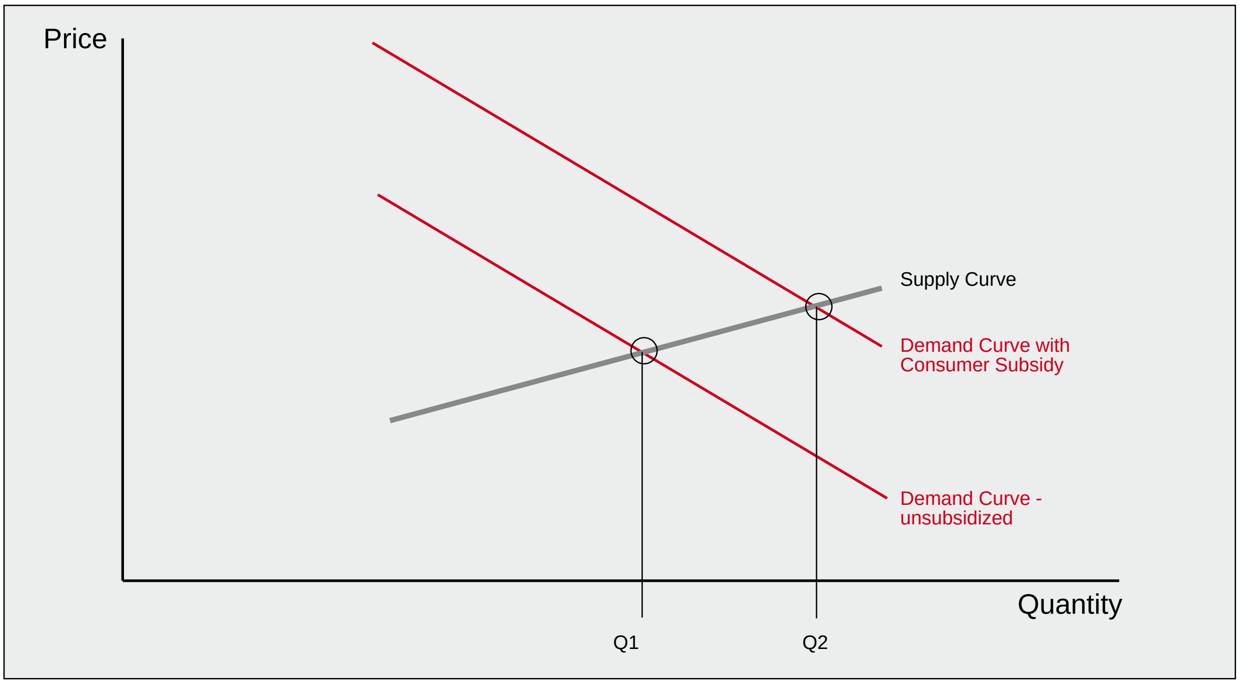
The exact definition of the term "subsidy" is in itself an interesting topic as definitions applied in relevant literature and practice are varying greatly and even nuances have significant implications.[17] Some examples are given in the text box below. In the context of this study, we found the following short practitioners' definition very useful, which serves the purpose in the majority of cases:

Practitioners' Definition:
Subsidies allow (supply and demand to meet at) (end-user) prices below costs

Figure 2.1.1 is typically used in economic textbooks to illustrate the way subsidies work in principle: a consumption subsidy comes on top of the actual consumers' willingness to pay, resulting in a right-shift of the demand curve: Supply and demand meet in a new market equilibrium with a higher output. Likewise, production subsidies shift the supply curve down, again with a new equilibrium.[18]

The inherent problem of all subsidies is that these shifts may distort price signals and therefore reduce allocative efficiency, leading away from a (Pareto) optimal distribution and use of goods/services (see next section 2.1.2).

Figure 2.1.1: *Consumer subsidies shift a demand function to the right; source: Own elaboration*



[17] Amongst others,, see: Boss&Rosenschon (2006) and Koplow (2004)
[18] The following chapter 2.2 applies the demand function concept more thoroughly, for a step-by-step discussion of the basic economics involved in subsidizing energy. By using simple calculus, typical costs and quantities (in this case, for electricity supply and demand) and real-life examples, the chapter stays close to practitioners' experience.

BOX: List of alternative subsidy definitions – in lieu of many

OECD 1998: A subsidy is "any measure that keeps prices for consumers below market levels or for producers above market levels or that reduces costs for consumers and producers"

IEA: An energy subsidy is "any government action that concerns primarily the energy sector that lowers the cost of energy production, raises the price received by energy producers or lowers the price paid by energy consumers".

OECD – COP8:[19] Subsidy is a **financial contribution by a government, or government-directed entity, that confers a benefit.** The definition used by the World Trade Organization (WTO) includes the case where government revenue that is otherwise due is foregone or not collected (e.g. a fiscal incentive such as a tax credits), but would not in most circumstances include the value of non-internalised externalities. The WTO definition also includes income or price supports. Implicit in the definition of a subsidy is the notion that a subsidy is an economic instrument purposefully used by a government to achieve an objective or objectives. Subsidies can be general or specific, and the beneficiary can be a producer, a consumer or some other market actor. **A subsidy is distinguished from a positive incentive in that a subsidy may go beyond correcting for a market failure** (e.g. compensating for the provision of a public good) and convey a rent to the recipient.

WTO:[20] For the purpose of this Agreement, a subsidy shall be deemed to exist if: **a.1)** there is a **financial contribution by a government or any public body** within the territory of a Member (referred to in this Agreement as "government"), i.e. where: (i) a government practice involves a **direct transfer of funds** (e.g. grants, loans, and equity infusion), potential direct transfers of funds or liabilities (e.g. loan guarantees); (ii) government revenue that is otherwise due is **foregone or not collected** (e.g. fiscal incentives such as tax credits)(1); (iii) a **government provides goods or services other than general infrastructure,** or purchases goods; (iv) a government makes **payments to a funding mechanism,** or **entrusts or directs a private body** to carry out one or more of the type of functions illustrated in (i) to (iii) above which would normally be vested in the government and the practice, in no real sense, differs from practices normally followed by governments;

or a.2) there is **any form of income or price support** in the sense of Article XVI of GATT 1994;

and (b) a **benefit** is thereby conferred.

[19] cop-08-27-add1-en.doc - OECD
[20] WTO: Agreement on Subsidies and Countervailing Measures

2.1.2 Why Subsidies Should be Avoided

Subsidies distort price signals and therefore lead to inefficient resource allocation (e.g. by maintaining uncompetitive sectors). They can crowd out private sector players and investments, hamper healthy market growth (e.g. by supporting inefficient firms or public agencies), reduce welfare (e.g. through wasteful competition of municipality subsidies for a new industry - a form of "local FDI") and they often are a constant drain on government budgets, cutting fiscal space and making governments unable to function properly, as budget deficits can only be met with additional taxes or more debt, which both hamper GDP growth (see below).

Price distortions in the energy sector are problematic for several reasons. On the consumer side, prices fixed below the free market level tend to result in an over-consumption of energy (e.g. electricity) and environmental burden.

The same logic applies to the supply side. Subsides assigned to energy producers reduce incentives to efficiently use input resources, which may lead to inefficient over-production.

Moreover, **subsidies often don't reach the intended beneficiaries** (e.g., diesel subsidies in LDCs which usually favor the non-poor).[21]

In short, it seems that subsidies ought to be avoided wherever possible. It is a major challenge for donors and governments to address this urgent issue, especially in the light of rising fuel prices.[22]

Table 2.1.2a: *The Impact of Removing Energy Consumption Subsidies in selected Non-OECD Countries; source: IEA (1999)*

Country	Average rate of subsidy (% of market price)	Annual economic efficiency gain (% of GDP)	Reduction in energy consumption (%)	Reduction in CO_2 emissions
China	10,9	0,4	9,4	13,4
Russia	32,5	1,5	18,0	17,1
India	14,2	0,3	7,2	14,1
Indonesia	27,5	0,2	7,1	11,0
Iran	80,4	2,2	47,5	49,4
South Africa	6,4	0,1	6,3	8,1
Venezuela	57,6	1,2	24,9	26,1
Kasakhstan	18,2	1,0	19,2	22,8
Total sample	21,1	0,7	12,8	16,0
Total world	n.a.	n.a.	3,5	4,6

[21] Barnes and Halpern 2000
[22] GTZ 2007

BOX: Morocco – reform of butane subsidies and social protection of low income households

Morocco has eliminated subsidies on most petroleum products in 2006. Butane however remains substantially subsidized for half of the consumer price. Subsidies were initially justified as an instrument to accelerate the use of modern energy especially among rural and low income households, and to reduce pressure on scarce fuel wood. The subsidy program proved very successful in this respect, as butane is now the fuel of preference for households in the entire country, with significant positive effects on indoor pollution and gender. With the growth of international prices of butane since 2000, however, and retail prices that remained fixed, the level of the subsidy has increased to about USD 500 million annually, equivalent to 20% of the government investment budget. Such levels of subsidies are logically having a very negative impact on public expenditures. Furthermore, the social analysis of the beneficiaries of the butane subsidies demonstrated that, in fact, only 20% of the subsidies are received by the poor. The Government is, therefore, exploring ways to revise its policy on butane subsidies. In that context, the Government wants assistance in exploring alternative mechanisms tested in other countries which would allow for a substantial reduction of its overall butane subsidies while ensuring that the social benefits of butane utilization are maintained for low income consumers, that no switching back to wood fuel takes place and that no negative gender impact is created.

Source: World Bank (2007)

However, there are specific cases where subsidies can be warranted on purely economic grounds, namely when they are the optimal way to address market imperfections or distributional objectives, and in cases where other forms of cash transfer seem more vulnerable to fraud. Some argue for energy subsidies on the basis of public good arguments, even though energy is not a public good per se (yet, perfect public goods are a rare thing).[23] Energy **subsidies may also be warranted for social reasons**, for instance if a society decides that universal access is a national priority (as is the case in Argentina, Bolivia, Brazil and Chile), or to dampen the negative impact of market liberalization on the most vulnerable groups.

The table below compares services provided by utilities with goods and services of other sectors, taking into account administrative features and other service-related arguments that can be advanced in favor of or against the effectiveness of subsidies: The universal reach argument militates in favor of subsidies to expand essential services to population segments that the market fails to reach. Subsidy support has a strong effect on welfare if the marginal valuation of the service/good in question increases with income, which is not the case for inferior goods/services. Subsidy targeting is easier for non-tradable goods/services because the difficulty to convert the subsidy into cash (through re-sales) reduces the incentive to apply for subsidy support even when the subsidized service/good is not needed. Obviously, a strong case can be made for subsidies if they address externalities or when the good/service in question is considered intrinsically desirable/beneficial irrespective of the consumers' preferences (merit good argument).

[23] The definition of a pure public good is that its benefits are non rival and non-excludable (e.g. street lighting).

Table 2.1.2b: *Comparison of infrastructure/utility subsidies with subsidies in other sectors[24]; source: Adapted from Foster (2001)*

	Utilities			Other goods and services			
	Water	Sanitation	Electricity	Food	Education	Health	Transport
Universal reach	*		**	***	**	**	**
Inferior goods	**	**	*	***	*	*	*
Differentiable	**	**	*	***	***	***	*
Non-tradable	*	**	*				
Externalities	**	***		*	*	***	*
Merit goods	**	***	*	**	***	***	**

Note: *** - often applies; ** - sometimes applies; * - occasionally applies

Even in absence of sound economical reasons, and after factoring in price reductions from cost and efficiency improvements, the political cost of cost-covering tariffs across the board may be significant in many cases, so that in reality energy subsidies are likely to remain an important policy instrument for quite some time.[25]

How to decide, then, when the overall benefits of a subsidy to society outweigh its costs? And – in cases where subsidies are given (be it for sound reasons or not), how can the benefits be maximized while minimizing distortions? The following sections of this paper analyze these questions, from a fresh perspective, which aims at bridging the gap between basic economic analysis and the questions of development practitioners in the field.

2.2 Rationale of Subsidies - Why, When and How much?

Subsidies for infrastructure services are ubiquitous, notably in developing countries, but the case made for the subsidies often is murky. Usually, it is simply assumed - without providing proof - that subsidies are justified because they "improve someone's well-being". This weakness does not mean, however, that no convincing arguments could be raised in favor of subsidies. In fact, simple economic reasoning suggests that subsidies may have a role to play in facilitating welfare improvements.

To demonstrate the potentially beneficial effects of subsidies it is useful to start with the opposite case where subsidies would involve a welfare loss (referred to by economists as a "deadweight loss"). The case in question is a well-functioning market in which prices reflect social costs and benefits and supply meets demand in a competitive equilibrium. The competitive equilibrium would be Pareto-efficient in that no one could be made better off without making someone worse off. Hence, a subsidy (or a tax) causing a departure from the equilibrium will entail a net loss in welfare.

[24] When comparing utility subsidies with subsidies in other sectors, one finds that the case for subsidies on purely distributional grounds is simpler to make for food and education than for infrastructure services.

[25] Komives (2005): "Nevertheless, achievement of full cost recovery has proved elusive even in those countries that have had the political will to embrace this goal. In many parts of Asia and Africa, tariffs would have to increase between twofold and tenfold (especially in the water sector) in order to have residential consumers cover the cost of the service they receive. Tariff increases of this magnitude would push around half of households in Africa and South Asia, and about a third of household in East Asia, to spend more than five percent of their income a month on water or electricity service, or to dramatically reduce their consumption below subsistence norms. They also would have major and unpredictable effects on demand for utility services and non-payment rates. Beyond these social concerns, attaining full cost recovery has also proved difficult from a political economy perspective. Given the utility subsidies currently benefit such a broad swathe of the population, it is often possible to form a large coalition against any measures to reduce or eliminate them. For all of these reasons, subsidies are therefore likely to remain an important component of utility service finance over the medium term. The relevant policy questions are thus how to improve the performance of utility subsidies, keep them as small as is practically possible, limit the extent to which they undermine the performance of the sector, and decide when there may be other (perhaps more effective) means of achieving policy objectives. This book has focused on one particular – but nevertheless central – aspect of subsidy performance: the extent to which subsidies succeed in targeting the poor."

2.2.1 Demand Function and Consumer Surplus

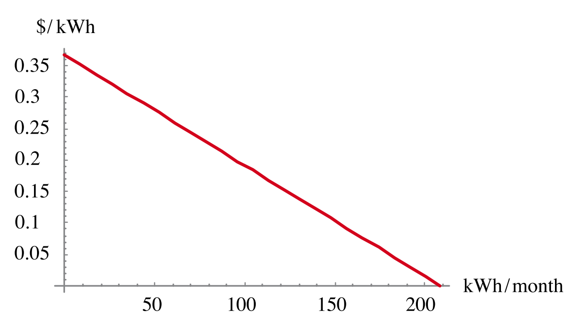
To illustrate the point, let us start with considering a linear demand function, say, for electricity, which can be defined as

$$(1) \quad X = aP + bY + k$$

where X = demand (kWh/month), P = price ($/kWh), Y = monthly income ($) and a, b, k are parameters to be estimated.[26] For a given income, demand is a function of price.[27] The corresponding inverse demand function shown in Figure 3.2.1 is given by

$$(1') \quad P = \frac{X - bY - k}{a}$$

Figure 2.2.1: *Inverse (Linear) Demand Function*



Clearly, the functional form of electricity demand depends on a number of factors. In the case of household electricity demand, the main features can be summarized as follows:

- The level of demand is strongly affected by appliance ownership and residence characteristics.
- Demand can be split up into baseline electricity use (lighting, radio powering, etc.) and consumption of energy-intensive appliances (air conditioning, water heating, etc.). The latter is more price- and income elastic (i.e., more responsive to changes in price and income) than the former.
- Demand of low-income households tends to be more sensitive to price than that of higher-income households.
- Short-run demand (given appliance portfolio) may differ from long-run demand (appliance change).

In any case, for a given level of income, each point of the inverse demand function P(X) can be interpreted as the consumer's marginal valuation of the good/service in question, i.e., the consumer's willingness to pay (WTP) for an additional unit, measured in $/kWh. Normally, demand is inversely related to price so that the WTP declines as the level of demand increases. Economists call the area under the inverse demand curve "consumer surplus": It provides a money measure of the welfare received by consuming the good. The "net consumer surplus" is the area down to price (and corresponding quantity) at which the good/service is purchased. If the good/service in question is non-essential in that it can be replaced with a substitute without any change in the level of welfare, the net consumer surplus will be finite (as is assumed in Figure 2.2.1). Energy can by and large be considered a non-essential good. For instance, electricity used for lighting or radio powering is replaceable by other sources of energy such as kerosene or batteries.

On the other hand, the "producer surplus", i.e., the producer's profit, is the difference between revenues, PX, and the cost of supply, K(X), with K(X) denoting the producer's cost function. The total surplus (TS) can thus be expressed as the sum of consumer surplus and producer profit:

$$(2) \quad TS =: \int_0^X P(X)dX - PX + PX - K(X) = \frac{\frac{X^2}{2} - kX - bXY}{a} - K(X)$$

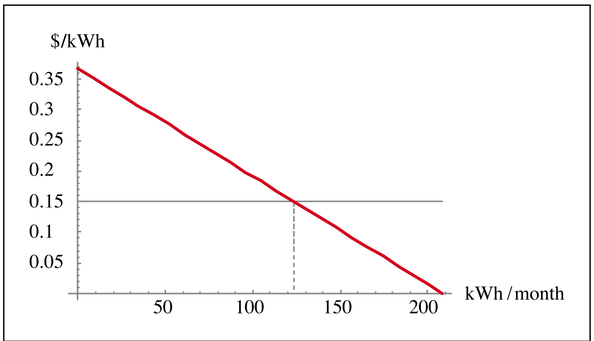
[26] In what follows we assume that a = -182.84, b = 2.7 and k = -568.23.
[27] This also assumes that the prices of all other goods/services are fixed.

2.2.2 Welfare Maximum and Deadweight Loss

As can easily be shown, a necessary condition for maximizing the total surplus is that demand be met at a price (marginal WTP) that is equal to marginal costs (MC), i.e., P(X) = K'(X). A market supporting this solution would be efficient in that it maximizes welfare. Moreover, any increase in supply beyond this point would result in a welfare loss. However, if demand is met at a price exceeding marginal costs and if the welfare that can be gained from additional supply is at least as high as the revenues required to cover the cost of supply, there would be a potential for welfare improvements (Pareto-improvement) through subsidies.

Figure 2.2.2 illustrates the case that demand (= 123.43 kWh/month) is matched by supply at constant marginal costs (= 0.15 $/kWh), thus maximizing the total surplus. The corresponding cost function is K(X) = cX, where c denotes constant marginal costs. Obviously, a production subsidy designed to increase supply beyond the point of 123.43 kWh/month would result in a welfare/deadweight loss, since the cost of the additional supply (= subsidy) exceeds the WTP. The deadweight loss, would be equal to the area (triangle) between the marginal cost curve and the demand curve.

Figure 2.2.2: *Demand – Supply Equilibrium*



A final note is in order with regard to the consumer surplus. Although the concept is widely used to approximate the monetary value of consumer welfare, it is not quite correct and it can be shown that the errors involved might be sizeable. The problem is that demand depends, among other things, on income, and that a change in price of a particular good changes the purchasing power of the consumer's income. Normally, this (real) income effect of a change in price entails a shift in the level of welfare. Hence, the area under the demand curve, say, between P0 und P1, refers to points for which the same amount of (nominal) income yields different levels of welfare. If the change in price were small (and/or the income elasticity of demand is low), this bias would be negligible. But if a large section of the demand curve is considered (large change in price), the bias may be significant.

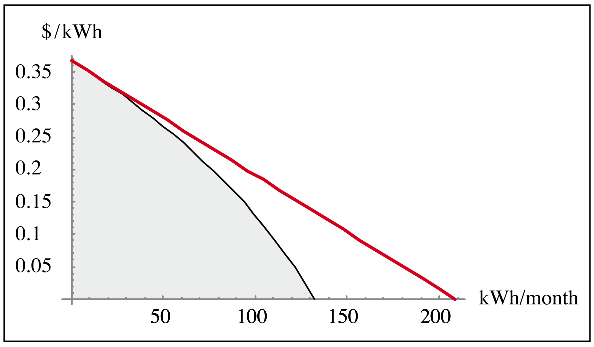
2.2.3 Compensated Demand

In order to obtain an unambiguous measure of the consumer's welfare, one has to adjust the demand function for the income that can be taken away from the consumer at lower prices without reducing the initial level of welfare. This type of adjusted demand function is called compensated demand function: It indicates the maximum amount a consumer is willing to pay for the option to purchase a good at a lower price. The area under the compensated demand function between any two points is known as the compensating variation (CV). Unlike ordinary demand, the compensated demand function is not observable. However, it can be (more or less easily) inferred from any estimated demand function. For the linear demand function specified in Equation (1), the compensated demand function is

$$(3) \quad X_c = be^{b[P_1 - P_0]}\left[\frac{a/b + k + aP_0}{b} + Y\right] - a/b$$

In Figure 2.2.3 the border of the shaded area is the concave compensated demand curve pertaining to the linear electricity demand function specified above. The shaded area under the compensated demand function is the correct money measure of welfare, which works out at 28.26 $/month. It is the amount of money that would compensate the consumer for reducing his/her electricity consumption to zero. By contrast, the total consumer surplus, measured as the area under the (uncompensated) linear demand curve, yields a value of $ 38.31; so the consumer surplus overestimates the monetary equivalent of welfare by 35%. Likewise, if demand is met at a price equal to marginal costs (= 0.15 $/kWh), the net welfare to the consumer, correctly measured in terms of CV, is 11.13 $/month, whereas the net consumer surplus would suggest a 19% higher value of 13.41 $/month.

