Global energy efficiency governance in the context of climate politics

Gupta, J.; Ivanova, A.

published in
Energy Efficiency
2009

DOI (link to publisher)
10.1007/s12053-008-9036-4

document version
Publisher's PDF, also known as Version of record

citation for published version (APA)
Gupta, J., & Ivanova, A. (2009). Global energy efficiency governance in the context of climate politics. *Energy Efficiency*, *2*(4), 339-352. https://doi.org/10.1007/s12053-008-9036-4

Energy Efficiency (2009) 2:339–352
DOI 10.1007/s12053-008-9036-4

Global energy efficiency governance in the context of climate politics

Joyeeta Gupta · Antonina Ivanova

Received: 16 June 2008 / Accepted: 27 November 2008 / Published online: 14 January 2009

Abstract This paper argues that energy efficiency and conservation is a noncontroversial, critical, and equitable option for rich and poor alike. Although there is growing scientific and political consensus on its significance as an important option at global and national level, the political momentum for taking action is not commensurate with the potential in the sector or the urgency with which measures need to be taken to deal with climate change. The current global energy (efficiency) governance framework is diffuse. This paper submits that there are four substantive reasons why global governance should play a complementary role in promoting energy efficiency worldwide. Furthermore, given that market mechanisms are unable to rapidly mobilize energy efficiency projects and that there are no clear vested interests in this field which involves a large number of actors, there is need for a dedicated agency to promote energy efficiency and conservation. This paper provides an overview of energy efficiency options presented by IPCC, the current energy efficiency governance structure at global level, and efforts taken at supranational and national levels, and makes suggestions for a governance framework.

Keywords Energy efficiency · Governance · Policy instruments

For the Special Issue on Energy Efficiency, edited by Bert Metz and Diana Urge-Vorsatz, *Energy Efficiency.*

J. Gupta (✉)
Institute for Environmental Studies,
Vrije Universiteit Amsterdam,
1087 De Boelelaan,
1081 HV Amsterdam, The Netherlands
e-mail: Joyeeta.gupta@ivm.vu.nl

A. Ivanova (✉)
Autonomous University of Southern Baja California,
La Paz, Baja California, Mexico
e-mail: aivanova@uabcs.mx

Introduction

Unlike climate change governance, but like water governance, energy governance is very diffuse at the international level. Climate change governance is highly centralized, as negotiations were initially launched by the United Nations General Assembly leading eventually to the adoption of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and the Kyoto Protocol (KP) in 1997. While the United States (US) has unilaterally pushed some initiatives outside the UN system on hydrogen (Sindico and Gupta 2004) and methane, it claims that such initiatives are in line with its commitments under the Climate Convention. In contrast, the water regime involves more than 23 UN agencies, and authority is dispersed in a "mobius-web" structure (Pahl-Wostl, Gupta and Petry 2008), and there are about a thousand water agreements with a global fresh water law that is not yet in force

(Dellapenna and Gupta 2008). Similarly the mandate to deal with energy is dispersed between many UN agencies and no clear message is sent to the global community regarding energy strategies.

Energy efficiency and conservation governance, however, is even more diffuse than energy supply governance and is hardly covered in the literature. The literature reveals a very large number of articles focusing on energy governance at national and local level (e.g., Dossani 2004; Lin et al. 2007; Perkins 2005; Srivastava et al. 2007; Teng and Gu 2007; Geller et al. 2004; Thakur et al. 2005). Most of these articles look at current policies and instruments in specific countries and how successful these have been and the potential for future policy. There are also many articles examining how international instruments may affect policies including energy policies in developing countries (e.g., Taylor et al. 2008; Fink and Cramer 2008; Scheumann 2008; Gupta et al. 2007). However, there are, relatively speaking, much fewer articles (Marauhn 2003; Goldthau and Witte 2008; Goldthau 2008), policy papers (Schrumm 2006), and presentations (Westphal 2005) on global energy governance. Most of these global energy governance papers focus on security issues and/or on supply issues and on transatlantic and East–West relations or the impact of energy strategies in China and India on the rest of the world. We were not able to locate any papers that focus on global energy efficiency governance.