Figure 2.2.3: *Compensated and Ordinary (Linear) Demand Curve*



The compensated demand function provides a measure of benefits that can be used to check on whether and to what extent subsidies can be instrumental in improving welfare.[28] What remains to be delineated are the conditions under which there is a potential for welfare improvements by dint of (energy) subsidies.

2.2.4 Arguments for Subsidies

All relevant arguments for the use of subsidies fall under two distinct lines of argument:

1) The first argument would be that the market fails to match supply and demand (and thus to allocate resources) in the most beneficial way. In these circumstances, subsidies would have the potential to improve welfare if there were incremental benefits that could be captured at a social cost not exceeding the benefits, but are not reaped because the market price does not cover the private cost of (incremental) supply or because the benefits are not appropriable through the market price. There are various, often interchangeable distortions and shortcomings that can be cited to support this line of argument, ranging from **market failures** (e.g. incomplete markets, incomplete information), **market imperfections** (e.g. imperfect competition, increasing returns to scale, "infant industries" operating below their minimum efficient scale) to **externalities** (e.g. non-existence of markets, public goods).

2) The second argument rests on **distributional considerations**: Subsidies may be considered desirable to support individuals that lack income and resources needed to achieve a certain standard of living (measured, for instance, in terms of access to minimum amounts of infrastructure services). In this connection, the typical concerns are about poverty, affordability and fairness.

Although these two lines of arguments are distinct, it may prove difficult to set them apart, and there is the tendency, notably among policy makers, to mix them up to buttress the case for subsidies. Correcting a market failure to improve economic efficiency does not necessarily call for a welfare program, but market failures often are a pretext for subsidization policies that are deemed desirable on equity grounds in the first place. Likewise, if the problem is that loans needed to finance upfront investments in energy supply are difficult to obtain because (imperfect) capital markets are not prepared to deal with this type of business, the effective response would be to ease the borrowing constraints (e.g. credit support through security arrangements) rather than to subsidize the investments or extend the credit support to any loan requested in the name of fairness. In short, subsidization policies should be designed in a way that they can be held accountable for the underlying reasons and objectives.

[28] In this context, social welfare would simply be the sum of (additive) individual welfare valued on the basis of compensated demand (provided that there are no consumption externalities).

Regarding the market-failure-line-of-arguments, it is obvious that some of the shortcomings that would justify corrective action through subsidies in other sectors are less relevant to the energy sector:

- Energy does not qualify as a **public good**, based on the definition most generally used,[29] except for some special services such as street lighting or signaling by a lighthouse. Unlike a pure public good, - which is non-rival and non-excludable -, energy supply has positive marginal/incremental costs and can be rationed through price (vis-à-vis an elastic demand). Thus, when the market fails to provide energy for which there is a willingness to pay, i.e., when there is an undersupply of energy, it is not because energy is a public good (that the public sector rather than private providers should provide/finance); so this failure must have other reasons.

- Since the use of energy sources such as fossil fuels have negative **externalities** in terms of environmentally damage (e.g. harmful emissions) that are not properly paid for, and given the fact that the private benefits from pollution abatement tend to be much smaller than the public benefits (notably in the case of regional or global effects),[30] one can argue for the subsidization of pollution abatement. However, the most efficient remedy would be a tax on pollution rather than a subsidy for abatement (e.g. investment in efficiency improvements or the use of cleaner sources of energy such as Renewables).[31] Energy subsidies would only be a second-best instrument for addressing negative externalities involved in the use of energy.

Leaving aside externalities and public-good arguments, one is left with the conclusion that the case for welfare-enhancing energy subsidies in large part rests on failures and shortcomings - or simply constraints - that affect market structure, industry organization, costs and price formation in a way that prevents the market from achieving an optimal allocation of resources.

In fact, while economic efficiency requires that price be equal to marginal costs, prices may be set above marginal costs because the lack of competition allows suppliers to charge higher prices or because MC-pricing fails to recover total costs. Whenever prices exceed marginal costs, there will be an undersupply, compared with the level at which demand would be met on the basis of marginal costs; in the limiting case there might even be no supply if no consumer is willing to pay the price. By contrast, a competitive equilibrium, if it exists, is characterized by many suppliers that act as price takers, are exposed to an U-shaped average cost curve and meet demand at a price equal to marginal costs, with the marginal costs being at least as high as the minimum average costs.

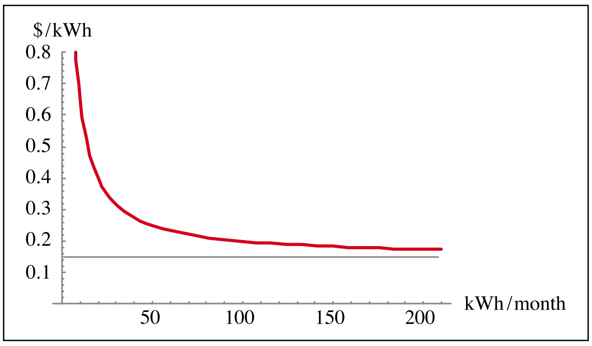
2.2.5 Declining Average Costs

To demonstrate the point, let us consider an energy supplier with a cost function composed of a fixed cost, F, and an output-dependent variable cost, cX, where c is the constant marginal cost (= 0.15 $/kWh), i.e.

$$(4) \quad K(X) = F + cX$$

The fixed cost can be a capacity cost, a network cost (etc.) and/or a transaction cost (e.g. the setting up and running of the business). In any case, average costs will decline as the output increases (see Figure 2.2.5a).

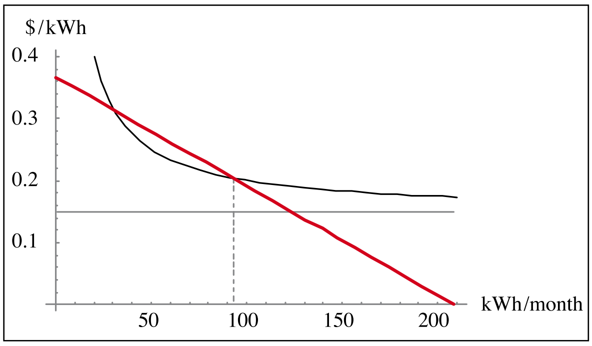
Figure 2.2.5a: *Declining Average Costs with Constant Marginal Costs*



[29] However, note that energy actually does qualify as a public good where the latter is defined in a broader sense via positive externalities (in order to address the fact that there are very few "pure public goods" in reality). This case is covered by our arguments below on externalities.
[30] Note the specific cases of (i) household energy and indoor air pollution and (ii) local deforestation or diesel havaries in ecologically sensitive areas.
[31] This is because a subsidy would also reduce the private costs of abatement und thus result in a higher level of pollution than under a tax.

Financial sustainability requires that revenues recoup total costs (break-even constraint). Hence, in the absence of profits, the supply curve meeting the break-even constraint is equal to the average cost curve. Let us assume that, for instance, F = 5 $/month. As is shown in Figure 2.2.5b, the resulting average-cost-based supply curve would intersect the demand curve twice, with 92.82 kWh/month being the demand that can be met at the lowest level of average costs (0.204 $/kWh).

Figure 2.2.5b: *Demand Met under Average Cost Pricing*



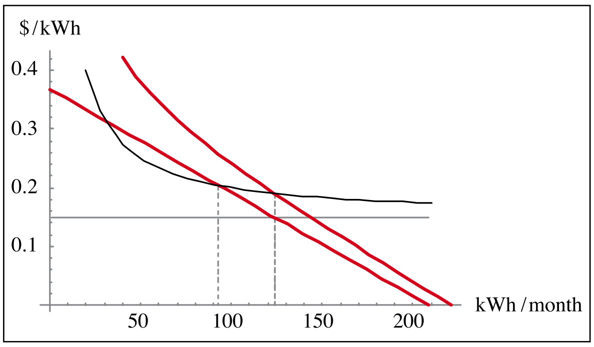
2.2.6 Production Subsidy

Obviously, if demand were met at a price equal to marginal costs (123.43 kWh/month at p = c = 0.15 $/kWh), the consumer would be better off than under average-cost pricing. Measured in terms of CV, the welfare gain from reducing the price from 0.204 $/kWh to 0.15 $/kWh would be worth 5.44 $/month. On the other hand, with a price based on marginal costs the producer would experience a loss equal to the fixed costs of supply (= 5 $/month). Hence, a case can be made for a subsidy: Covering the monthly fixed costs through a **production subsidy** of $ 5 would yield a net welfare gain of 0.44 $/month.[32] Needless to say, the above reasoning does not account for potential distortions and transaction costs associated with raising and delivering the subsidy funds[33]; so in a strict sense the subsidy would only be justified if its transaction costs fall short of the achievable net gain in welfare. Moreover, the example assumes that there are no alternative suppliers that could meet demand at lower average costs. If there were cheaper source of electricity supply available and if the goal would be to keep the higher-cost supplier in the market, then a production subsidy given to the higher-cost supplier would not improve welfare.[34]

2.2.7 In-Kind Subsidy to Consumer

An alternative to subsidizing the producer is to provide a subsidy in kind to the consumer. For instance, the consumer could be given non-cash vouchers or "energy stamps" confined to the purchase of electricity, which would turn the electricity demand curve to the right and change its shape, without affecting the supply function (the vouchers would be prepaid or refunded to the producer by the subsidy provider). In particular, handing out non-tradable energy vouchers worth 5 $/month to the consumer will increase the demand-supply balance from 92.82 kWh/month to 123.43 kWh/month (see Figure 2.2.7).[35] Supply matches higher demand at a cost of 0.191 $/kWh, but thanks to the vouchers the consumer pays only 0.15 $/kWh, which is just the MC of supply. Therefore, the welfare gain to the consumer (5.44 $/month) as well as the net gain from the voucher-based subsidy (0.44 $/month) will be the same as with a production subsidy that would allow the producer to sell at marginal costs

Figure 2.2.7: *Increase in Demand by Vouchers*



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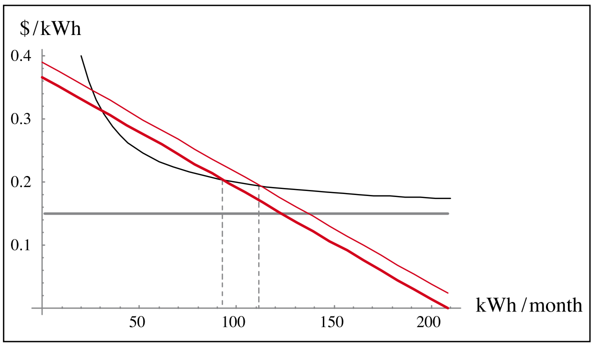
[32] Typical examples of a production subsidy are soft loans, investment grants or tax exemptions.
[33] Subsidies could be financed through taxes, government or other sources (for details, see Section 3.4.2).
[34] A case in point is a subsidy support policy that requires consumers to purchase a certain amount of high-cost electricity (e.g. quota or obligation to buy). Obviously, this kind of production subsidy would not qualify as welfare enhancing (unless it is targeted at positive externalities associated with the higher-cost source of supply).
[35] Note that if the vouchers were tradable, the recipient could sell the vouchers and use the cash proceeds for the purchase of whatever is the mix of goods/services that improves his/her welfare.

2.2.8 Cash Subsidy to Consumer

Another option is to give the consumer a cash subsidy. The advantage of this solution is that it does not affect consumer choice. The effect of a cash subsidy designed to ease the consumer's budget constraint will be different from that of a production (or voucher-based) subsidy, however. Giving the consumer 5 $/month in cash will shift the electricity demand curve to the right, without changing the supply curve (see Figure 3.2.8). Higher electricity demand, which is backed by the cash subsidy, will be met by supply at a cost-recovering price of 0.195 $/kWh, corresponding to 111.43 kWh/month (compared with 92.82 kWh/month in the absence of a subsidy); so the increase in demand met by supply turns out to be lower than under a voucher-based subsidy scheme.

Nevertheless, with 111.43 kWh/month, for which the marginal WTP (in the absence of a subsidy) is 0.171 $/kWh, the consumer will be better off than with 92.82 kWh/month, for which the marginal WTP is 0.204 $/kWh. In terms of electricity benefits, the corresponding welfare gain, measured along the un-subsidized compensated electricity demand curve, is equivalent to 3.21 $/month. Since the additional expenditure on electricity is only 2.79 $/month (= 21.71 - 18.92), the remainder of the cash subsidy, 2.21 $/month (= 5 - 2.79), is left to the consumer to be saved or spent on another good or service. In total, the benefits to the consumer would be worth at least 5.42 $/month, thus justifying the cash subsidy (provided the transaction costs are less than 0.42 $/month).

Figure 2.2.8: *Cash Subsidy to Consumer*



2.2.9 Cash Subsidies versus In-Kind Support

Economists prefer cash subsidies to in-kind support because income transfers allow the recipients to purchase goods according to their own preferences ("consumer sovereignty"). With in-kind subsidies there is the risk that they distort choice. Their effect may be that the consumer is induced to buy more of a good than he/she would with an equivalent cash subsidy.[36] Policy makers, on the other hand, often opt for in-kind subsidies because it is precisely this effect they want to achieve, i.e., they want the consumer to acquire a minimum amount of some good/service that is considered necessary to improve individual welfare, reduce poverty or to achieve a minimal standard of living ("father-knows-best" or **merit-good** argument). What also militates in favor of in-kind subsidies is that typical measures of poverty, living standards or distributional inequality are consumption-based (rather than income-based) so that in-kind targeting of specific areas of consumption appears to be an effective vehicle for welfare improvements through consumption changes.

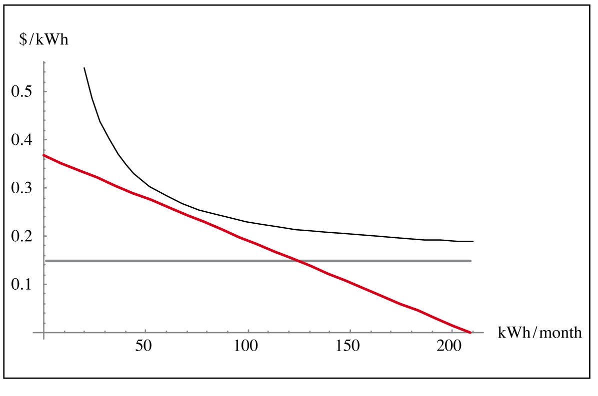
[36] In this case a cash transfer would be more (cost-) efficient because the welfare gain from an in-kind subsidy could also be achieved by a smaller cash subsidy.

Be that as it may, if the in-kind subsidy addresses a **market failure**, as is assumed in the above example, the paternalistic leanings of the subsidy provider would simply advance a case that in the first place can be justified on account of the welfare gain from mitigating the failure. However, the paternalistic view would dominate the argument for an in-kind subsidy if the overriding concern were to attain a target consumption level deemed beneficial, no matter whether or not there is a market failure. In fact, in the limiting case the thrust for in-kind subsidy support would simply be based on **distributional reasoning**.

2.2.10 Shortfall in Demand

There is another important case that may warrant subsidies, namely when demand is too small, or costs are too high, to establish a viable market. For instance, prohibitively high average costs exceeding demand can be found in rural electrification, when demand is small and remote and the costs of extending the grid to new customers exceed the willingness and ability to pay. This situation is illustrated in Figure 2.2.10, based on the assumption that the fixed cost of supply is 8 \$/month, i.e., K(X) = 8 + 0.15X, vis-à-vis a demand function as specified above. Since the demand curve does not intersect the average cost curve, there will be no supply and, thus, no consumption (no electricity benefits).

Figure 2.2.10: *Price below Average Costs*



Again, a production subsidy covering the fixed cost of 8 \$/month would allow the producer to supply electricity at marginal costs and meet demand at X = 123.43 kWh/month. The subsidy would be warranted on economic grounds because the net welfare to the consumer (electricity benefits), measured as the area under the compensated demand curve down to the point where demand is met, would be 11.13 \$/month.[37] In fact, this net gain that is achievable with MC-pricing defines the upper limit for a subsidy that is justified on economic grounds if demand cannot be met at average costs (provided the transactions costs of the subsidy are negligible).

It goes without saying that a subsidy exceeding the welfare gain that can be inferred from the compensated demand curve may still be granted on **equity** grounds (affordability argument, poverty alleviation, etc.). However, the rationale for such a subsidy would no longer fall into the category of market failures: A market that cannot be established because there is no willingness to pay for the (marginal) cost of supply does not qualify as a market failure. Rather than being a remedy for market failures, the subsidy would become a means of achieving purely distributional goals.

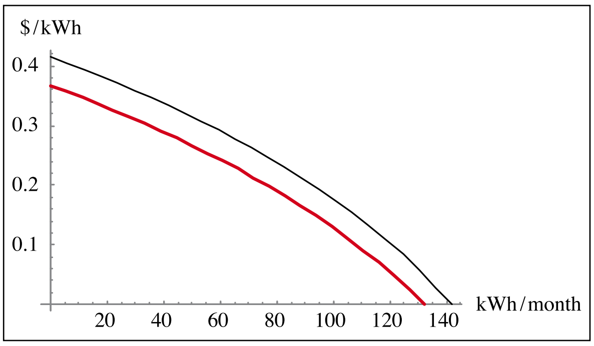
2.2.11 Quality of Service

So far the welfare-gain arguments in favor of a subsidy centered on the higher level of consumption (lower price) rendered feasible by a subsidy. Strictly speaking, this perspective is adequate when the change in the level of energy consumption does not involve a change in quality. However, there may also be welfare gains from a **higher quality** of service/supply, as is the case, for instance, when lighting is done with an electric lamp rather than a kerosene lamp or when the quality/reliability of electricity supply increases (e.g. through better voltage/frequency control, less frequent outages).

[37] Note that the net gain compares with the alternative that there would be no electricity consumption (and, thus, no electricity benefits to the potential consumer) if electricity were offered at average costs.

Normally, quality improvements incur additional costs and, thus, will only be provided through > the market if there is a willingness to pay for the improvement. The WTP for the quality change would be reflected in the difference in demand (per kWh, lumen hour, etc.) with and without the quality improvement. The area between the compensated demand curves inferred from the (observable/estimable) uncompensated demand curves would be the money measure of the associated change in consumer welfare (see Figure 2.2.11). Again, the necessary condition for a subsidy to improve welfare in the presence of a market failure is that the net gain from the quality change exceeds the extra-cost of providing the higher-quality service/energy.

Figure 2.2.11: *Welfare Measure of Improvement in Quality of Supply*



In sum it can be stated that whenever the market would provide energy services or service quality at a level that falls short of the willingness to pay for the marginal costs involved, a case can be made for subsidies on account of market failures. The case would be valid if the net welfare gain rendered feasible by the subsidy is at least as large as the subsidy amount (including the cost of raising and delivering the subsidy funds). Subsidies exceeding this limit would have to be justified on purely distributional grounds.

2.3 Four Objectives of Energy Subsidies in the German Economic Cooperation

"Governments can try to reduce emissions in three ways: subsidize alternatives, impose standards on products and processes and price the greenhouse gases that cause the damage. The first is almost always a bad idea; the second should generally be avoided; the third is the way to go. Europeans do all three. […] Consumers pay for these indulgences through surcharges on electricity prices, but politicians like them."
The Economist: Climate change: What price carbon? (3-17, 2007)

On the general level, the concern of energy or infrastructure subsidies is for the well-being of the recipients/beneficiaries, notably the poor and needy. But in practice the specific objectives tend to address outward manifestations of, or alleged reasons for, poverty and/or distributional inequality, – rather than manifest or proven market failures.

Therefore, energy subsidies in most cases are geared towards minimum (energy) consumption levels or service standards that are assumed to conform to acceptable living standards and help eliminate poverty. By the same token, preference is given to production subsidies that reduce the cost of supply.

For instance, according to the new **energy sector concept of the German Economic Cooperation (EC),** the core objective of energy sector support is to alleviate poverty, and the subordinated goals are to provide poorer population segments with access to (higher-quality) energy and energy services, to spur economic growth through cost-efficient and reliable energy supply, to curb the environmental damage inflicted by energy supply and use, and to prevent energy-related conflicts and crises.[38] In this context, energy subsidies would be justified to

- bring energy prices down to a socially acceptable level,
- support the poor at the expense of more affluent consumers (cross-subsidies)
- facilitate the development and sustainability of energy markets in urban and rural areas, and
- finance the extra-costs of clean energy and efficiency measures (especially those that prevent CO_2-emissions).

As a general rule, the subsidy support should not finance consumption, be confined to the poor (target group) and be subject to an exit scenario.

Equity

The role and objectives that the German EC assigns to energy subsidies are indicative of the raison d'être underlying the subsidy policy advocated by most donor agencies (see Section 2.4). The main thrust of the subsidies is to **alleviate poverty**, which results in a categorical pro-poor alignment of subsidies, corroborated by basic-needs arguments or political/social prerogatives with regard to essential energy services. Market failures are not at the forefront of this reasoning, but they may be a hidden argument when the subsidy is given on account of affordability constraints (inability to pay) or because there is an undersupply of energy – or, as the case may be, finance – (which from the consumer's perspective is a lack of "access"). For example, subsidies given to kick-start or develop energy markets (viable market size, scale economies) often are maintained under the objective to help the poor, but a valid point to begin with might as well be market imperfections.

Economy

It is worth noting in this connection that since **economic growth** has proven a major vehicle for reducing poverty, energy subsidies could be also given or targeted to accelerate growth. However, hardly any attempts have been made to justify broad-based subsidies for productive energy users in the name of poverty alleviation. On the contrary, the policy rule that energy prices to users in industry, agriculture etc. should reflect the true (un-subsidized) cost of supply has become common wisdom (although it is not always and everywhere determining the course of action).

Higher oil prices and both actual as well as potential disruptions in energy supply have revived the debate over **energy security**[39] and the concomitant need for government action, and whenever there are reasons for the government to interfere, the propensity to call for subsidies is high. However, subsidies that could be given, for instance, to develop domestic energy resources or to diversify the energy mix (to decrease portfolio risk)[40] are only one policy instrument among the many options suited to improve energy security (import tariffs or other measures that would reduce energy demand, stockpiling, integration of energy markets, etc.). No prima-facie case can be made for subsidies when the problem is the security and reliability of energy supply. In short, the German EC would be on tenuous ground if it advocated or even financed energy subsidies in the name of energy security.

Externalities

Among the other objectives widely used to vindicate energy subsidies, the most prominent one is that of **protecting the environment.** In fact, negative externalities, such as atmospheric pollution caused by energy consumers or suppliers, is a textbook case for a market failure calling for government intervention. Subsidizing the least harmful energy alternatives has become the preferred policy, even though it is second-best compared to taxes on pollution or the imposition of (more or less sophisticated) environmental standards.

[38] BMZ (2007)

[39] It should be noted that the Energy Security Objective – which has been very prominent over the last decade due to incalculable regional risks in virtually all Oil producing regions ("global hot spots"), increasing demand in BRIC countries and a corresponding unprecedented surge in Oil prices towards 100 US$ per barrel – could also be subsumed under the second Objective (Economic Growth) as the political question of energy security (assuming the absence of outright (trade) wars which completely ban energy trade) translates largely into an (all important) economic question of the GDP effect of price and volatility of a given national energy mix.

2.4 Donor Positions on Subsidies

"Most important of all has been the Bank's development of the Clean Energy Investment Framework which we were first asked to do by the Gleneagles Summit of the G-8 in July 2005. As the world mobilizes resources to diversify energy sources, reduce carbon emissions, avoid deforestation and help countries deal with the effects of climate change, most of those resources have to come from the developed countries. The most productive place to invest them will often be in developing countries."
Paul Wolfowitz (resignation statement 2007)

2.4.1 World Bank and other Multilaterals

Energy Sector

There is a cyclical element to the World Bank's "best practice" guidelines on infrastructure subsidies over the last two decades (which can be explained in part with the historical sector contexts summarized above): With the first reform waves, there was an explicit and general impetus to abolish all subsidies, deregulate power sectors, and always guarantee fully cost covering prices and stop lending to public utilities completely (which had previously been the mainstay of World Bank funding since its inception). Over the last years, the Bank has come full circle – in the late 1990s, "smart subsidies" were recognized as a necessary exception in specific cases (yet, initially without a clearly spelled-out rationale) and PPPs recognized the importance of public players in specific cases.[41] Recently, lending to state utilities (including weaker ones), is back on the agenda (if only because the vast majority of LDC utilities continue to be public)[42] – albeit with a clearer attention to efficiency incentives and metrics. Other donors have gone through a similar cycle.[43]

Komives et al. (2005) recently published an in-depth analysis of utility subsidies. From a good analysis of the typical arguments for and against subsidies,[44] this milestone publication moves on to a thorough empirical analysis of the targeting performance of water and energy subsidies.

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41 Barnes and Halpern 2000; Mathur 2003

42 World Bank 2004

43 UNEP 2002: "The case for subsidizing electrification, especially in developing countries, is widely accepted. That is why electricity subsidies make up such a large share of all the energy subsidies still in place today. But the way the public authorities go about subsidizing electrification is crucial in determining how successful these policies are. Badly designed programs can lead to waste and inefficiencies, which can actually impair the ability of electricity companies to extend service. Where this happens, the poor who are supposed to benefit from the subsidies can actually end up worse off."

44 Komives 2005: "The impact of subsidies on both counts has been the subject of much controversy. [...]One reason the debate over utility subsidies can become so heated is that the provision of adequate and reliable infrastructure truly matters – to economies, to households, and to poor households in particular. Improved water supply, sanitation, and electricity services are associated with raising productivity and living standards. [...] Disparities in access to basic infrastructure services between countries and among income groups within a particular jurisdiction have often been invoked as a motivation for providing subsidies to utilities and to utility customers: households would be unable to afford these services if subsidies were not offered. In discussions about affordability, there is particular concern about the impact on the poor of raising tariffs to recover a greater share of costs in order to mobilize private finance or simply to reduce the use of scarce fiscal resources by utilities. This concern has prompted governments to maintain subsidies in the short-term and only gradually move towards cost recovery pricing. The counter argument is that subsidies have adverse consequences that can actually work against improving the quality of service to existing consumers and extending access to unconnected households. Subsidies engender distortions in the use of water and electricity, leading to an inefficient use of resources and thus indirectly raising costs of service provision. Subsidies can also induce inefficiency in utility operations, as utility managers face soft budget constraints. The costs of subsidies in terms of inefficiency may rival or exceed any benefit derived from the provision of the subsidy. Moreover, utility subsidies have tended to produce financially weak utilities with stagnant service areas and declining service quality because fiscal transfers are not always dependable and cross-subsidies frequently insufficient to cover the subsidies provided to consumers. This means that the poorest unconnected households face the prospect of relying on alternative and often more expensive water and fuel sources for many years to come. Given the high cost of utility subsidies and their potential for creating this "collateral damage" to utilities and households, there is much interest in evaluating and improving utility subsidies. The notion that utility subsidies are an effective mechanism for expanding coverage and ensuring that the poor can use utility services is joined by another view which posits that utility subsidies are an important component of a broader social policy agenda: the redistribution of resources towards the poor. Particularly in countries where it is not administratively feasible to implement means-tested cash transfers, consumer utility subsidies appear to present themselves as a practical mechanism for delivering transfers to the poor. From this perspective, how utilities subsidies affect utility behavior and household use of water, sanitation, or electricity services is less important than how subsidies compare to other social protection programs in terms of their ability to accurately target poor households and to reduce poverty levels."

The study draws a series of highly relevant conclusions:

1. Utility subsides are ubiquitous and will remain for some time.

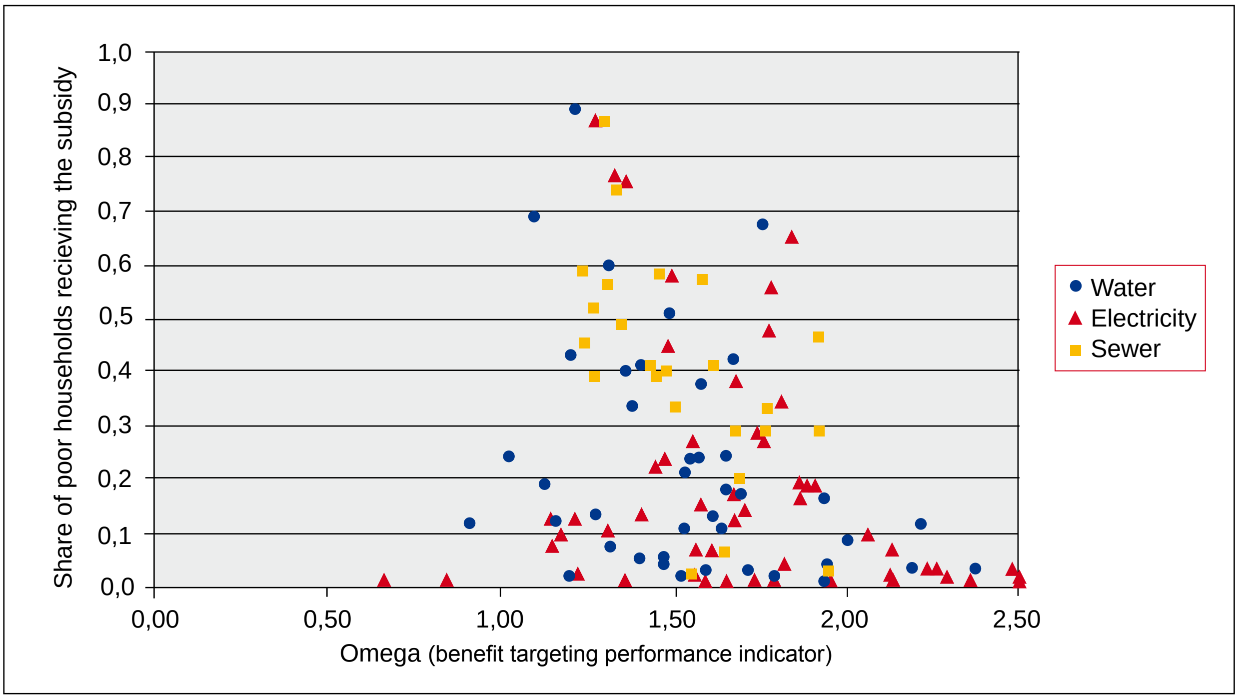
2. The targeting performance of the most prevalent subsidy type (consumption subsidies) is usually awful, and changes in tariff schemes or consumption subsidy type can do little to improve that. The most fundamental reason is the existing access-differential between poor and non-poor households.[45] Regions, neighborhoods or households that lack access to energy networks are excluded from any quantity-based subsidy – so the poor are less likely to benefit.

3. Thus, for better poverty targeting, subsidy mechanisms should first of all provide access to households without energy access. The figure below demonstrates that the benefits distribution of connection subsidies is almost always progressive.

4. Further research is warranted on the impact and design of energy access subsidies.

5. Complementary measures, especially for cost reduction, are intrinsically better performing and often evolve around technology issues (e.g., use of indirect subsidies to more adequate standards, efficiency gains and new technology solutions).

Figure 2.4.1: *Poverty targeting performance of universal connection subsidies for electricity, water and sewerage. The "benefit targeting performance indicator"* ***Omega*** *is defined in Komives (2005) as a product of five contributing factors which describe the likelihood of poor households to benefit from access, connection and service.* ***Omega*** *>1 means that the poor receive a larger share of benefits than their population share. The graph for connection subsidies shows much better results for* ***Omega*** *than comparable results fro consumption subsidies, for systemic reasons.*
Source: Komives 2005



45 Komives 2005, p. 149.

Financial Sector

When discussing energy subsidies, it is instructive to look to the financial sector literature for additional guidance. Typical assumptions of (some) energy practitioners appear under a different light from financial sector perspective:

In light of poor access to local financing for many local energy companies, providing dedicated credit lines seems preferable to granting subsidies (hoping for less distortions of the energy sector) – however, this runs the risk of distorting two sectors at once.

Another example for a misjudgment of (some) energy practitioners is the ubiquitous market barrier argument: Some (not all) of the "market barriers" often weighed in favor of energy subsidies turn out to be correct price tags for real market risks (say, higher risk premiums for off-grid markets). In such cases, the market barrier argument makes sense only if long-term economic costs can be reduced on a significantly larger scale than the subsidy quantity needed for buying down short-term financial cost.

As a general rule, subsidies in the financial sector (such as "soft loans" from directed credit lines as often applied in energy projects) should be avoided so as not to distort the financial sector and to allow for self-sustainable local FIs to develop.[47 48 49] Hoff/Stiglitz (1997) provide an illustrative example on subsidies with perverse effects in imperfect market situations.[50]

However, recently a similar trend as in the energy sector has emerged: the need for subsidies in some cases has been recognized (usually it is argued loosely that they may be warranted (i) for social inclusion (in order to increase outreach) and/or (ii) to redress market entry barriers via start-up subsidies – but without quantitatively convincing arguments). In such cases, as in energy, the importance of proper design ("smart subsidies") is highlighted, and some general rules for such smart subsidies are given (time bound, transparent, measurable).[51]

As in energy, the "rural access frontier" is where the least experience exists.[52]

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46 Reiche et al. 2000

47 CGAP 2006: "Microfinance can pay for itself, and must do so if it is to reach very large numbers of poor people. Unless microfinance providers charge enough to cover their costs, they will always be limited by the scarce and uncertain supply of subsidies from donors and governments. The job of government is to enable financial services, not to provide them directly. Governments can almost never do a good job of lending, but they can set a supporting policy environment. Donor funds should complement private capital, not compete with it. Donors should use appropriate grant, loan, and equity instruments on a temporary basis to build the institutional capacity of financial providers, develop support infrastructure, and support experimental services and products. The key bottleneck is the shortage of strong institutions and managers. Donors should focus their support on building capacity."

48 Morduch 2005: FINANCE for the poor. ADB (2005): "Long-term sustainability is critical for microfinance. The desire to escape ongoing subsidization spurs institutions to innovate, cut costs, and improve products and services. The push for profitability attracts new investors into the sector, reinforcing calls for professionalism, transparency, and good governance. None of this is likely in settings dominated by subsidy."

49 World Bank (1997): "Subsidised credit leads to low levels of operational efficiency as financial institutions have little or no incentive to become sustainable. Subsidised interest rates create excess demand that may result in a form of rationing. Subsidised credit leads to poor repayment habits. As subsidised funds are scarce and desirable, credits tend to be allocated to local elites who have influence."

50 Hoff, K. & Stiglitz, J. : Moneylenders and Bankers: Price-increasing Subsidies in a Monopolistically Competitive Market. Journal of Development Economics, 52 (2): 429-462 (1997)

51 Morduch 2005

52 CGAP 2006: "Despite significant learning about how to be effective in microfinance, frontier issues, such as rural finance, the application of technology, social performance measurement, and others, require further experience to define good practice. [...] The donor community and the larger microfinance world have learned much over the past few decades about the best ways to support the emergence of inclusive financial systems. However, many core issues remain unresolved. Although these issues are numerous, this section describes a few that pose particularly stubborn dilemmas that have proven difficult to resolve and/or that represent an enormous opportunity. [...] Delivering financial services to rural areas presents several challenges: dispersed and uneven demand, high information and transaction costs because of poor infrastructure and lack of client information, and weak institutional capacity of rural finance providers, to name a few. In addition, rural areas often depend on agriculture. The seasonality of productive activities leads to uneven income, there are risks inherent in farming (e.g., weather, pests, price fluctuation, access to markets), and many rural poor lack usable collateral. Also, the risk of political intervention, such as debt forgiveness or interest rate caps, is high in rural areas given the economic priority of agriculture in most developing countries. Moreover, the key obstacles of rural finance must be understood within the much broader context of natural-resource-based livelihood issues and the productivity of real sectors, for example, fisheries, timber, etc."

2.4.2 Millennium Goals, Paris Declaration and COP08

"At the very least, the Guidelines seek to enforce a sort of Hippocratic Oath to "do no harm"" [53]

Almost three years after the Paris Declaration called for improved Aid Effectiveness through better harmonization, cooperation and coherence, donor community and governments are still in search for successful instruments to meet its mandate.

At the same time, a massive scale of new investments is needed in LDCs energy sectors over the next decades, to meet recently defined international targets for energy-related (i) growth objectives,[54] (ii) social objectives[55] and (iii) CO_2 abatement targets.[56]

As these vast investment needs will be covered only in part by FDI, and as increased FDI in turn will require improved investment climates, there will be a corresponding massive scale-up in energy ODA, including large volumes of new energy-related subsidies (hopefully accompanied by elimination of existing inefficient subsidies).

The sheer size of this unprecedented energy sector effort requires coordination. So do the particular network aspects of energy planning and the global scale of some of the climate and growth objectives.

In addition to identifying lessons for better subsidy design (to assure that coherent concepts of sound subsidy design are implemented in developing countries), donors need to identify their comparative advantages in energy sector ODA – and use these to leverage parallel ODA from other sources.

[53] Ibid
[54] See World Bank 2004 on quantifications of GDP-losses due to energy bottlenecks and investment needs for sustained growth.
[55] MDG 2000, UN 2005, Estache 2006
[56] Stern 2006 and the respective declarations of Rio, WSSD, Gleneagles and Bali.

3 PRACTITIONERS' TOOL: Using the "Subsidy Matrix" Framework to Analyze Design and Performance of Subsidies

"Subsidies to energy make sense in some cases, especially where they are aimed at encouraging more sustainable energy use. There is a strong case for temporary support for renewable and energy-efficient technologies, aimed at overcoming market barriers and kick starting their deployment. Measures to improve poor or rural households' access to modern, commercial forms of energy – such as lifeline rates for electricity – may also be justified on social grounds, even if they result in higher overall consumption of fossil fuels and emissions. ***The way in which specific programs are designed is crucial to their cost-effectiveness."***
UNEP (2008)

3.1 Design Determines Performance: A Systematic Approach to Better Subsidy Design

When policy makers and practitioners (re)design any subsidy scheme, they decide about its performance. As we have seen in chapter 2, there are inherent dangers to any form of subsidization, and most existing subsidy schemes should ideally be outright abolished (this is the case for most fuel subsidies). However, reality tells us that energy subsidies are here to stay, be it for economic or political reasons. In this context, it is important to note that even subsidies with a sound economic rationale are usually underperforming unnecessarily in practice (Komives 2006).

Therefore, far more attention needs to be paid to a proper design of (existing or planned) subsidies, to improve their performance and minimize their negative effects. Such well-designed subsidies are sometimes called "smart subsidies"[57] or "intelligent subsidies" – we use the term "sound subsidy design" in this publication, to highlight the process involved.