This paper makes a modest contribution to this challenge by addressing the question: Does global energy and, in particular, energy efficiency and conservation governance have a role in promoting energy efficiency and conservation, and hence reducing greenhouse gas (GHG) emissions? Energy efficiency involves doing the same amount of work or producing the same amount of goods or services, with less energy. Energy conservation involves using less energy regardless of whether energy efficiency has changed (NEPEG 2001).

This paper examines the policy and legal literature and official policy documents. It argues in favor of a supporting role for global energy governance (see "The importance of global energy efficiency governance" section), synthesizes energy efficiency policy options presented in the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 2007; see the "Energy efficiency: Policy options from IPCC" section), looks at the current global to national governance framework (see the "Overview of governance from global to national level" section), and then draws conclusions about how governance at global level can promote energy efficiency (see the "Analysis and conclusions" section).

The importance of global energy efficiency governance

We argue first that energy efficiency and conservation governance is a critical, noncontroversial, and desirable priority issue for all governments as it can simultaneously address four energy challenges, namely, energy security, energy and development, energy and environment, and energy poverty. Energy security refers to each country's desire to have continuous and reliable energy to meet national demand. Energy and development looks at how energy can be harnessed to meet development needs. Energy and environment focuses on minimizing the environmental impacts of energy systems. Energy poverty refers to the 1.6 billion people without access to electricity and the 2.4 billion people who lack access to modern fuels for cooking and heating. A common solution to all these problems is enhancing energy efficiency and conservation (cf. IPCC 2007: 13), since they reduce the demand for fossil fuels, the fastest growing source of GHGs, and can be implemented rapidly (IPCC 2007: 47). This is the most immediate policy response, with the development of renewable sources being a medium-term alternative.

Energy efficiency and conservation are also noncontroversial unlike fossil fuel, nuclear power, and hydropower, which have come under considerable critique because of their negative environmental and social side effects, and even in comparison with some renewables (e.g., wind energy is sometimes seen as landscape pollution).

Finally, energy efficiency and conservation is a desirable policy option as it is equitable and sustainable (Dernbach 2007) and in line with three principles recognized by the Climate Convention. These principles include developed country leadership, equity for developing and vulnerable countries, and the right to promote sustainable development. Energy efficiency is good for poor countries since efficiency is cheaper

than creating new supply, it releases scarce resources for other uses, supports energy security, increases access to energy services, reduces energy poverty, improves environmental quality and human health, and has a positive effect on employment by creating new business (IPCC 2007; 58 and 6.9).

We argue, secondly, that there is a complementary role for global governance on energy. Improving energy efficiency and conservation implies influencing the diverse uses of energy and the actors and processes involved through a mix of regulations, technology, economic incentives (Marauhn 2003), communication, and the promotion of good practices. Many ambitious national policies and programs have been implemented in developed and developing countries (see the "Overview of governance from global to national level" section), but, paradoxically, since energy security tends to be defined in national terms, and energy policies have traditionally been dealt with at national level, there is very little global collaboration. However, there are four reasons why energy and energy efficiency governance should *also* be dealt with at global level. First, security concerns make energy a global issue (Bradford 2007). Such security issues justified the creation of the International Atomic Energy Agency (IAEA); modern security reasons concern the long-distance pipes transferring oil and gas from one country to another, often passing through unstable political regions. Second, the energy–environment system is a global system as energy extraction, production, distribution, and use may have impacts in different parts of the globe, and therefore, solutions need to be sought at global level. Third, the driving forces behind energy production and use are often beyond national boundaries, and dealing with these may call for global level measures. Besides, a global process may help to share ideas, experiences and context relevant best practices to other parts of the world as well as discuss how to overcome bottlenecks in the process. Fourth, the scale at which such new technologies and management practices needs to penetrate the market is very large if we are to make a significant dent in pollution levels. A global framework may allow for creating the necessary political will (Richards 2003) and supporting institutions that give social actors the push needed to actually change behavior at the scale that is necessary.