There is a remarkable gap in the literature regarding readily usable advice on the crucial question "How to design a sound subsidy scheme in practice".[58] This gap is particularly striking for subsidies with a social equity objective (access and consumption subsidies). A similar gap exists for appropriate regulatory practices that are pro access.[60]

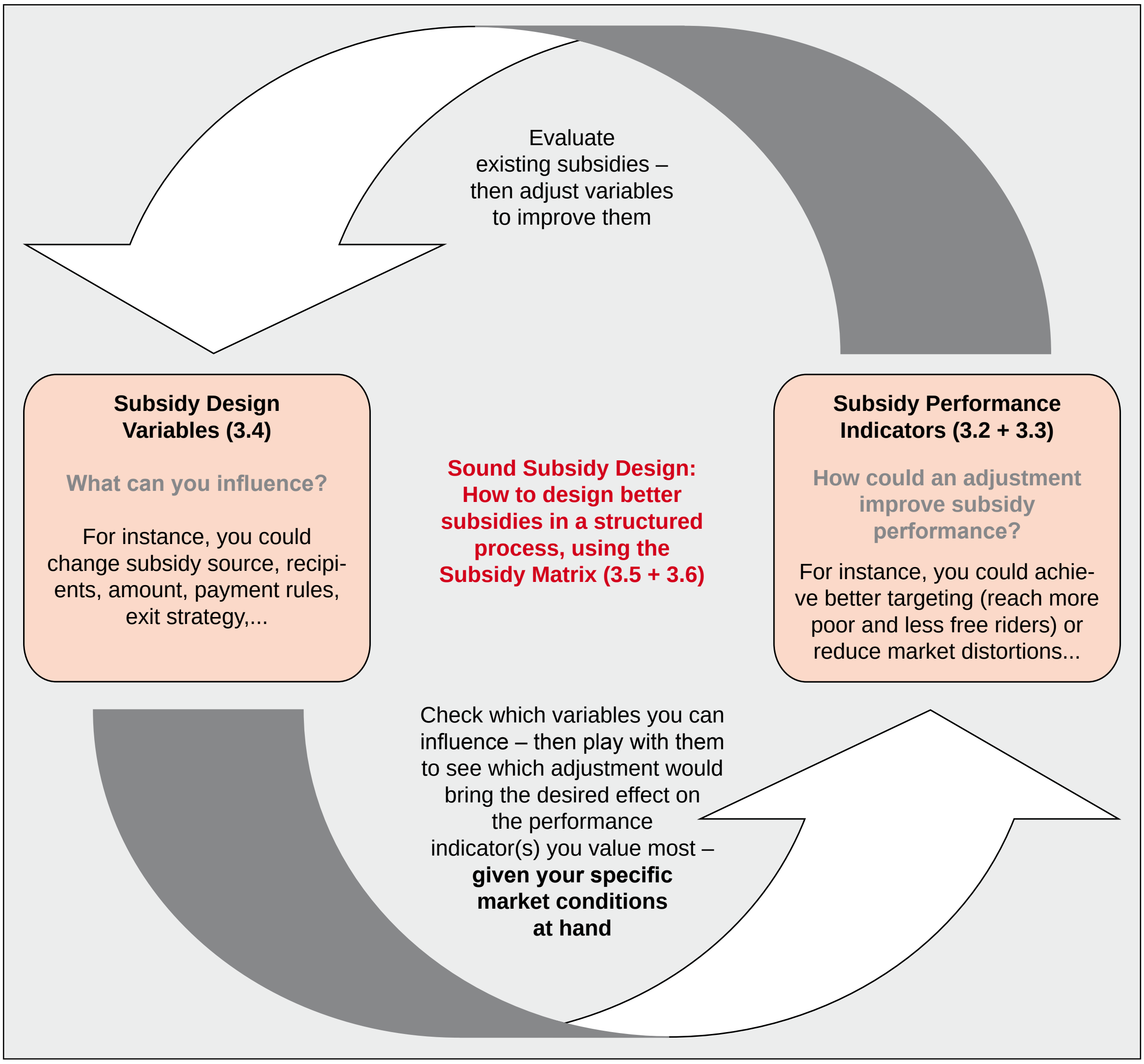
The present chapter provides practical advice and a new, simple tool for subsidy design. Figure 3.1 illustrates the subsidy design process: Practitioners can influence a set of design variables (usually not all, in a given political and market context), and these decisions influence subsidy performance. Performance in turn can be judged by more than one measure: in fact, we will see that inherent trade-offs exist between "competing" performance indicators (chapter 3.6): this is where (political) choices have to be made. There are no one-size fits-all solutions for this optimization process: the specific market context determines which combination of design variables is best for a given set of performance priorities (say, to connect a large number of users quickly, whatever the cost).

[57] "The idea of "smart subsidy" springs from the premise that subsidies are neither inherently useful nor inherently flawed. Rather, their effectiveness depends on design and implementation. Smart subsidies maximize social benefits while minimizing distortions and mistargeting." – Morduch 2005
[58] UNEP 2008
[59] The design of environmentally motivated energy subsidies is less country-specific and has been covered more broadly in recent literature.
[60] Reiche et al 2006

Chapters 3.2 and 3.3 present all relevant subsidy **performance criteria** one by one. Chapter 3.4 discusses the main **design variables** and shows how they typically influence performance (highlighted by keywords for easier use). Chapter 3.5 introduces a new tool which practitioners can use for a simple, systematic approach to subsidy optimization: the **Subsidy Matrix** (Figure 3.5).

Chapter 3.6 applies this new tool to design and evaluate different types of energy subsidy schemes, in order to illustrate how it can be used.

Figure 3.1: *The process of subsidy design in practice*[61]*; source: Own Elaboration*



[61] The choice of each design variable along the y-axis in Figure 4.1 affects one or more of the performance indicators of the subsidy scheme along the x-axis. It can be hard to quantify the connection between the variation of a specific design variable and shifts in performance exactly. For instance, lack of effectiveness can be caused by a poor institutional set-up and/or the fixing of an inappropriate amount of financial support. Chapter 4.3. shows the entwined relations between the performance indicators we have singled out.

3.2 Primary Subsidy Performance Criteria

The two Primary Subsidy Performance Criteria are based on the general economic concepts we have seen in chapter 2, which apply to subsidies in particular as well as to governmental decisions in general. The two broadly accepted requirements for sound subsidy schemes are effectiveness and efficiency (called primary performance criteria in this report)[62] – we distinguish them from a set of more operational secondary performance criteria, which can be of higher interest to practitioners on the ground and are discussed in chapter 3.3.

3.2.1 Effectiveness

Attainment of the defined objectives

The first criterion to take into account when evaluating a subsidy scheme is effectiveness: is the intended objective reached?! This concept refers to the importance of assessing subsidies according to whether they (i) allow attaining the targeted objectives at all and, if so, (ii) to which extend the objective is reached (e.g. poverty targeting) and (iii) whether the speed of their allocation is appropriate to meet the desired overall effect. For instance, a subsidy might produce the expected effect, but if the time span between its launching and the achievement of the objectives is too long, it dissipates financial resources unnecessarily.

Targeting Performance

The second issue is of special importance for the energy sector, as utility subsidies underperform chronically on targeting:[63] The social groups or entities for which a subsidy is designed should be well delimited, and the subsidy should actually reach them. If there is no clearly delimited target group, there is a risk that non-targeted social groups, such as wealthy households and/or well-performing industries, also benefit from a subsidy (they get a "free ride" which minimizes subsidy effect as well as efficiency – see more below).

Scalability and Significance[64]

While not usually subsumed under the effectiveness criterion, the scalability and potential leverage effects of a subsidy scheme are of highest practical import for donors striving for effective subsidy schemes: From an aid effectiveness point of view, subsidy schemes are only effective if they deliver a significant contribution to the overall development agenda as laid out by the MDGs (and to some extent by COP8). The very idea behind this concept was the definition of quantitative targets to (i) benchmark the effectiveness of aid in reaching these objectives and (ii) highlight the fact that there is an element of scale and time to the development agenda: time is short and massive strides will be needed to win the race against poverty (and climate change). Therefore, subsidy schemes which promise massive results (say, objectives reached as % of MDG-related and country-related development goals per time) are clearly more effective than minuscule pilot operations that may have highest local performance but cannot show replication potential.

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[62] Barnes and Halpern 2000. Note that our performance criteria for subsidy schemes diverge fdrom the typical five DAC evaluation criteria (namely, Effectiveness (Outcome), (Economic) Efficiency, Relevance, Sustainability and Development Impact,, because of the narrower focus of our analysis on the practical criteria for subsidy design and performance.

[63] Komives 2005

[64] Note that we subsume the – usually separate – DAC evaluation criterion "Relevance and Significance" under effectiveness for the present paper.

3.2.2 Efficiency

The second classical criterion of subsidy provision is efficiency, meaning the absence of inefficient assignment and dissipation of (financial) resources.[65] Energy subsidies are efficient if they do not undermine the incentives of consumers to use energy according to their preferences and/or of producers to supply energy efficiently, i.e., following the market situation.[66]

Minimal Distortions

Economic efficiency exists when scarce resources are optimally deployed within a country's economy. Its assessment relies on general cost-benefit-analyses and provides insights on the allocation of resources (capital, labor, land) on a micro, meso and macro level. In practice this means that any subsidy has to be assessed ex-ante with regards to its potential costs (service, subsidy collection/ disbursement, etc.) and benefits (for consumers and providers). An efficient subsidy does not require the absence of any distortion, but its minimization to an optimal level.

Trade-offs

Trade-offs between different sets of values and/or objectives are unavoidable in subsidy allocation. For instance, if the set priority is its allocation speed – that means a fast-working short-term subsidy –, its achievement might be at the expense of equity. An efficient subsidy scheme is aware of these mechanisms and identifies the performance priorities before implementation in order to reduce unintended performance losses.

Predictability

A further precondition to the efficient use and supply of energy is the predictability of market boundary conditions, including future incentives, obligations and planned investments in the energy sector. Predictability is a precondition for efficient supply and demand response; it decreases volatility and risk perceptions and thus costs and prices.

Even if the development of the energy market (e.g. national price trends) strongly depends on the international environment (e.g., the Oil price), a reliable framework (and especially the rule of law) is essential to any domestic energy sector. Clearly defined and predictable subsidy rules and schedules are a prominent element of such reliable market boundary conditions. For instance, Brazil's renewable energy law failed to create efficient local prices because an unpredictable subsidy funding suppressed private sector FDI by the international wind industry; and subsidies that allow consumers to avoid paying bills "on a whim" ("no disconnection") – as applied in India and in most of the former soviet republics – undermine a reliable service by the energy providers and discourage private investors.[67]

Sound subsidy schemes have to be predictable for energy players (both providers and users), for the private sector at large (who banks on energy price and quality as an important input) and for the subsidy government (as administrative costs can be significant and unexpected changes in subsidy disbursement can have severe fiscal consequences, for a lack of short term fixes).

[65] In a way, it is the direct application of the Economic Principle (maximize output at given input) and effectiveness can be subsumed under the efficiency requirement as a special case (i.e., when objectives are not reached at all, this is an extreme case of inefficiency (division by zero) – and all other cases of less effective subsidies can also be described as efficiency losses in terms of output per subsidy)

[65] Compare Von Moltke/McKee/Morgan 2004, p. 249.

[66] Ibidem, p. 149.

3.3 Secondary Subsidy Performance Criteria

In practical terms, it is important to look at a set of Secondary Performance Criteria, to complement the primary criteria. Most of them could be subsumed under one or both of the primary criteria above, but we have elevated them into a separate category because of their particular importance for practitioners who have to make decisions on subsidy design. Looking at those criteria – one by one – ensures sound subsidy design in practice. This section presents and dissects the secondary performance criteria into practical performance indicators to watch out for. Obviously our typology is not the only possible one. For instance, many of the performance indicators relate to each other. These relations are summarized in the following table.

Table 3.3: *Subsidy Performance Criteria often relate to several other criteria in causal relationships. Often, one criterion is a necessary but not sufficient condition for another. Source: Own Elaboration*

	Effectiveness	Efficiency	Sustainability	Resilience	PSP	Transparency	Politics
Effectiveness	■						
Accomplishment of objective	■	→		→			→
Targeting	■		→				→
Scalability	■						→
Speed	■						→
Efficiency		■					
minimal distortion		■			→		
$/Output		■	→				→
Admin Costs		■					→
Sustainability			■				
economical (user / provider / market)			■	→	→		
financial			■	→	→		
ecological			■				
social			■				
Resilience				■			
simplicity, stability,				■		→	
flexibility, adjustability over time			→	■			
PSP					■		
FDI					■		
PSD		→			■		
Transparency						■	
monitorability	→	→				■	→
predictability					→	■	
Politics							■
visibility, constituency, votes			?				■
(personal profits, power)		☠		☠	☠	☠	■
(fast disbursements)		☠	☠				■

Legend:

■ = direct relation

▒ (grey) = strong relation

→ = ROW "increases chances of" COLUMN

? = unclear, might work both ways

☠ = ROW "is hindering" COLUMN

3.3.1 Sustainability

Economical Sustainability: Economy – Market – Provider – Beneficiary

A prominent criterion of the performance of modern energy subsidies is their sustainability. If subsidy objectives are to last, sustainability needs to be assured on micro, meso and macro level. Only a sustainable national energy market (or energy provider) outlasts an eventual phase-out of all financial (technical) support. A solar home system installed in a remote area without attention to maintenance issues and availability of spare parts will be useless after 2-3 years. There are several specific elements to sustainability, which can ultimately all be traced back to long-term economical sustainability:

Financial Sustainability

Subsidies should be (i) subject to a responsible handling of financial sources on macro level and (ii) provided only to projects and providers that are financially sustainable (on micro level). On provider level, the risk of losing the subsidy is too high if financial sustainability is shaky (and providers might be lured into unviable business ventures). On macro level, subsidy support funded through the government's budget and indirectly through increased debts may foster positive effects in the short-term, but, in the long-term, charges future generations for expenditures they might not benefit from. A financially sound subsidy guarantees refunding within the same period (e.g. taxes, cross-subsidies, etc.) or ensures it within a short time frame, through a stable institutional setting (e.g. revolving funds).

Ecological Sustainability

Existing subsidy schemes in developing as well as in industrial countries often boost the demand and/or supply of ecologically harmful fuels, the generation of electricity on the basis of non-renewable primary resources and the output of emissions relevant to the greenhouse effect. An ecologically sustainable subsidy regime minimizes those negative environmental impacts by avoiding over-consumption and fostering the generation of a "clean" energy supply. Fuel subsidies are the most prominent culprit on this account.[68]

Social Sustainability

Social sustainability refers to the distributional effects of a government intervention. Much of the recent critique of power sector reforms points to underperformance on this account. More often than not, existing energy subsidies increase existing social inequalities in favoring high income groups on the expense of the lowest ones (again, fuel subsidies are the most prominent example). Stakeholders have to be aware of the distributional short- and long-term effects of any support to foster an equitable development of the countries' economies.

The assessment of ecological, financial and social sustainability has to be conducted in a pluri-dimensional approach, that is to say at the micro-, meso- and macro-levels. For instance, an efficient domestic sector, minimizing over-consumption and over-production at the micro- and meso-levels, is not overall sustainable if it relies, for its electricity production, on old, inefficient and polluting power-plants. The same conclusion can be drawn from subsidy schemes favoring both poor connected households and better-off income groups, but which fail in targeting the poorest households who do not have access to the electricity grid.

[68] GTZ 2007

3.3.2 Resilience

An often forgotten, but absolutely critical prerequisite is the resilience or robustness of energy subsidies. All of the above-mentioned criteria are obsolete, if a subsidy scheme cannot adapt to the quickly changing political, social or financial environment. Thus, resilience includes two antagonistic factors: rigidity on the one hand and flexibility on the other.

All too often, subsidies are designed with an ideal – or at least static – snapshot of the country context in mind. Risks are evaluated, but mitigation measures too often are only suited to reduce the risk, instead of mitigating impacts. Yet, reality shows that "external shocks" and changes in boundary conditions are the rule, not the exception, for developing countries. Therefore, resilience is of direct importance for the long-term effectiveness and sustainability of any subsidy scheme.[69]

External Shocks

Due to the high degree of global interdependence in the energy sector (e.g. provision with primary resources), domestic energy markets are particularly sensitive to external shocks coming from the international environment. Higher fuel and/or coal prices increase the costs of domestic energy supply and, consequently, end-user prices. A stable subsidy scheme copes with those adversities and is, to a large extent, independent of external price shocks.

Changed Boundary Conditions

In many developing countries, political and other relevant institutions of the energy sector (e.g. electrification boards or regulators) lack stability. This can be caused for example by (frequent) political changes (sometimes with radically changing policies regarding PSP and subsidies, as is described for the case of Bolivia in GPOBA (2007)), the lack of technical know-how and fiscal or social crisis. The result of instability is the presence of unreliable boundary conditions that undermine the planning and consistency of subsidy regimes and endanger the effectiveness and efficiency of their performance. It is therefore important that a subsidy regime disposes of stable institutions, which can consistently adjust to a changed economic environment or political landscape over time.

Simplicity

In order to ensure the long-term performance of subsidies, governing institutions should be designed in a simple manner. Institutional simplicity guarantees the long-term validity of a subsidy scheme, even when personal resources and boundary conditions are changing. Furthermore, a simple framework enhances the ability to plan for both the energy producers and consumers and strengthens its acceptance by the citizens.

Internal Distortions

A major challenge to the performance of subsidy regimes in developing countries is the high risk of nepotism, favoritism and corruption. Against this background, the subsidy scheme's robustness against unintended influences of policy makers is essential to their long-term performance.

3.3.3 Private Sector Development

As discussed above, the development of a strong private sector is crucial for an efficient energy sector. The competition mechanisms inherent to the private sector minimize the dissipation of scarce resources, enhance their optimal allocation and make the successful introduction of market mechanisms possible. Private sector development (PSD) is therefore a prerequisite to sector efficiency. However, due to its importance for the energy sector and the economy as a whole (and due to the multipronged nexus between subsidies and PSD discussed in chapter 1) PSD is assessed independently in this report.

[69] A corollary to this finding is that an ongoing subsidy scheme that is functioning well but seems to be not perfect, should not always be replaced at the first occasion by an alternative scheme which promises slightly better performance (the better is the enemy of the good), as resilience in itself can be an asset: the matrix tool can be used in such cases to estimate the gain from changing an existing scheme, and weigh it against the cost in terms of predictability and risk.

3.3.4 Politics

Energy is politics![70] In many (if not most) cases, real-life energy subsidies are instrumentalized for reaching strategic goals and political priorities. Obviously, political intrusion (or outright bad governance) has direct, negative effects for all other subsidy performance criteria and needs to be avoided. The theory wants subsidy schemes to be as independent as possible from short-term political interests (see previous chapter) in order to guarantee effectiveness and efficiency. However, this is often not possible in practice. Therefore, practitioners are often left alone with idealized "textbook recommendations" which are impossible to attain in their specific country context – but get no practical advice on (i) how to make the best of given political realities while maximizing subsidy performance and (ii) where to draw the line with regard to political hand-holding (i.e., what are minimum requirements for independence?).[71] Sometimes, short-term political interests such as more visible results (which can be turned into votes) can even be used to argue for economically warranted subsidy improvements (say, more efficient spending) or administrative efficiency (i.e., not delaying implementation unnecessarily).

At least during the set-up process of a subsidy regime, the close cooperation between policy makers and implementers is essential, to avoid "dead born" donor schemes.[72] Since the implementation of a sound subsidy design and its long-term performance highly depend on political "good-will", politics is an important criterion. Consequently, depending on the country's political environment, factors like visibility, constituency, votes' maximization and politicians' personal advantage and control over subsidies may be relevant for the subsidies' success.

3.3.5 Transparency

Finally, a sound subsidy design necessarily implies a high degree of transparency. The objectives, financial burdens and mechanisms of a particular subsidy regime should be comprehensible for citizens as well as for donor organizations and private investors. Full transparency increases planning abilities for market participants and is a necessary condition for the attraction of private (foreign) investment. Furthermore, periodic reporting on subsidies by the national authorities to the parliament increases funds' control and prevents resources' dissipation and fraud. For instance, such a practice exists in Germany since the 60s.[73]

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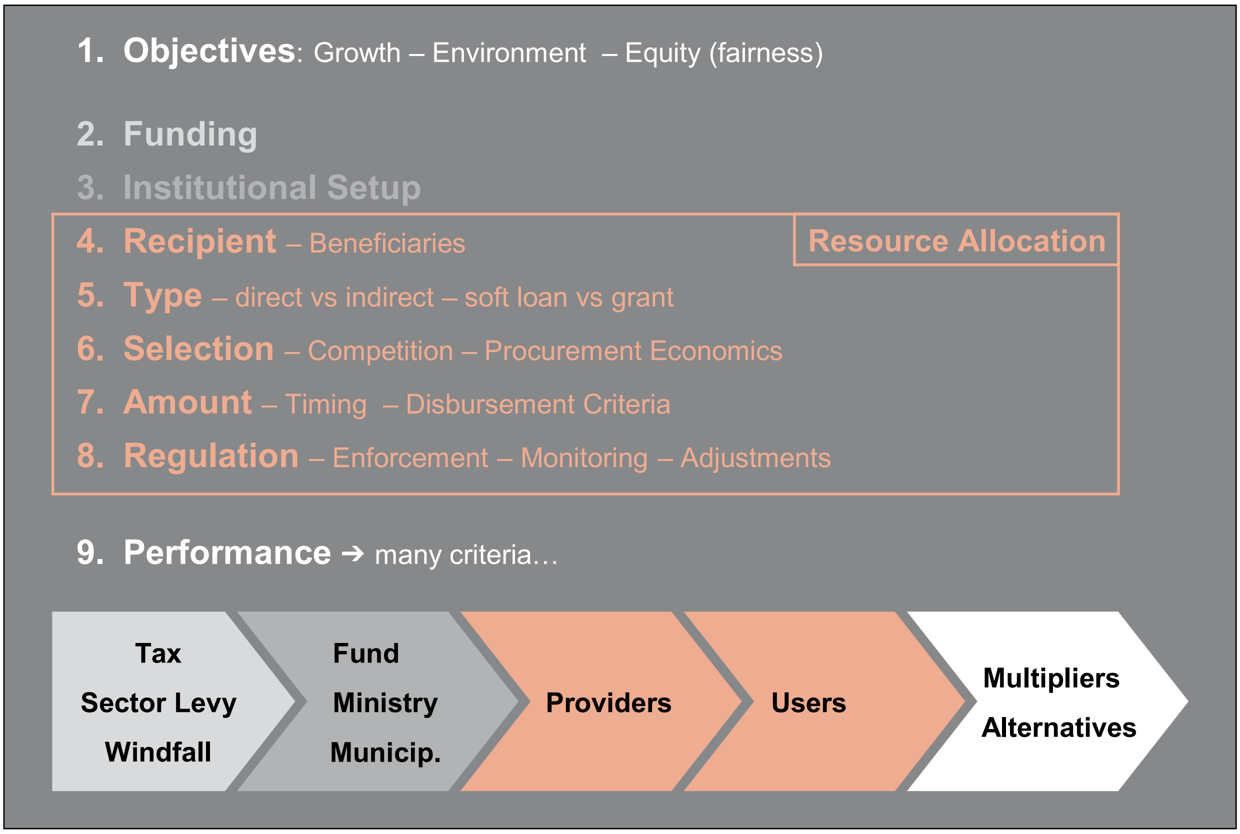
70 Opitz 2007
71 OECD 2007
72 This particular aspect of political sustainability is covered under the sustainability criterion of the DAC evaluation sytem.
73 Von Moltke/McKee/Morgan 2004: p. 151.

3.4 Subsidy Design Variables – and their Effects on Performance

The performance of energy subsidies is subject to different design variables which can be adjusted either by policy makers or practitioners. In order to optimize the multi-dimensional performance of a subsidy mechanism, a sound and coherent choice of these design parameters is indispensable.

The figure below shows the main subsidy design variables, ordered in practical categories along the flow of funds: Objectives → Funding → Institutional Setup → Allocation → Regulation. These are the main categories of the x-axis in our Subsidy Matrix Tool (chapter 3.5). Obviously, other categories are possible; this one is intuitive for practitioners. In a given market context (i.e., market stage, starting point and country boundary conditions), practitioners have to (i) identify the possible design options ("variable values") for each of the design variable (not all options will be possible in most cases) and (ii) judge the marginal effect on overall subsidy performance for different design variable combinations ("**Subsidy Mechanisms**"). Usually, one would start by comparing a few typical examples that have worked in other countries and show typical variable combinations ("**Subsidy Models**") – and then adapt those to local circumstances. Experience shows that working with the matrix in a systematic way helps tremendously to dissect all design options that are available in a given case and to detect design features of previous examples (the Models) which can be changed to address specific weaknesses of the latter with respect to local circumstances without sacrificing the strengths. This way, one can "fine tune" the design features of a subsidy mechanism step by step, to improve its probable performance (i.e., the weighted sum of performance criteria) under given country conditions.

Figure 3.4: *Overview of subsidy design variables that can be influenced by policy makers; source: Own elaboration*



3.4.1 Objectives

As shown above, energy subsidies usually aim for one or more of the following four objectives: **Economic Growth**; **Energy Security**; **Social Equity**; and **Environmental Sustainability**. It is important that the specific objectives targeted by a subsidy scheme are clearly stated, prioritized – and not mixed up. This is an obvious rule which is broken all too often in practice, which then leads to inefficient and ineffective allocations:

In Brazil, for example, one single energy law has declared all the objectives above as national priorities:[74] (i) improved energy efficiency for economic growth, (ii) improved social equity via (a) lifeline rates and (b) a universal access fund, as well as (iii) increased investment in Renewables to improve the country's energy mix. However, no priorities were stated and the funding sources identified in this law were not enough to meet all objectives at once – the result was a loss in performance on several of these objectives. The renewable energy subsidy scheme, for instance, never got off the ground as it could have, because private sector could not trust the long term availability of funds (the large Phase Two was never clearly assured) so that possible FDI was suppressed and cost reductions due to competition and private sector creativity didn't happen.

Another example is GEF's funding for Renewables, and especially for SHS, during the 1990s: GEF mixed up laudable, hidden social objectives (access for dispersed, marginalized population via innovative offgrid technology service models) with the original objective of climate change prevention (via support of promising renewable energy technologies). As a result, program performance was judged by different measures (CO_2 abatement only) than those considered by project implementing agencies (jump starting markets for RET-based offgrid access solutions for deprived rural areas) and international support for the program components in question stalled (especially for SHS), in part for this mixed-up definition of goals at the outset.[75]

Once the objectives for the subsidy scheme are clearly stated, specific outputs have to be defined that allow reaching the overall objectives with a high chance of success. The outputs have to be measurable at affordable cost – tracking them allows to evaluate the subsidy performance transparently and to adjust if needed.

3.4.2 Funding

Basically, there are three ways to fund a subsidy regime in the energy sector. The classical way is through the government's budget. General tax revenue, specific taxes or even debts are possible primary sources of subsidies.

Moreover, funds can be raised within the energy sector. Bounded levies or cross-subsidization – a widespread instrument in developing and industrialized countries – generate financial resources for the subsidization of specific groups on the energy market.

Other possible sources of funding subsidies are windfall profits, which may arise (i) from the privatization of energy utilities, or (ii) the provision of donor grants, especially in developing countries, or (iii) may be reaped, say, by the oil industry (price hikes) or the nuclear power industry (life extension of plant). Even if these sources can generate considerable amounts of money, they often lack stability and reliability. Whilst i and iii above normally appear once and are therefore appropriate to the start-up financing of investments within the energy sector, ii depends on external resources and is subject to the setting of political priorities by international donor organizations or governments in industrial countries.

[74] ESMAP 2005

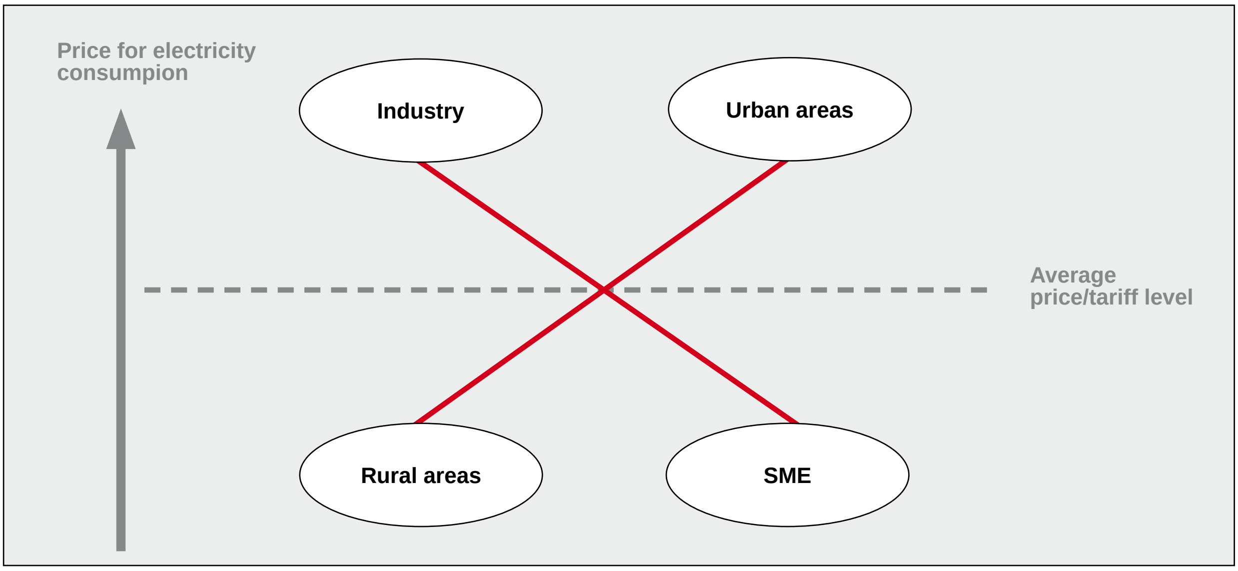
[75] One of the implementing agencies, the World Bank, did a somewhat better job at differentiating objectives: their GEF-funded programs usually blended two funding sources into one operation, but kept their activities and outputs clearly separated, according to the main objectives of these sources: GEF grants were used for TA (and to some degree subsidies) for promotion of offgrid technologies and solutions, while the Bank-funded loans were often had poverty-related outputs (namely, increase in access).

However, the funding scheme of energy subsidies generally consists in a hybrid combination of governmental, sector-based and/or windfall funds and depends on the domestic needs for subsides, the political landscape, the reliability of political and sectorial institutions and, finally, the market actors as such.

Cross-subsidies

Cross-subsidies[76] refer to a sector-wide or utility internal price setting that meets the break-even constraint (total revenues cover total costs) while differentiating by service or consumer group in a way that some consumers pay more and others pay less than the (average) incremental costs of service provision.[77] For instance, if there is a single service and one group of consumers (e.g. industrial consumers) pays a price exceeding average costs, then this allows setting the price for other groups (e.g. public institutions or rural households) below the average cost of supply (see figure 3.4.2a). Cross-subsidy patterns are widespread in developing and industrial countries and most often successfully applied where large public utilities are in charge of the energy supply of the whole country (or a monopoly service area) and a stable sector exists.

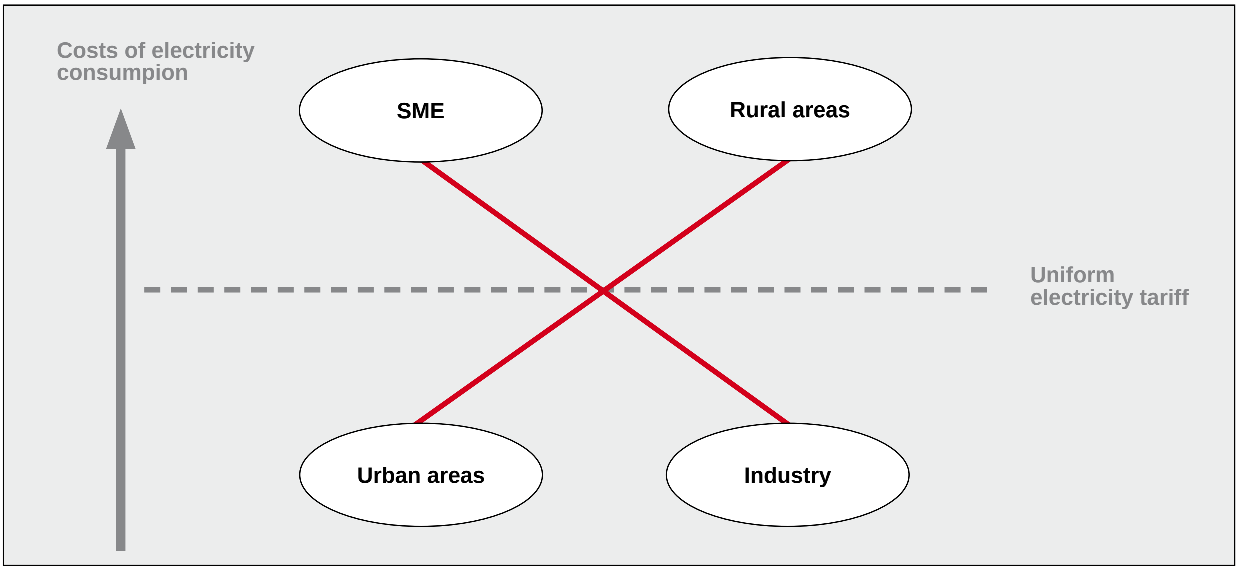
Figure 3.4.2a: *A pattern for cross-subsidies; source: Own elaboration*



In practice cross-subsidies can also appear in the form of uniform electricity prices/tariffs for different services (e.g. when the cost of supply differs across consumer groups). For instance, the setting of a uniform price level for all electricity consumers may favor remote (rural) areas, which lack infrastructure and where the electricity supply is comparatively costly. The contrary holds for urban areas and large industrial customers endowed with energy infrastructure and/or located near power plants, where the costs for access and supply of energy are relatively low (compare figure 3.4.2b).

[76] Faulhaber (1970)
[77] This is usually referred to as the "incremental cost test" for the existence of cross subsidies (Baumol, 1986).

Figure 3.4.2b: A pattern for uniform electricity prices; source: Own elaboration



Theoretically, cross-subsidies can be set so as to meet the revenue requirements of energy utilities or the energy sector. Thus, the particular attraction of such sector funding mechanisms lies in their independence from the national budget and the prevention of fiscal burden. Financial autonomy makes cross-subsidy mechanisms less vulnerable to changes of political priorities than alternative funding sources.[78] It should be kept in mind, though, that cross subsidies in a strict sense are economically inefficient because they entail a departure from marginal cost pricing.

Energy Funds

Another common funding source for energy subsidies in developing countries are energy funds. In this case, the key question is to assure the sustainability of funding over time ex-ante. Donor contributions can help to jump-start new markets but are not sustainable.[79] Similarly, annual budgetary allocations tend to be volatile, depending on political priorities and the overall economic situation.[80] The best-functioning funds usually count on reliable sector-based sources of finance, such as a sector-based levy (Brazil), or privatization proceeds allocated in a secured escrow account (Guatemala). Both long-term, reliable funding and clear allocation rules are essential for attracting private investors into difficult (rural) markets, and lower their risk perception, reducing the overall program costs.

While a government funded subsidy scheme rests on the performance of the tax regime, a sector-based subsidy scheme relies on the performance of the tariff system. For instance, in Mexico, rural households pay prices that account for about 30% of the supply costs, whereas residential energy consumption is charged with prices that are a lot higher.[81] In this case, residential households pay for the subsidy, but of course other settings are possible.[82]

If the funding of energy subsidies relies on domestic resources, citizens (tax payers or energy consumers) finance the different instruments. So, in order to assure the attainment of objectives such as efficiency, (social) sustainability and resilience, an in-depth analysis of the tax regime or the tariff structure has to be undertaken.

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[78] Especially the "classical" funding source, i.e. the governmental budget, depends on changes in the political landscape and is therefore often not reliable.
[79] In order to increase sustainability of donor grants their phasing might be an option (Barnes 2007, p. 90). Instead of being dependent on single donors and their political priorities the phasing of donor contributions steadies and stabilizes the financial sources.
[80] Compare chapter 4.3.1.
[81] See Gutierrez-Poucel 2007, p. 145.
[82] In industrial countries, for example, energy prices are set according to the marginal costs of supply. Residential consumers pay higher prices than costumers in the industry. For a more detailed elaboration on the practical implementation of cross-subsidies see chapter 5.5.1.

3.4.3 Recipient

Beneficiaries and Recipients

Weight outreach and targeting! One phenomenon, which renders the allocative assessment of energy subsidies complex, is the fact that the recipients of the subsidies often do not fully coincide with the final beneficiaries. If for instance a direct subsidy (e.g. soft loan or grant) is given to an electricity utility, the utility is both recipient and beneficiary of the subsidy. However, this does not exclude the possibility that the subsidy might also benefit other entities that are not direct recipients. In the case at hand, further beneficiaries such as households can eventually benefit from lower end-user prices or increased access.

Subsidy Recipient

A recipient of a subsidy is the entity (person, utility, organisation, institution) that receives the subsidy directly (in the form of loan, grant, TA, etc.).

Subsidy Beneficiary

The beneficiary of a subsidy is the entity (social group, sector) that gains from the provided subsidies. One subsidy can yield several beneficiaries.

Thus, the calculation of the benefits generated by a subsidy has to take into account the benefits reaped by all beneficiaries and not only its direct recipients. Most of the time, benefits are spread out among the different players on the respective market. For instance, technical assistance to the Ministry of Energy induces diffuse benefits for the whole energy sector and, therefore, for both the energy suppliers and the energy consumers (compare figure 3.4.3a). This logic also applies to direct financial support of energy utilities, where both the players on the supply side and those on the consumer side of the market benefit from the subsidy. The former – being recipients – benefit directly from the support, while the latter might get lower end-user prices and/or increased access to the market.

In order to assign subsidies in a sound and sustainable manner, and particularly to ensure reaching the designated target-group, it is indispensable to clarify the recipient-beneficiary problem. But even if the commonly accepted procedure when dealing with (energy) subsidies consists in precisely defining the target group,[83] targeting has to be weighted out against the possible reach of a non-targeted subsidy generating several beneficiaries. Especially if the subsidy regime is designed for the long term, an indirect subsidy (e.g. capacity and institution building) can have positive impacts on the energy sector as a whole as well as on energy providers and consumers in particular.

On the contrary, subsidies designed for the short-term should generate quick and positive results subject to the chosen goals or objectives. It is thus preferable to assign the subsidies in a clear-cut and transparent way. This does not lead to the refusal of wide-reaching subsidies, it rather aims at making the generally limited financial resources converge towards the defined goals in order to avoid unnecessary market distortions and effectively reach the target group.

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[83] See primary performance criteria chapter

Figure 3.4.3a: Example of a diffuse subsidy (recipient ≠ beneficiary); source: Own elaboration

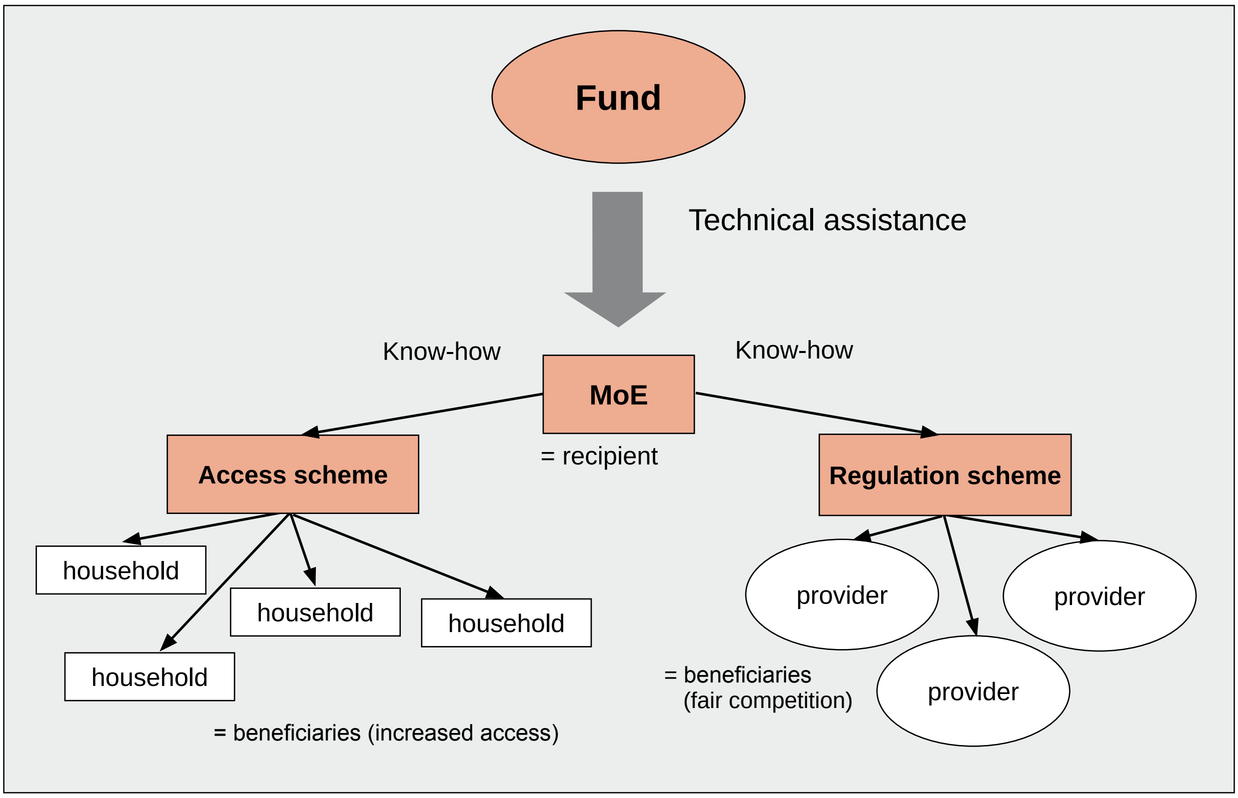
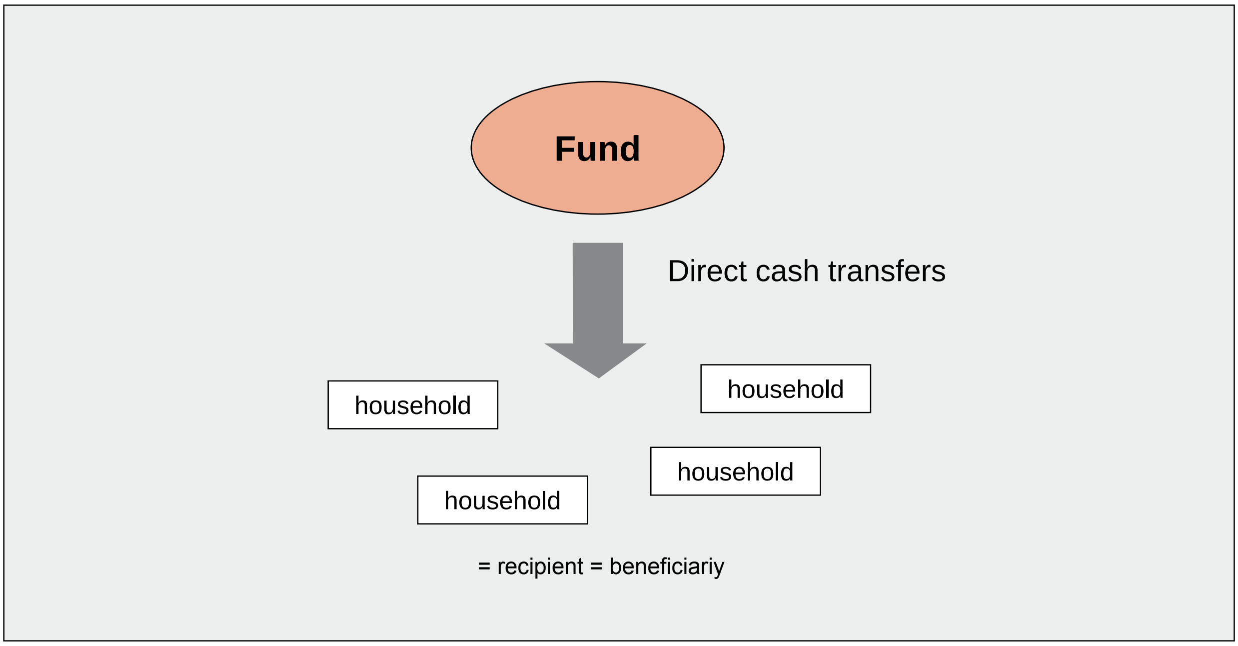


Figure 3.4.3b: Example of a clear-cut subsidy (recipient = beneficiary); source: Own elaboration



While the direct recipients are relatively easy to identify, this is not the case for beneficiaries. Indirect and unintended effects of subsidies are common. It is especially true with diffuse subsidies since their benefits and consequences are hardly measurable. This mainly causes two problems: On one hand, if some beneficiaries are not part of the target-group, this implies a sub-optimal allocation of the subsidy **(efficiency)**, leading to a dissipation of the scarce economic resources[84] which could be better used for effective poverty-targeting subsidies **(effectiveness)**.[85] On the other hand, if the number of beneficiaries is too high, the monitoring of the benefits produced by the subsidies becomes more difficult, transparency is undermined and corruption and free-riding may ensue.