A global governance perspective does not replace other solutions, but complements and strengthens it. It does not imply that we should not look at cross-level interactions. Energy governance occurs at local through to global level through a wide range of actors, and there will always be need for a multilevel perspective.

Energy efficiency: Policy options from IPCC

This section overviews the energy efficiency options assessed in the IPCC report (IPCC 2007). It shows the range of possible energy efficiency options, assesses the effectiveness of such measures, and discusses potential international measures.

Bottom up studies show that there is considerable potential for enhancing energy efficiency in different sectors (see Table 1), but that these options are not always feasible because of contextual barriers (IPCC 2007: SPM).

Table 2 provides an assessment of the effectiveness of instruments building on the success factors of governance instruments in the building sector (IPCC 2007: Table 6.6) and on inferences regarding the generic effectiveness of different instruments (IPCC 2007: Table 13.1). However, the other chapters reveal that the success of the instruments depends on their design, and sectoral and contextual issues. Thus, improved efficiency in light duty vehicles may not penetrate the market because consumers often want big cars even if prices go up (IPCC 2007: Chapter 5), although the current high price of fuel is making a dent on consumer choices for big cars according to newspaper reports. In the aviation sector, however, this might be different as fuel prices are more dominant factors than the size of the aircraft.

Finally, the report lists international cooperative mechanisms including emission targets and trading, sectoral agreements, coordinated policies and measures, cooperation on R&D, development-oriented activities, financial mechanisms, and capacity building (IPCC 2007: Table 13.3). It argues that legally binding options are likely to be more successful if there are noncompliance mechanisms and inclusion of greater numbers of sectors/countries. The policy approaches are likely to be less successful but may be more politically feasible. Development-oriented mechanisms may not directly contribute to reducing emissions; but energy efficiency is very compatible with development challenges for poor countries. While technology

Table 1 Energy efficiency options listed in IPCC FAR

Chapter	Energy efficiency options
Energy supply (4.3, 4.4)	Improved supply and distribution efficiency
Transport (5.4)	Fuel-efficient vehicles
Buildings (6.5)	Efficient lighting and daylighting; more efficient electrical appliances and heating and cooling devices; improved cook stoves for developing countries, improved insulation; passive and active solar design; for heating and cooling; shell retrofit incl. insulation
Industry (7.5)	More efficient end-use electrical equipment; heat and power recovery; efficient motors; process technology; iron and steel (smelt reduction, near net shape casting, scrap pre-heating, dry coke quenching); non-ferrous (inert anodes, efficient cell designs); chemicals (membrane separation, refinery gas); cement (pre-calciner kiln, roller mill, fluidized bed kiln); glass (cullet preheating, oxyfuel furnace); pulp and paper (efficient pulping; efficient drying, shoe press, condebelt drying); food (efficient drying, membranes)
Agriculture (8.4)	Energy efficiency (e.g., in water pumps)
Waste Management (10.4)	Waste incineration with energy recovery; composting of organic waste; controlled wastewater treatment; recycling and waste minimization.

Building further on Table SPM 3; Table 6.2; Table TS 7.5 of IPCC 2007

transfer is potentially very interesting, capital financing is often a bottleneck (IPCC 2007: 58), and although the flexibility mechanisms under the Climate Convention could play a role, they are presently playing a limited role in terms of technology transfer on energy efficiency (see also the "Multilateral treaties" section).

Littered through the text of IPCC (2007) is the message that energy efficiency is a no-regret option, very cheap, and good for rich and poor countries. Some governments like the European Union (EU) have reacted positively to the report, saying that it proves the overwhelming need for, inter alia, energy efficiency (EC 2007).

Overview of governance from global to national level

Introduction

This section argues that the global organizational framework for energy and energy efficiency governance is highly diffuse and that there is no global agency with a mandate to promote energy efficiency. While at national level, there is an emerging consensus on the need for energy efficiency and conservation, and many policies are in place, implementation appears to be slow. This section looks at global energy governance (see the "Global governance" section) and briefly discusses some national initiatives (see the "Some national strategies" section).