Even more problematic than unintended beneficiaries and free-riders are non-beneficiaries. This refers to the phenomenon that the originally targeted group (or a part of it) does not benefit from the subsidy at all. This is especially the case with general price subsidies. For instance, subsidized fuel prices favor middle- and upper-income groups that possess appropriate access to and appliance for fuel. At the same time, the benefit for poor households, which lack the necessary funds to purchase fuel, tends towards zero. Empirical data on rural electrification shows that poor rural households are often excluded from electricity access due to the lack of affordability.[86]

User or Provider?

Figure out the needs! There are several reasons to favor direct subsidies intended for energy end-users. Compared to financial or technical support intended for providers, consumer subsidies are less market distorting and may generate important catalytic effects to market development **(sustainability)**. It is therefore often stated that subsidies should be provided to end-consumers in the interest of targeting and the strengthening of consumer sovereignty.

However, objections must be seriously taken into account. In regions lacking basic energy infrastructure (i.e. in remote rural areas), the subsidization of energy providers, through technical and/or financial assistance (e.g. soft loans or grants), can be the preferential option. In the case of off-grid electrification, recently evaluated programs of output-based subsidies in Latin America (Argentina, Nicaragua, and Bolivia) proved to be successful.[87] Another promising approach is the Dutch-German program Energizing Development (EnDev). The EnDev-partnership combines the provision of access to clean energy and the development of sustainable electricity markets for up to 5 million people with a focus on African countries.

For a final decision on user- or provider-support, the specific needs of the targeted country have to be taken into account. In the absence of any energy infrastructure, a two-step approach may be advisable: (i) encourage providers to install a minimum level of energy infrastructure and (ii) support (poor) consumers to purchase a sufficient level of energy services in order to sustain the market.

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[84] In this context resources refer to direct financial support as well as to indirect technical assistance.
[85] See Barnes 2007, p. 7.
[86] Ibidem, p.8.
[87] For an extensive evaluation of these programs see Reiche et al 2004b.

3.4.4 Subsidy Type

Find (or build) the adequate subsidy type! There are innumerable subsidy types and typologies. The sheer variety and the complementary (or conflicting) character of several subsidy types require a prudent assessment prior to implementation. It is self-evident that the best combination depends on the country context. The dissection of design variables we have chosen for this report is a typology in itself, albeit with the aim to raise practitioners' awareness to "look beyond existing typologies" by taking existing subsidy models (and related experience) and understanding which design feature of a given subsidy type or model has had a positive or negative effect in a previous application. This is the only way to avoid application of previous models in inadequate contexts.

Each of the three tables below provides a different, illustrative subsidy typology. As we can see, subsidy typologies depend on the respective point of view, which in turn reflects the objectives of the policy maker (or researcher).

Table 3.4.4a: *This **general energy subsidy typology** by IEA provides a good overview of the most common energy subsidies in developing countries and their effect on market prices as well as some recommendations for practitioners; source: UNDP (2002)*

Government Intervention	Example	How the subsidy usually works		
		lowers cost of production	raises costs of production	lowers price to consumer
Direct financial transfer	Grants to producers	●		
	Grants to consumers			●
	Low interest or preferential loans to producers	●		
Preferential tax treatment	Rebates or exemtions on royalties, duties, producer levies and tariffs	●		
	Tax credit	●		●
	Accelerated depreciation allowances on energy-supply equipment	●		
Trade restrictions	Quotas, technical restrictions and trade embargoes		●	
Energy-related services provided directly by government at less then full costs	Direct investment in energy infrastructure	●		
	Public research and development	●		
Regulation of the energy sector	Demand guarantees and mandated deployment rates	●	●	
	Price controls		●	●
	Market-access restrictions		●	

*Table 3.4.4b: A typology of **electricity subsidies** by funding source and subsidy object; source: Mostert (2007)*

Financing Sources	Subsidy Targets	
	Cost of investment	**Price of output**
Tax payer	Direct capital subsidies Soft loans VAT exemption Import duty exemption Accelerated depreciation Subsidies to R&D	Top-up premium to the distribution company per sold kWh Top-up premium to distribution company per (sold kWh to) lifeline consumers VAT/excise duty exemptions on rural power tariffs Vouchers for low income households
Power consumer	Connection costs are subsidized by utilities Support to loan finance the cost of consumer internal wiring	National unified power transmission tariff National or regional unified retail (distribution) tariffs Lifeline rates

*Table3.4.4c: An overview of **clean energy incentives;** source: Stern (2006)*

Incentive	Example
Fiscal incentives	Reduced taxes on biofuels; investment tax credits
Capital grants	For demonstration projects such as the clean coal programme in the US; photovoltaic (PV) rooftop programmes in the US, Germany and Japan, marine renewables in the UK and Portugal.
Feed-in tariffs	Fixed price support mechanism, usually combined with regulatory incentive to purchase low-carbon power output, e.g. wind and PV in Germany; biofuels and wind in Austria; wind and solar schemes in Spain; wind in Netherlands.
Quota-based schemes	Renewable Portfolio Standards in 23 US states; vehicle fleet efficiency standards in California
Tradable quotas	Renewables Obligation and Renewable Transport Fuels Obligation in the UK.
Tenders for tranches of output	Uplifted output prices paid for a general levy on electricity tariffs, e.g., the former UK Non Fossil Fuel Obligation.
Grants to infrastructure	Covering the costs of connecting new technologies to the electricity network.
Public utility procurement	Historically the approach of public electricity monopolies for the purchase of nuclear power in OECD countries. Currently used by China. Often combined with regulatory agreements to ensure cost recovery, soft loans and government assumption of nuclear waste liabilities.
Government procurement	Demonstration projects for public buildings; use of fuel cells and solar technologies by defence and aerospace industries; hydrogen fuel cell buses and taxis in cities; energy efficiency in buildings.

3.4.5 Selection

Defining clear, transparent and efficient rules for selecting target areas, projects and service providers is arguably the most important, and possibly the most challenging task when implementing direct subsidies on the ground. If rules for provider selection are unclear or wrong, sector distortions, corruption and bad targeting are hard to prevent (see subsidy score cards in the next chapter).

This is a reason why donors with a long history of direct subsidy programs usually have intricate guidelines and processes for procurement and disbursement. Smaller donors, who have only recently (re-) engaged in direct subsidy measures, sometimes lack such guidelines or their staff can lack the experience needed for the design of proper provider selection processes.

There are two basic approaches to provider selection: working with incumbents and competition for subsidies.

Working with incumbents is usually easier and has lower administrative costs – it also may be the only option where natural monopolies exist.[88] GPOBA, for instance, is mainly working with strong incumbents in order to minimize risks and transaction costs when working without TA. Specific regulatory measures have to be taken in such cases to assure subsidy efficiency.[89]

Competition can increase transparency and subsidy efficiency. The optimal competition type depends on country and market stage. One can distinguish competition for the market; in the market; by projects; by clusters; and yardstick competition.[90] In subsidy tenders, subsidies are bid out against pre-defined rights and obligations, usually using one bidding variable (as opposed to multi-variable tenders). Frequent bidding variables in energy access projects are: subsidy amount, end user tariff, connection charge and minimum number of new users. In all cases, the objective is to minimize the subsidy per user and/or minimize user contribution at given service quality. For off-grid projects, the bidding variable is not as decisive as for traditional power sector auctions, because investors always provide equity and commercial debt for the upfront investment, so the walk away option is not as strong as in traditional transactions. Efficiency gains from tenders have to be weighed against their transaction costs.[91] Renegotiation is a potential problem of all types of concession contracts, and can reduce the effects of tendering.[92] Each competition type has advantages and disadvantages and depends on the supply model and the market conditions. It is important to ensure, however, that the resulting scheme is sustainable over the long-run. As subsidy contracts always contain a set of rules and obligations, the subsidy agency and the regulatory agency need to coordinate effectively.[93]

3.4.6 Amount, Timing, Exit Strategies

Amount: How High Should the Subsidies be?

Don't distort prices and willingness-to-pay!
In economic terms (Pareto efficiency), any intervention in a country's economy that benefits one individual or group (welfare gain) should not be at the expense of any other individual within the economy.[94] Hence, subsidies should not be bigger than the welfare gains they generate and losses of efficiency should be avoided. In the practical application of energy subsidies, this rule faces several challenges. First, in most cases, welfare gains are not exactly measurable. Apart from the (measurable) financial dimension, subsidies can also generate "soft" or long-term welfare gains which can hardly be expressed in budgetary terms and can not be compared with the original financial effort for the subsidy.

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[88] Hodges 2007
[89] GPOBA 2003 and Tineo 2007
[90] Reiche et al 2004b
[91] Klein 1998
[92] Guasch 2004
[93] Reiche et al 2006
[94] This rationale is referred to as Pareto efficiency. The concept helps to compare the economic performance of different allocational settings in absolute terms. A major weakness of the Pareto concept is, that is does not allow any conclusions on distributional effects of the welfare gain.

Second, the Pareto criterion does not provide a basis for judgement on the degree to which the objectives of a subsidy are reached. If for instance the goal is to provide the poorest households with energy, the financial welfare effect might be negative, but the objective of equity is reached.

Following the Ramsey Pricing Principle, support should focus on those products and services where the absence of a subsidy decreases or completely impedes demand or supply (i.e. where demand is highly inelastic).[95] However, transfers to consumers or energy providers should not undermine the effective willingness-to-pay of the consumers or the effective willingness-to-supply of the providers, but absorb it. If not, there is a strong risk of free riding and misappropriation of funds. Recent examples of subsidy auctions demonstrate an effective way to figure out the true supply costs of energy services. For example in Chile and Peru (pioneer countries in applying this method), subsidies for rural electrification could be lowered considerably.[96]

Exit Strategies and Timing

Don't enter without an explicit strategy for your exit! Academic subsidy discussions, often call for an exit strategy for (financial) support. Since subsidies cause a financial burden for the government (or rely on temporary external sources like donor grants), it is reasonable to introduce an exit strategy from the beginning. A prudent phase-out of the support helps to familiarize consumers as well as producers to a situation without subsidies and gives the private sector the chance to adjust its business strategies to the new situation without financial support.
In developing countries, where public and private funds are especially scarce, a clear focus on developing (self) sustainable markets is important.

However, it should be noted that exit strategies can have many forms – and that a phase-out of subsidies at exit (for instance the end of a donor project) is not a necessary (nor necessarily sufficient) requirement for a valid exit strategy. While the logic described above is usually applied to "market pump priming" subsidies aimed at creating scale economies and reducing market inefficiencies (chapter 2), with the aim to bring down economic costs, two caveats are important for realistic energy subsidy design in this context:

1. The timing of such subsidy reductions has to be based on realistic estimates of actual cost reductions – all too often, the time it takes until volume and industry efficiency gains bring down costs has been underestimated by ambitious projects in the past (most GEF SHS projects of the 90s are an example for grossly underestimated durations for the cost reduction in nascent national markets). This is especially true for new technologies and new players.

2. There are cases where subsidies will be needed even in the long run. For instance, increasing the access to energy by poor households can be justified on equity grounds or by the merit good argument,[97] but it will not create a positive return on investments in financial terms – even in the long run. Moreover, this is a case where efficiency gains and cost reductions through market volume are likely to be overcompensated by (a) increases in logistics and transaction costs (for instance when serving areas with lower demand densities) and (b) ever lower WTP of the remaining users without access, as coverage rates increase (referred to as the "last mile problem" by Reiche 2004b). In this case, a subsidy phase-out at project end is not applicable as exit strategy. Instead, a valid exit strategy of such a donor project could be to create a national electrification fund with transparent funding and implementation rules.

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[95] This assumes that inelastic demand (lack of alternatives/substitutes) is characteristic for the poor and needy. Ramsey Pricing says that mark-ups on marginal costs that are needed to recover (average) cost should be imposed on services with inelastic demand (because this would reduce the welfare losses associated with a departure from marginal cost pricing). Accordingly, Reverse Ramsey Pricing means that prices be lowered through subsidies for services with inelastic demand (see, for instance, Laffont 2001, p. 73).

[96] Clarke/Wallsten 2002, p. 14.

[97] For a definition of merit goods see chapter 2

Table 3.4.6: *Strengths and weaknesses of typical exit strategies for rural energy access projects. Real-life energy project exit strategies (columns) and their typical effect ("+" means often positive effect; "-" means often negative effects) on the main sustainability levels (user; provider; market and sector). While a "sunset clause" for subsidy phase-out is a typical example, it is by no means the only form of a valid exit strategy. The EnDev Sustainability checklist (Annex) nicely lists the main sustainability questions for practitioners.*
Source: Own elaboration

EXIT STRATEGIES: Typical strengths and weaknesses						
exit risk covered for...	Stand-alone pilot	Business startup subsidy 5 years	Pump Priming Subsidy 5 years (GEF case)	Revolving Fund (community / sector)	Basket Fund, phased, declining subsidy	ongoing funding for programme (by provider, sector, country)
...User	–	+	varies	+	+	+
...Provider(s)	–	+	varies	varies	+	+
...Market	–	varies	–	varies	+	+
...Sector	–	varies	–	varies	varies	–
Remarks	typically worst case re exit strategy. If Pilot NGO stays in situ long time, can be sustainable for users.	needs attention to overall market sustainability, see EnDev sustainability criteria for positive example	too short	may collapse if badly managed or designed	may not reach last 10% of users.	may drain government ressources and create inefficiencies

3.4.7 Regulation and M&E

"One further step is to institute regular, rigorous statistical evaluations of program impacts. Only then can donors evaluate the social returns on their investments – and have the information to improve impacts." – ***Morduch (2005)***

An important characteristic of network services in the energy sector (e.g. transmission/distribution of electricity or gas) is that they are natural monopolies. Without government interventions, the market power would allow the service providers to increase prices beyond the (marginal) cost of supply. The solution of this market failure (under-supply of services) is either to create and control a public enterprise or to regulate the energy market in order to stimulate competition (open access) and increase efficiency.

Regulation is of particular importance with regard to subsidies because they are two sides of the same coin: providers' costs depend on quality standards (regulation) and where tariff schemes (regulation) cannot cover these costs, subsidies are needed.

However, natural monopolies do not prevail in all kinds of energy services. Off-grid electrification, for instance, might require a different regulatory approach than the control of one or few centralized utilities.[98]

[98] Reiche et al. 2006, p. 41.

On this matter, Reiche (2006) defines four principles for pro-electrification regulatory systems: (i) Adopt light-handed and simplified regulation; (ii) Allow (or require) the regulator to "contract out" or delegate, either temporarily or permanently, regulatory tasks to other government or nongovernmental entities; (iii) Allow the regulator to vary the nature of its regulation depending on the entity that is being regulated; (iv) Establish quality-of-service standards that are realistic, affordable, monitorable, and enforceable.

Monitoring and enforcement of provider obligations, including service quality, is a key task of regulation, and necessary for credibility and for learning effects during scale-up. All subsidy schemes therefore have to define a set of simple, readily measurable performance indicators, and their achievement has to be measured through pre-defined, transparent, independent, cost efficient monitoring activities. GTZ's EnDev program has succeeded in designing and implementing a simple (sic) monitoring process that not only allows to track the performance of each component efficiently (and frequently enough), but also to benchmark country components against each other for immediate transfer of lessons – and to reassign funds from weak performers to stronger ones.

Evaluation, on the other hand, has been the stepchild of Development Aid for too long. There is a shocking gap on data regarding the actual development impacts of donor programs on the ground.[99] This is partly because they are difficult to assess quantitatively, because (i) impact typically shows over the medium to long term (when the donor funding has typically ended and attention has shifted), and (ii) the complex determinants of all impact measures are hard to control in real life country contexts, so that counterfactuals are usually hard to find. As part of new programmatic approaches, interventions should at least define and document clear baselines, and donors should strive for joint evaluation efforts, which should span several typical project cycles (say, one measurement per decade).

In the context of direct subsidies, a close evaluation of performance and impacts is even more important than for other interventions, because of their specific features and risks (see previous chapters) and the shaky grounds on which many subsidy schemes are built.[100]

The BMZ/DGIS-funded, GTZ-managed energy access program "EnDev" has developed a particularly interesting process for monitoring and benchmarking about twenty access programs on a continuous basis, with a relatively slim monitoring tool. As a result, it can afford to tackle more projects and components at a time – and assign funds quickly to the best performers (based on actual performance of subsidies inside benchmarked on project level as well as portfolio level – see Box on the right.

3.4.8 Multipliers

To increase the development impact of energy subsidy schemes, donors have repeatedly tried to move away from the singular attention to effectiveness on one account (say, number of new connections, or GWp installed capacity) to look at additional determinants of medium term development impacts. Where such determinants can be identified, it can make sense to add "complementary" services or measures to a subsidy scheme, in order to increase the chances that the intended program outcomes will be met.

[99] World Bank 2008b : "The evidence base remains weak for many of the claimed benefits of [rural electrification]. Tailor-made surveys, designed to test these benefits, need to be built into a greater number of Bank projects and designed so they allow rigorous testing of the impact of electrification."

[100] Morduch 2005: "Deploying subsidies though raises the bar on evaluations. The microfinance industry has made great strides by developing – and insisting on the use of—clear, rigorous financial measures. The same must be true for subsidies. If smart subsidies are deployed in the hope of producing demonstrable social impacts, those impacts should be measured using rigorous statistical analyses—with solid control and treatment groups and attention to measuring causal relationships. Every intervention need not be rigorously evaluated, but at present there is almost no careful evaluation (i.e., with appropriate control groups), and it is time to shift the balance. Microfinance experts have worried, justifiably, that badly designed subsidies not only undermine the financial performance of micro lenders but can also undermine social impacts by limiting scale and the quality of services. If subsidies are deployed in the name of improved social impacts, donors should make it a priority to measure the degree to which they generate important net impacts for customers."

BOX: Diversification for portfolio optimization (from Reiche/Ziegler 2006)

The design of the overall EnDev program facilitates inclusion of a few interventions with higher risk (but potentially high return) and/or initially higher subsidy amounts per beneficiary, to reap optimal overall results from this innovative instrument. The latter decision is considered to be of relevance for the overall EnDev Program: EnDev allows for a blend of more interventions and sub-activities than most other donor programs (without losing focus) because the local team leader can initiate, monitor (and flexibly re-design) innovative smaller endeavors at low marginal costs (as long as targets are met and sustainability remains assured). This is impossible for most traditional donor operations, which need to fix all means and measures at the outset, usually with only one option for design adjustments (the Mid-Term Review). EnDev portfolio diversification (at given beneficiary targets) can maximize short term benefits (i.e., during project) and long term (i.e., scale-up effects after project) benefits of a given Country Component at a given overall risk and allows the local team leader to try out a few promising components with potential for scale-up and or important sector policy implications. Early lessons from EnDev Bolivia confirm this thesis.

The EnDev program combines four design elements which – together – allow for such optimization of risks and benefits via portfolio diversification: (i) The clear overall beneficiary targets; (ii) flexibility in the means; (iii) GTZ's development approach which allows for intensive supervision and re-design during implementation - based on continuous M&E - by a full time senior local team leader (which in turn allows for short preparation times – exactly opposed to the World Bank's Aid approach which calls for extensive preparation because supervision is essentially limited to two short missions per year); and (iv) the firm commitment of GTZ and DGIS to long term sustainability and sector dialogue to prepare future scale-up (which is not counted under the outcomes early lessons from EnDev Bolivia show that but intended as a future side effect).

Motta (2001) proposes such complementary measures (business development and microfinance services) for a World Bank program providing direct and indirect energy access subsidies. During program implementation, rural road quality in some target areas was added, and the additional administrative cost of handling several sector interventions under the one project became apparent.

Such complementary measures make sense in many cases, but again practitioners need to be careful regarding the trade-offs involved: combining too many components under one program can lead to administrative inefficiencies. Reiche (2004) therefore argues for an approach whereby selected complementary infrastructure and non-infrastructure services are tested on various program intervention levels separately for their performance enhancing potential – and suggests that no more than three such complementary services should be added. Sometimes it is possible to increase efficiency and sustainability through coordination with parallel government or donor interventions, which already provide the complementary services (maybe in another area). However, such coordination can also decrease program resilience and speed drastically (as was the case in the World Bank Uganda project "Energy for Rural Transformation").

3.5 The Subsidy Matrix Tool for Systematic Subsidy Design

The present report proposes a new tool for systematic subsidy improvement: **The Subsidy Matrix** – (Figure 3.5). The matrix attempts to give a simple, coherent structure to the design and implementing decisions of sound subsidy schemes. The choice of each design variable along the y-axis affects one or more of the performance indicators of the subsidy scheme along the x-axis. It can be hard to quantify the connection between the variation of a specific design variable and shifts in performance exactly. For instance, lack of effectiveness can be caused by a poor institutional set-up and/or an inappropriate amount of financial support. It should be noted that the set-up of a sound subsidy scheme, with regard to the defined performance criteria, is a cyclical process, rather than a one-dimensional unique act, and it spans several administrative periods. The constant supervision and adjustment of the subsidy schemes require both flexibility of the institutional set-up and strong long-term commitment of the involved stakeholders.

This new, pragmatic approach to subsidy design has several practical uses:

(i) It helps to explain to non-energy specialist policy makers (i) that there are **inherent trade-offs when designing subsidy schemes** (i.e., no scheme can perform best on all accounts) and (ii) that there is no "silver bullet" subsidy model that can readily be applied in all circumstances, boundary conditions and contexts ("one size fits all"). This should help to redress a series of "subsidy myths" or "subsidy mantras" which are perpetuated amongst practitioners and seem appealing ("We don't do credit lines"; "Revolving funds are bad practice" etc.) but should not be applied to all circumstances without checking boundary conditions (as has been the case in the past). Successful models need to be dissected and understood before they can be transferred to a new country or market stage!

(ii) The matrix serves as a **simple "checklist" for practitioners** to see (i) if all design options have been thought through for a new subsidy scheme and (ii) which issues to watch out for regarding performance. The latter is of particular importance because non-economist practitioners sometimes feel that general economics literature on subsidies fails to provide them with practical, readily applicable advice on how the few guiding "textbook principles" (namely effectiveness and efficiency) can be operationalized.

(iii) It can be used to **produce subsidy score cards** (chapter 3.6), which in turn are very useful to identify strengths and weaknesses of existing subsidy programs: by estimating (using subjective criteria) or "calculating" (using quantitative performance indicators such as (cost of) connections per year in access programs or (cost of) GWp installed per year in RET incentive schemes – with obvious caveats)[101] one can score subsidy performance to (i) benchmark existing subsidy mechanisms or (ii) compare idealized subsidy models in general. Such a benchmarking effort is of special interest for donors with a large portfolio of similar projects (such as the EnDev electrification interventions and stoves interventions, or the World Bank's offgrid access and grid extension programs), as comparability is better and lessons can quickly be applied in other countries.

[101] Subjective judgment is necessarily involved in choosing the parameters to be benchmarked and in weighing them for priority. Also, given the varying boundary conditions of subsidy models applied in different countries (lack of counterfactuals), they are usually not readily comparable. However, trends can be identified via such score cards as we will illustrate below.

(iv) Obviously the categories of the matrix themselves are no **"one size fits all"** either: One can argue at length about better ways to systemize the categories - especially along the performance axis, as several of the performance criteria influence each other.[102] For instance, monitorability is necessary for transparency which in turn is bound to increase efficiency. On the same token, speed has to do with both efficiency and effectiveness; resilience has to do with sustainability; private sector participation could be subsumed under efficiency; and even effectiveness (i.e. targeting performance and how much of the objective has been reached) could be argued to be a mere corollary to the economic principle – which is ultimately about resource efficiency. However, this does not diminish the usefulness of the matrix at all: its value lies precisely in breaking down the overall (meta) principles into typical wishes of policy makers, which are recognizable and easier to handle for an average practitioner.

(v) In doing so, the matrix can help to bridge the gap between general energy subsidy economics (as lined out in chapter 2) and practical questions of energy practitioners.

BOX: The Subsidy Matrix can help development practitioners in the field to...

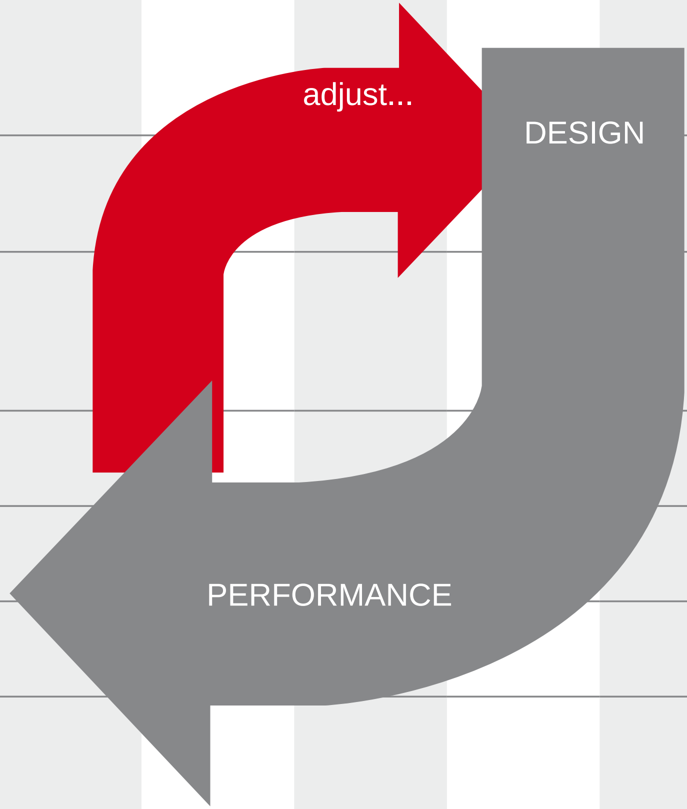
- optimize the design of subsidiy schemes in a structured process
- identify those subsidy design options (on the x-axis) that can be influenced
- check the effect on performance (y-axis) if design variables are changed
- understand that not all performance criteria can be optimized at the same time, because there are inherent trade-offs (for instance, a utility that rolls out grid very quickly will usually drive up its unit costs, as it has to procure goods which become scarcer on the local market)
- weigh the performance trade-offs to find a well balanced design

[102] In addition, not all of the issues will matter (nor all design options be open) for a given, real case – thus the matrix in itself needs to be adapted to each specific case. The underlying method (i.e., to look at the options for several design variables at a time see what effect on performance a change would have) can be applied with very different looking tables.

Figure 3.5
The Subsidy Matrix;
source: Own elaboration

X: Subsidy Design Variables

	Objective	**Funding**	**Institutional Setup**	**Recipient and Beneficiary**	**Type**	**Selection Competition**	**Amount Timing Exit**	**Regulation**	**Monitoring & Adjustments**
	economy, environment, security, social equity	tax, levy, windfall	government tiers; autonomous fund; multi-player fund; escrow; private agent;...	private sector firm(s); households; communities; children etc.	by targeting method; direct/indirect, etc.	selection by fixed/variable economic/ social/ financial/ political criteria etc. competition for/in market by project/ yardstick	how much sequencing; phaseout;...	who regu-lates; tariff schemes mirror regulatory requirements; minimum quality of service/ product/ reporting etc.	who monitors output indicators; who evaluates impacts; baseline; M&E scheme cost,...
Y(X): Subsidy Performance									
Effectiveness accomplishment of objective **targeting** scalability speed									
Efficiency **minimal distortion** $/output admin costs									
Sustainability (user/provider/market) **economical** **financial** ecological social									
Resilience **simplicity, stability** flexibility, adjustability over time									
PSP FDI PSD									
Transparency monitorability predictability									
Politics **visibility, constituency, votes** (personal profits, power) (fast disbursements)									



3.6 Applying the Subsidy Matrix Tool – Score Cards for Subsidy Models and Mechanisms

The present chapter applies the Subsidy Matrix approach and similar, systematic approaches to performance analysis to selected Subsidy **Mechanisms** and **Models**[103] in order to (i) benchmark their performance **ex post,** (ii) gauge their suitability for a country situation **ex ante,** (iii) illustrate typical trade-offs between performance criteria, and (iv) identify starting points for subsidy improvements in practice.

Caveat: All examples we have prepared for this chapter are real cases which have been analyzed for the purpose of the present study either for the first time or starting from previous analysis; each section provides its sources of data and analyses. While the trends in all examples (for instance the ranking of subsidy mechanisms that are benchmarked) are considered valid by the authors and meant to spark discussion (hopefully spurring further work on a topic we consider important), it has to be noted that these examples are neither exact nor final results in a scientific sense. They are merely meant to illustrate the possible uses of the systematic subsidy matrix approach (and some typical trade-offs involved in subsidy design). More thorough analysis is needed for more robust results. For instance, we did not have sufficiently detailed data on many of the country cases (which would have allowed the construction of better quantitative performance indicators for the various performance criteria) and more country cases would be needed to filter for comparable country conditions.

3.6.1 Comparing Specific SHS Access Subsidy Mechanisms Ex Ante for one Country

The Subsidy Matrix links subsidy design variables and performance indicators in a simple, structured way and can be used to produce score cards for qualitative or quantitative comparisons of subsidy schemes, their advantages and disadvantages, and their suitability to address given policy priorities. These comparisons can be based on quantitative data analysis, (self) assessments by experts, or combinations of both.

The table below is based in part on a somewhat simpler score card that was used during the design of an appropriate access subsidy mechanism for Solar Home Systems under the World Bank IDTR program in Bolivia (World Bank 2003). During a dedicated three day workshop in 2002, a group of six local and international practitioners and policy makers compiled and ranked the performance criteria of import to the program objectives, and rated them (by assigning scores for each cell) with a view to country context and SHS market stage.

In this process, the analysis of design elements, strengths and weaknesses of the originally considered three options (Mechanism 1, 3 and 4 above – all based on actual examples from other countries) led to the design of a completely new SHS mechanism: the SHS Medium Term Service Contract, which combines strengths of free market and concession models in a unique way, while avoiding some of the weaknesses. Similar (if less ambitious) “hybrid” approaches have emerged in other countries, and combined they represent a clear trend away from cookie-cutter “Subsidy Model” implementations.[104] In the specific context of Bolivia, this new mechanism was considered the most promising option ex ante – an assessment that has been confirmed by the fact that the model has meanwhile survived extremely turbulent times and adverse administrative contexts.[105] In fact, it has been the only national program implementing PPI or SHS of significant scale in recent years.

It should be noted that a decisive design variable in this specific cases was provider selection: the tender-based MSC scheme performs far better regarding efficiency than Mechanism 3 and 4, both due to local market conditions and to general advantages.

[103] Chapter 3.4 defines the distinction between these Subsidy Mechanisms (specific, real-life cases) and Models (generalized, typical subsidy “prototypes”) for the purpose of this paper.
[104] PVPS 2002 and Gaul 2008
[105] GPOBA 2007

Table 3.6.1: *Performance comparison for fictive SHS subsidy mechanisms in Bolivia. This Score Card compares four alternative designs for a real-life energy access subsidy scheme in Bolivia regarding their performance, using the performance criteria defined in the "Subsidy Matrix". Scores go from 0 to 3, with higher scores being better. The weight of each performance indicator was taken from an actual subsidy design workshop on SHS subsidies which took place in 2002.*
Source: Own Elaboration, based on Reiche/Rysankova/Birhuet (2002).

Ex ante performance comparison of possible SHS subsidy mechanisms in Bolivia

	Mechanism 1	Mechanism 2	Mechanism 3	Mechanism 4	weight
Name	**Classic Concession**	**IDTR MSC**	**UNDP Project Comp**	**Classic Dealer**	
Effectiveness					
scalability	2	2	1	2	1
implementation speed	2	2	1	2	3
Efficiency					
Admin & Regulation simplicity	2	2	1	2	3
cream skimming danger					
cost to user	2	3	3	2	3
User choice (payment/size)	1	3	3	3	3
depth of local market penetration	2	2	2	2	2
Sustainability					
service sustainable	3	3	2	1	3
risk allocation sustainable	3	3	2	1	1
Resilience					
simplicity	3	2	1	2	2
Government experience with concept	3	3	2	1	2
PSD					
Innovation local market	1	2	2	3	2
PS has experience with model	2	1	2	2	1
Local PS survives / improves	2	3	3	3	1
find clients easily	2	2	2	3	1
Politics	n.a.	n.a.	n.a.	n.a.	
Total Score	**59**	**68**	**54**	**57**	
Rank	**2**	**1**	**4**	**3**	

3.6.2 Benchmarking 13 Ongoing SHS Subsidy Mechanisms Ex Post

The following tables present the result of an ex post comparison we have done of ten ongoing and three closed Solar Home System (SHS) Programs executed by GTZ/EnDev, IDB, UNDP and the World Bank. For our analysis, two energy sector experts have scored each of these programs regarding their (i) Effectiveness, (ii) Efficiency and (iii) Sustainability, based on a quantitative analysis of program results by 2007 and a qualitative analysis of design features. The scores for effectiveness are based on installations per year, scalability and targeting performance. The scores for efficiency are based on market distortions (sector efficiency) and subsidy per Wp (project efficiency – see chapter 3.3). The scores for sustainability are based on a qualitative judgment of program exit strategies.

Tables 3.6.2a and 3.6.2b: *Benchmarking SHS subsidy schemes ex post: comparison of the subsidy performance of 13 real-life SHS programs. To test the influence of varying policy priorities, we have calculated three sets of subsidy scores (A, B and C), by using different weights for six performance criteria (2nd table - for instance, multiplying speed, scalability and targeting with a maximum "weight" of 5 for Score B, which prioritizes effect over sustainability). Then we have normalized the total score for all programs, so that programs can score from 0% (very bad) to 100% (very good). Results are shown in the 1st table. The Bangladesh subsidy mechanisms score best under two of three policy scenarios (A,B) while Nicaragua IDB scores worst under all three. The weights for our three illustrative, "policy priority scenarios" are shown in the 2nd table.*
Source: Own elaboration, based on own analysis and on EnDev program data from Gaul (2008).

Benchmarking SHS schemes ex post: Scores for three different policy priorities

Mechanism	Model	Balanced Score A	Effect! Score B	Sustainability! Score C
Nicaragua IDB	C	16%	19%	15%
Bolivia CRE	C	20%	24%	16%
EnDev Honduras	D	32%	37%	24%
EnDev Nicaragua	D	37%	44%	26%
Bolivia UNDP	D	38%	35%	30%
Nicaragua PERZA	D	52%	59%	42%
Bolivia GPOBA Pico	D	54%	54%	45%
Argentina PERMER	C	58%	59%	50%
Sunlabob Laos	C	63%	70%	52%
Sri Lanka RERED	D	67%	65%	52%
Bolivia IDTR	C	68%	78%	61%
EnDev Bangladesh II	D	71%	79%	51%
EnDev Bangladesh	D	73%	84%	52%

Benchmarking SHS schemes ex post: Weights used for three score cards

		Balanced Score A	Effect! Score B	Sustainability! Score C
Effectiveness	speed: shs installed p.a.	2	5	1
	scalability + admin	4	5	1
	targeting	4	5	5
Efficiency	market distortion	4	5	5
	$/W	3	2	1
Sustainability	Exit Strategy	3	2	5

The most interesting results are:

- Changing policy priorities has a visible effect on the ranking of program performance – yet, the general trends remain in this example. Scores B and C assign opposite relative importance to subsidy effectiveness over sustainability (a typical trade-off in real life subsidy design). This seems obvious at first glance, but is of utmost importance to the design of subsidy programs: "What you order is what you get." The same holds true for subsidy benchmarking: the analyst's decisions about priorities are subjective and influence the ranking. This is why balancing trade-offs is so important in subsidy design. Bad scores can be the result of (i) difference in policy priorities between subsidy designer and analyst or simply (ii) bad design. Case (i) is not a problem per se, case (ii) warrants design changes.

- Subsidy schemes with scores below 50% should be analyzed in greater detail. For instance, the EnDev SHS programs in LAC get a low score mainly because of their small pilot character which reduces scores for scalability and exit strategy. However, EnDev had good reasons on portfolio level to start with these small pilots, as lessons can directly be transferred to other countries under its unique program set-up (see chapter 3) so that the low scores are explicable and rather case (i) than case (ii) above. The Nicaragua IDB and Bolivia CRE (Cooperativa Rural de Electrificación – a Bolivian utility) pilots, which have the lowest scores turned out failures in reality: systems had to be de-installed in both cases, for similar reasons.

- Programs with scores above two thirds can be considered good practice and should be looked at for transfer of success factors.

- The trend suggests that small pilots involving direct subsidies should only be implemented in cases where demonstration and learning effects can be clearly shown ex ante. It is important to note that this may be quite different for pilots that involve only indirect subsidy, such as local training for MSME or technicians.

- Obviously, confining the focus to scale and volume (Score B) is risky too: massive programs with fast roll-out have to compromise on cost efficiency on project level (see Luz No Campo example for grid extension in ESMAP 2005, with unit costs above US$4,000 per household for some recent grid extensions) and all too often forget about sustainability. GTZ's EnDev is one of the few large access programs which actually combine massification with sustainability explicitly, in a new way.

- The hot off-grid electrification debate of the late 90s about SHS dealer versus concession models (D and C in the table above) seems to be moot: there is no clear winner regarding performance between the two approaches, irrespective of policy priorities. This supports our hypothesis that adaption of subsidy mechanisms to local conditions (as opposed to copying existing models) is what matters.

3.6.3 Scoring Energy Subsidy Models in General (Indirect vs Direct - Consumption vs Access)

The two following tables are meant to illustrate the potential of subsidy score cards for learning and decision making. For both cases, the authors have assigned scores (in one case from -2 to +2, in the other case from + to -) based on general trends percieved in the performance of Subsidy Models that are highly relevant for policy makers. This simple, straightforward approach is obviously not based on hard evidence (and hence does not claim objectiveness), but helps to understand the causalities involved in subsidy design – and may be easier to understand (and apply to real-life subsidy questions) and therefore more instructive for non-energy practitioners than the (few) thorough empirical analyses that have been published recently on the subject matter (Komives 2005).

Indirect versus Direct Subsidies

For table 3.6.3a, we have scored the general category of direct subsidies (say, buy-down grants for access or feed-in laws for Renewables) against indirect subsidies (say, training for utility managers or TA to SME for energy efficient production) separately for each of the performance categories we have defined in chapters 3.2 and 3.3.

Compared to the other scorecards in this chapter, the results are less exact, as scores are based on judgments on general strengths and weaknesses as opposed to actual performance on the ground. Thus, the table is subjective – and specific cases may divert from the general trend summarized in the table. In both cases, proper design has been assumed (i.e. only inherent limitations were taken as the basis for scores, not suboptimal design in real examples).