Global governance

UN and non-UN agencies focusing on energy and energy efficiency

The IAEA is the key UN body with an explicit mandate in the energy area focusing on atomic energy (IAEA Statute 1956) and is promoting nuclear energy as a way to address climate change. Energy governance is spread through the UN agencies, and UN Energy[1] was established as an interagency collaboration platform following the World Summit on Sustainable Development (WSSD) in 2002 to help achieve the Millennium Development Goals (MDGs). The Platform includes the Economic Commission for Africa (ECA), Economic Commission for Europe (ECE), Economic Commission for Latin America and the Caribbean (ECLAC), Economic and Social Commission for Asia and the Pacific (ESCAP), Economic and Social Commission for Western Asia (ESCWA), the Food and Agriculture Organization (FAO), IAEA, UN Human Settlements Programme (Habitat), United Nations Educational and Scientific Cooperation Organizations (UNESCO), United Nations Environment Programme (UNEP), the United Nations Framework Convention on Climate Change

[1] For more information, visit http://esa.un.org/un-energy.

Table 2 Effectiveness of instruments

Well designed instrument	Examples from building sector	Environmental-effectiveness	Cost-effectiveness	Other
Regulation AND compliance	Appliance standards	High	High	Popular in countries with weak markets; compliance needs to be strong; continuous updating needed
	Building codes	High	Medium	
	Public procurement	High	High/medium	
	Energy efficiency obligations	High	High	
	DSM	High	High	
	Mandatory audits	High, but variable	Medium	
Taxes AND charges	Taxes	Low	Low	High, if set high enough to induce behavior change; often politically unpopular
	Exemptions	High	High	
Tradeable permits/ flexible mechanisms		Low in building sector	Low in building sector	Requires well functioning market and legal institutions; equity depends on initial distribution
Voluntary agreements/ codes	Building codes	Medium/high	Medium	Politically popular; often requires significant administrative staff
	Energy efficiency certificates	Medium	Medium	
	Labelling/ certification	Medium/high	High	
Subsidies and incentives	Capital subsidies/ loans	High	Low	Popular with recipients; difficult to phase out; potential resistance from vested interests; risk of free-riders; may induce pioneering investments
R&D	N/a			Requires many decisions; depends on research capacity and funding
Education/information	General information	Low/medium	High	More applicable in residential than commercial sector; applied best in combination with other measures
	Detailed billing	Medium	Medium	Applied best in combinations with other measures
Energy performance contracting (ESCO)		High	Medium	No need for public spending or market intervention; co-benefit of improved competitiveness

Based on combining information in Table 6.6 and Table 13.1 of IPCC 2007.

(UNFCCC), United Nations Industrial Development Organization (UNIDO), United Nations International Research and Training Institute for the Advancement of Women (INSTRAW), the World Health Organization (WHO), World Bank (WB), Department of Economic and Social Affairs (DESA), and the Chief Executive Board Secretariat. UN Energy aims to contribute to energy discussions, policy coherence on energy access, support UN Energy Africa, and promote energy efficiency and renewable energy. Among other activities, it has mapped UN Energy Efficiency Activities.[2] Although UN Energy promotes collaboration, it is unable to give energy policy the rapid push it needs.

The most prominent non-UN energy Agency is the International Energy Agency (IEA) set up in 1974 to support energy security and has since then coordinated information-sharing, policies, and program development on energy-related issues within the OECD

[2] For more information see http://esa.un.org/un-energy/Activities%20and%20Events.htm.

member countries.[3] It has strategies, policies, and instruments to promote energy security, economic development, and environmental protection in its 27 member countries and more recently with China, India, Russia, and the OPEC countries. Other non-UN bodies working on energy efficiency include the Asia-Pacific Economic Cooperation (APEC; Ivanova and Angeles 2006: 112). Table 3 sums up the energy governance system.