However, we believe that the table serves quite well to (i) highlight the specific strengths and weaknesses of these categories (if only to address the myth that indirect subsidies are always preferable, on all accounts), (ii) support the need for a balanced (and often combined) use of both instrument categories to reach given policy objectives under programmatic sector approaches; and (iii) prompt practitioners to think about the ranking for each performance category separately.

Table 3.6.3a: *Comparing direct and indirect subsidies regarding their typical strengths and weaknesses along the performance criteria we have defined in the Subsidy Matrix. Indirect subsidies (such as TA) tend to be less distortive and more sustainable, while direct subsidies (such as consumer grants) can reap more scale over a short period of time. Source: Own elaboration*

Comparing direct and indirect subsidies – typical tendencies in practice

	effective	fast	efficient	sustainable	resilient	PSD	transparent	measurable
Direct	+	+	–	– –	–	–	+	+
Indirect	0	–	++	++	+	++	–	–

As a general rule of thumb, indirect subsidies are less distorting and more sustainable, while direct subsidies are typically faster in achieving a given target over a short period of time (a common objective of politicians and donor projects of limited life span) – and they may (sic) be more transparent and measurable.

Comparing Utility Consumption Subsidies and Access Subsidies in General

The next table benchmarks typical subsidy models of three important categories against each other, using the criteria Efficiency and Effectiveness (data and information on their sustainability was too patchy to provide for robust scores). The three subsidy categories are amongst the most relevant for infrastructure policy makers in real life: (A) Consumption subsidies and (B) Access Subsidies are compared with (C) selected non-energy subsidies with distributional aims. Selection and scores are based in equal parts on previous analysis from Lovei (2000) and Komives (2005) as well as own elaborations.[106]

[106] Lovei 2000 scores the subsidy types under category A based on actual utility subsidy performance in Eastern Europe and uses the same five performance criteria we use in this table. Komives 2005 provides actual results for the targeting performance based on an intensive empirical analysis of extensive data sets and simulations for subsidies from categories A to C. As Komives identifies access subsidies as the most promising type for targeting the poor, and suggests future research on what such access schemes should look like, we have added four specific access subsidy models (some of which figure in the tables above) in order to compare their overall performance and especially their (expected) targeting performance compared to more widely spread subsidy schemes.

Table 3.6.3b: *Comparison of consumption and access subsidies. This score card compares different typical types of consumption subsidies, non-energy subsidies with distributional aims, and solar home system subsidy schemes regarding their potential maximum Effectiveness and Efficiency. Scores for each single performance indicator (columns) go from -2 (very bad) to +2 (very good) and are added at equal weight to the total score of each subsidy type. The performance indicators describing Effectiveness and Efficiency are somewhat different from the standard indicators applied throughout this paper, to (i) allow the use of actual data from the literature for a subset of subsidy types (rows) and (ii) illustrate that indicator choice can vary according to the practitioner's needs, without changing the underlying logic of systematic performance comparisons based on score cards. Sources: Lovei 2000; Komives 2005; own elaborations*

Comparing efficiencies of consumption subsidy and access subsidies instruments

	Effective		Efficient			
	Coverage	Targeting	Predict-ability	Distortion	Admin costs	**Score**
A) consumption subsidies						
no disconnection	1	1	0	-2	0	**0**
across the board price subsidy	2	0	2	-2	0	**2**
Lifeline tariff 2 blocks	2	0	2	-1	0	**3**
Lifeline tariff 3 blocks	2	2	1	-2	0	**3**
Lifeline tariff floating blocks	2	1	2	-1	-1	**3**
discount for privilegded consumers	1	1	2	-1	-1	**2**
burden limit based on actual utility expenditure	1	0	1	-2	-2	**-2**
burden limit based on utility expenditure norms	1	1	1	0	-2	**1**
B) access subsidies						
across the board grant to new grid connections	2	3	1	-1	-1	**4**
fixed grant for all SHS (classical dealer)	1	3	2	-1	-2	**3**
SHS MSC (progressive area subsidy tender)	3	3	1	-1	-1	**5**
SHS competition by project	1	2	2	-1	-2	**2**
small village grid investment subsidy	1	3	1	0	-1	**4**
C) non-energy subsidies with distributional aim						
other earmarked cash transfer	2	3	1	-1	-2	**3**
non-earmarked cash transfer	2	3	2	0	-2	**5**
food subsidy	3	3	1	-1	-2	**4**
public works	3	3	1	-1	-2	**4**

As suggested by Komives 2005, energy access subsidies can score very high on targeting and coverage performance. The targeting performance of the analyzed access subsidies depends strongly on proper design, as we have seen also in the previous scorecards. The SHS MSC (Medium-Term Service Contracts) subsidy model scores high because it was designed with specific attention to poverty targeting: self-selection (users chose between different sizes and payment options) is combined with a progressive subsidy (as opposed to the fixed per Wp subsidy of most other SHS programs), and in addition, geographical selection and minimum market penetration targets are expected to further improve targeting and thus realize the full targeting potential of access subsidies. However, implementation has not ended yet, and initial evidence points to a somewhat less conclusive targeting performance, because the uptake for the smallest SHS sizes (which the poorest strata were expected to prefer) is low.

3.6.4 Low Performance Scores – Avoidable Design Mistake or Unavoidable Trade-off?

As we have seen, failure of a subsidy scheme regarding with respect to a single performance criterion does not necessarily root in design mistakes! Apart from avoidable mistakes made during the set-up and design of a subsidy, suboptimal performance on account of one or two of the secondary and primary performance indicators defined above is often due to unavoidable trade-offs between the chosen policy priorities.

If for example speed is the political priority, its attainment is likely to be at the expense of efficiency, since a fast roll-out of the subsidy mechanism is likely to produce higher unit costs. In some ways, the German feed-in law has sacrificed short-term subsidy efficiency for more speed, to reach predefined targets (and with view to long-term cost reductions through scale economies).

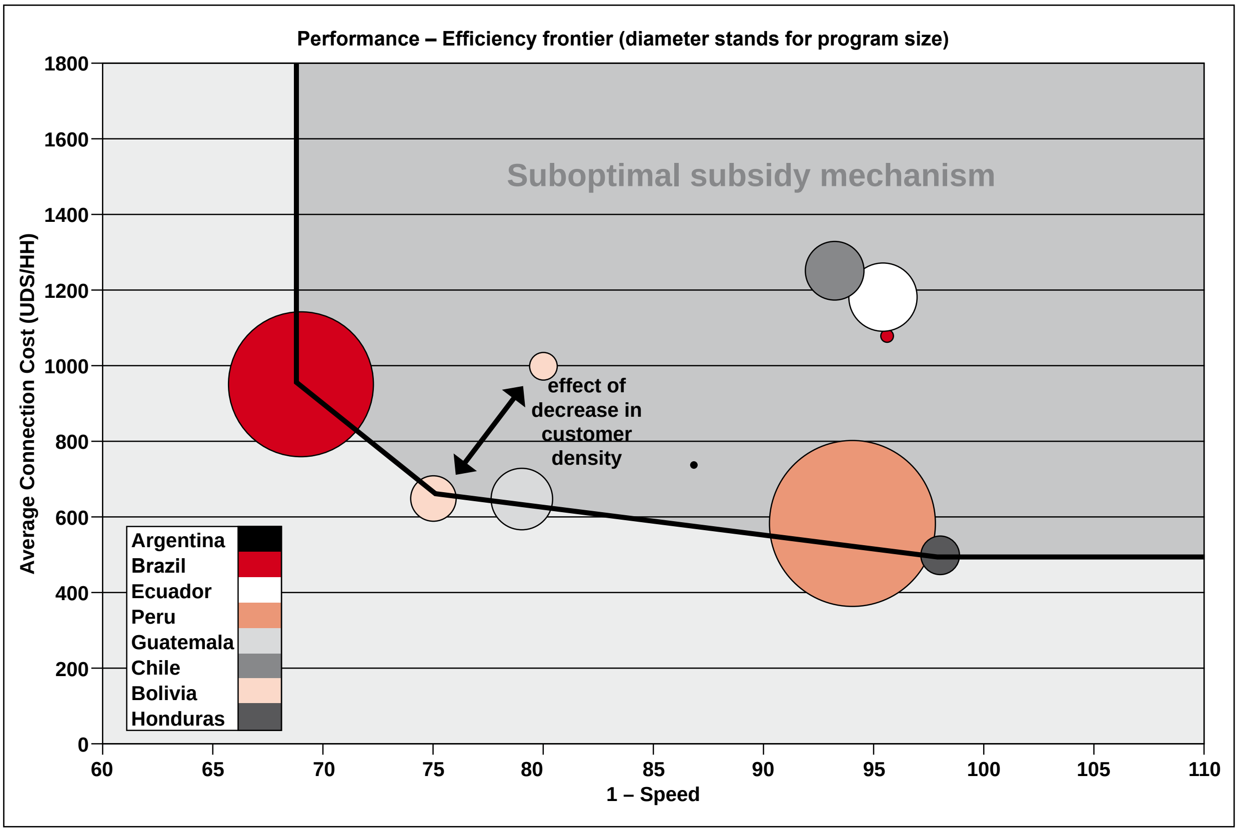
Another inherent trade-off lies between efficiency and equity: If efficiency is the sole optimization parameter, households with the lowest marginal cost will be served first with electricity, and remote rural areas, where the poorest income strata dwells and population is often indigenous, may remain without service. Most large, centralized electrification programs fall under this category.

Thus, there are many (not one) "optimal subsidy schemes" for any given country and point in time (distributed along an "efficiency frontier"), which differ in the (political) prioization (or weighting) of sector objectives (and thus performance criteria).

To the upper right of this "optimal subsidy performance frontier", there are sub-optimal subsidy mechanisms: those that would have improved on any of the performance criteria without sacrificing on any of the others (corresponding to a shift parallel to the x- or y-axis).

This is illustrated in Figure 3.6.4, using a dataset of electrification LAC programs assembled by Teplitz, 2006.

Figure 3.6.4: *The idealised "Subsidy Performance Frontier. The graph shows the connection costs [US$/HH], the roll-out "speed" of the subsidy program [new connections per year] and the program size [proportional to size of the coloured bubbles] of ten typical electrification programs in LAC. This is meant to illustrate (not prove!) our thesis that faster electrification programs have to sacrifice cost efficiency (and may well be willing to do so, to reach objectives in time). In addition to such unavoidable trade-offs between performance criteria, there are avoidable "subsidy design mistakes" which sacrifice performance unnecessarily – in our graph, these would be the "underperforming" subsidy schemes to the upper right of the – roughly hyperbolic – "subsidy performance frontier". Obviously, starting conditions and market context make a ceteris paribus comparison of real life electrification programs difficult (and maybe impossible), but the tendencies shown here fit our thesis well – and serve at least as an illustration of the concept. Further research with more data will be needed for an actual, evidence-based test of the hypothesis.*
Source: Teplitz 2006



4 Conclusions and Outlook

4.1 Conclusions for Practitioners

1. Energy subsidies are ubiquitous and typically reduce welfare by creating market distortions and significant GDP losses. They should therefore be avoided where possible.

2. However, subsidies can make economic sense in specific cases that we discuss and quantify in this report, applying basic economic theory.

3. Irrespective of their economic rationale, energy subsidies can be expected to remain a mainstay of public policy and ODA in the medium term. Therefore, it is an important task for practitioners to (re)design subsidy schemes in a way that minimizes damage and maximizes performance.

4. A new practitioners' tool for good (energy) subsidy design is proposed: the Subsidy Matrix. The matrix approach allows for a structured process to identify design options and weigh typical performance trade-offs inherent to subsidy design. It can be used to produce scorecards for the evaluation of subsidy models and mechanisms regarding their performance, when (re)designing subsidies on country level, and for benchmarking portfolio level, to extract lessons.

5. Direct subsidies can be more effective (in terms of sheer scale) than TA in the short term, if massive results are intended in a limited time - for instance to reach MDGs. When providing direct subsidies, monitoring of performance and evaluation of impacts is even more important than for other forms of ODA.

6. Where direct subsidies are applied, standalone small pilots can be risky, because their performance is inherently limited by scale and long-term market sustainability (exit strategies are difficult). Therefore, it has to be demonstrated for such pilots that long-term gains from replication and learning outweigh the relatively high transaction costs.

7. Access subsidies have better targeting performance than consumption subsidies, but experience and advice on access subsidy design is rare to date.

8. SHS subsidies can potentially have stellar targeting performance, because they allow progressive self-selection schemes.

9. There is no "one-size-fits-all" subsidy instrument – especially for access subsidies, appropriate solutions have to be found for each country separately.

10. It is dangerous to trust "well known subsidy rules" blindly or take existing models for direct subsidies and simply copy them to a new country, especially in the case of access subsidies: they depend heavily on country boundary conditions.

11. The two often quoted subsidy performance criteria (efficiency and effectiveness) should be complemented explicitly by secondary, "pragmatic" performance criteria (such as implementation speed and resilience against unexpected country crises) as those greatly affect subsidies in real life.

12. Subsidy design involves inherent trade-offs (say, between efficiency and speed, or speed and equity) that should be openly discussed and transparently prioritized at design stage.

13. The need of sacrificing a given performance aspect (say, efficiency) due to a given goal function which prioritizes other performance aspects (say, speed and scale) needs to be understood as separate from unnecessary subsidy design mistakes. The "Subsidy Performance Frontier" is used as an example to explain this important difference. The "Subsidy Matrix" tool can help to distinguish between these two types of

subsidy performance reductions – and avoid the latter (unnecessary) type while making the former (necessary sacrifices) more transparent.

14. Contractual arrangements along the service supply chain need to take the differences in incentives, risks and weaknesses of each actor level into account when defining subsidy rules, obligations and responsibililties.

15. Proper procedures for provider selection are a condition for sound subsidy schemes and successful private sector participation but sometimes neglected by small donors.

16. Complementary services (such as BDS, microfinance – or other infrastructure services) can increase the impact of energy subsidies.

17. Functioning PSP requires functioning local markets. Because of limited local capacities in most LDCs, PSP entails capacity building for private and public market players.

18. It should be noted that targeted TA is also a case of (indirect) subsidies. In subsidy benchmarks, indirect subsidies (and even soft loans) are often not counted, yielding wrong results.

4.2 Outlook

The study has confirmed a striking gap on literature, data and practical advice on proper subsidy design. This poses an urgent problem for policy makers and practitioners alike, in light of the vast investment needs projected for energy sectors in LDCs for the coming decades. Economic, environmental, social and political concerns will lead to a massive flow of ODA to LDC energy sectors – most of it as direct subsidies, all of it with potentially distortive effects.

More research and readily usable practitioner guidelines are therefore urgently needed. Chapter 3 of the present study proposes a whole set of new tools and research hypothesis which can – and should – be used as starting points for further work.

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ANNEX – ENDEV Sustainability Checklist (GTZ 2006)

Item	Sustainability criteria	Explanation
1	**Economic sustainability for technology providers/producers and service providers.** Key question: Will the project create or enter a self- sustaining market where cost recovering mechanisms are ensured for the long term?	
	General	
1.1	Self-sustaining market after five years	A self-sustaining market for energy access technologies is established after a maximum of 5 years after start of intervention
1.2	Providers/producers have technical skills after five years	Providers are equipped with sufficient technical skills like production, installation, management, maintenance/after sales services and quality control
1.3	Providers/producers have business skills after five years	Providers are also trained on business know-how including bookkeeping, financial management, sales and marketing.
1.4	Quality control of services and products is ensured	Quality control is institutionalized within the project (e.g. assignment of responsibilities) and measures are carried out in regular intervals.
	Technology providers/producers	
1.5	Prices cover costs and create profit	Technologies are priced to cover all costs and to allow for a profit margin that gives an incentive to maintain the business alive.
1.6	Technology meets purchasing power of consumers	Consumers (Customers) have sufficient purchasing power either by their own or supported by credit facilities.
1.7	After-sales structure exists	Existence of an after sales structure
1.8	Capability for product adjustments	Producers have the capacity of adapting the product design if necessary as well as of adapting their production efficiency and capacity in case of a shift in the consumer preferences and/or a change in the market conditions.
	Service providers	
1.9	Sufficient income is generated to cover all costs	Providers of electricity and other energy services generate sufficient income to cover running costs, re-investments and generate profit, if necessary supported through available credit infrastructure
1.10	Tariffs are set to cover costs	Tariffs are set to cover all costs mentioned above
1.11	High share of consumers pay for services	A high (sufficient > 90%) share of users pays for the services
1.12	Financial reports of community utilities	Public annual financial reports by community owned utilities
1.13	Grid extensions only if tariffs cover the costs and power supply is stable	Villages are connected to the national grid that is managed by a respective utility. This option is only considered if the national electricity supply system is sound and stable enough to take up new customers without frequent power shortages.
1.14	Clear exit strategy	A clear (credible) and transparent exit strategy will be part of any subsidy scheme.

Item	Sustainability criteria	Explanation
1.15	Long term viability of products without subsidies	Thorough investigations of the long-term viability of products or services after the withdrawal ofsubsidy schemes have to be carried out.
1.16	Local contribution	Use of start-up subsidies (for investment costs, not for the costs of operation) at a maximum level of 90% for village electrification schemes. The local contribution ensures ownership. In some cases they are provided as labor during construction. The user tariffs are set in a way that guarantees the coverage of all running costs (operation and maintenance), as well as major repairs for at least 15 years (in most cases for much longer).
2	**Consumers' view on economic sustainability.** Key Question: Are the technologies and services offered attractive and affordable from an energy user's perspective?	
	General	
2.1	Attractive and affordable products and services	Products and Services are affordable and attractive to users.
2.2	Products for different abilities to pay	A range of products is offered to meet different needs and particularly different abilities to pay
2.3	Products/services contribute to development	The impact of the acquired products or services (P/S) lead to a standard of living that is higher than without these P/S, i.e. they don't take away household budget that could be spent more effectively like for clean water or school fees.
2.4	Low risk credit schemes	If Credit schemes are offered they are designed in a way to reduce the risk for the credit taker, like to reduce to risk of no income during droughts or after a loss of a harvest.
2.5	Products suited for large user groups	Available Products are adapted to cover the needs of a large user group (and not only niche consumers)
2.6	Customer satisfaction	Consumers/Users are satisfied with products and services and state that they will reinvest in a product after the end of the lifetime or continue to subscribe to an energy service
2.7	User awareness of benefits	Users are well-informed about the significant monetary and non-monetary benefits that go along with modern energy services, such as reduced fuel consumption and costs, time savings from reduced cooking and wood collecting time, less health hazard through smoke emissions
	Energy for productive use	
2.8	Additional income is created by productive use of energy	Additional income from productive use through the supply of energy. There is an improvement of the standard of living.
	Energy for institutions (social infrastructure)	
2.9	Ability to pay for services	Explicit commitment (ownership) and credible ability for paying for operation and maintenance has to be ensured.

Item	Sustainability criteria	Explanation
2.10	Clearly defined assignment of responsibilities	Responsibilities for operation and maintenance have to be clearly defined, training on user level for handling the technology, small repairs and training of service structures.
2.11	Accounting standards are met by institutions	Institutions that do not meet minimum accounting standards will not benefit from energy services under the partnership agreement, as a system failure after a short term is hardly avoidable.
2.12	Fund for maintenance	A fund will be set up to pay for maintenance, repairs and spare parts if the structures allow for a "sustainable" fund management.
2.13	Technical service is organised	Creation of service contracts with private service providers and training of service provider and institutions (in managing service contracts) will be provided.
3	**Policy requirements.** Key question: Is the project philosophy in line with policies at the local and regional and national levels?	
3.1	Project is in-line with policies	The project fits into existing local, regional and national policies or their development.
3.2	Legal framework is supportive or at least not prohibitive	Existing legal framework allows for or is supportive for project execution (an for example individual power generation or charcoal production is not illegal)
4	**Social, cultural and environmental considerations.** Key question: Does the project take these aspects into account?	
4.1	Service or product fit into cultural environment	Service or product fits into the customers' cultural environment, i.e. it should respect the customers' traditions and customs
4.2	Project meets local demand	The project meets local demands and problems and does not conflict with local cultural traditions.
4.3	Living conditions for women improved	Living conditions for women do actually improve
4.4	Awareness of key actors concerning the benefits	Consumers decision makers and "local trend-setter "are aware of monetary and non-monetary benefits of energy access
4.5	Neutral to immediate environment or protective	Does the project not burden the local and regional environment or, better, does the project improve local and regional environmental conditions? (Reduce rate of deforestation and hence contributing to a sustainable fire wood supply reduction of frequency of respiratory problems)

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