Policies on energy and energy efficiency

Global commissions and meetings have also discussed energy efficiency. The World Commission on Environment and Development (WCED 1987) promoted energy efficiency as part of sustainable energy, and in 1992, the UN Conference on Environment and Development (UNCED) adopted Agenda 21 (1992) which stated that: "The need to control atmospheric emissions of greenhouse and other gases and substances will increasingly need to be based on efficiency in energy production, transmission, distribution and consumption ..." (Agenda 21 1992: Chapter 9, 9.9). It emphasized research into and technology transfer of energy-efficient technologies and practices, and strategies to improve energy efficiency (ibid. 9.12h), promoted appropriate energy efficiency and emission standards (9.12 j) and education and awareness on energy efficiency.

Subsequently, the UN Commission on Sustainable Development (CSD) was set up, and this body has also focused on energy issues (UNCSD 2001) and concluded that sustainable energy is reliable, affordable, economically viable, socially acceptable, and environmentally sound energy. It emphasized the need to involve the private sector in the energy modernization process. In 2002, the World Summit on Sustainable Development (WSSD) produced the Johannesburg Plan of Action which called for improved access to reliable and affordable energy and, inter alia, for improving energy efficiency through innovative financial and technology transfer and capacity building mechanisms and removal of market distortions (harmful taxes and subsidies; WSSD Report 2002: 16). These could be achieved via the Global Environment Facility (GEF) and public private partnerships through developing policy and regulatory frameworks; promoting research and development (WSSD report 2002: 17); promoting the energy efficiency of travel (p. 18), energy efficiency buildings, labeling, standards and procurement policies (p. 101), and especially through local consultations (p. 129). The first UN Energy (2005) report promotes basic energy services such as lighting, heating, and cooking power and states that reforms to the energy sector should protect the poor and, in particular, women and that energy efficiency is a critical option.

Outside the UN system, the Asia–Pacific Partnership on Clean Development and Climate (APP) a partnership between governments (Australia, Canada, China, India, Japan, South Korea, US) and the private sector promotes, inter alia, energy efficiency. They have recently designed energy efficiency labels in China that are similar to the US Energy Star Programme, and this is expected to reduce emissions by 17.7 Mt CO_2 annually.[4] Other initiatives include the Renewable Energy and Energy Efficiency Partnership (REEEP) supported by governments, businesses, development banks, and NGOs. Their projects include Financial Models for Energy Efficiency in

Table 3 UN and Non-UN Agencies working on energy and energy efficiency

		Energy Core focus	Indirect focus	Includes EE
UN	IAEA	Yes		
	ECA		Yes	Yes
	ECE		Yes	Yes
	ECLAC		Yes	Yes
	ESCAP		Yes	Yes
	UNESCO		Yes	
	ECSWA		Yes	Yes
	DESA		Yes	Yes
	FAO		Yes	Yes
	Habitat		Yes	Yes
	UNDP		Yes	Yes
	INSTRAW		Yes	Yes
	UNFCCC		Yes	Yes
	UNIDO		Yes	Yes
	UNEP		Yes	Yes
	WHO		Yes	Yes
	World Bank		Yes	Yes
Non-UN	IEA	Yes		Yes

[3] For more information on the IEA see http://www.iea.org.

[4] More details can be found on http://www.state.gov/g/oes/rls/fs/2008/102910.htm.

Water Services in South Africa; and microlending for Energy Services in North Karnataka and Gujarat (Osterkonn 2007). The G-8 at its 2005 session established a Clean Energy, Climate Change and Sustainable Development Dialogue process for the largest emitters. The G8+5 forum is discussing energy efficiency agreements and standards that may help phase out the worst products or services from the market (and thereby counter dumping) and promote better technologies (Klessmann et al. 2007).

Multilateral treaties

The above plans indicate a general growing consensus on the need for energy efficiency and partnerships promoting these; but there is no global concerted legally binding treaty on energy or energy efficiency. There are, however, regional energy agreements. Following the adoption of the political declaration on the Energy Charter by the G-8 countries in 1991 (Energy Charter 1991), the Energy Charter Treaty (ECT 1994) and the Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA 1994) were adopted in 1994 and entered into force in April 1998. The parties to the agreement include 51 European states, the European Community, and Euratom. The Energy Charter encouraged member states to cooperate on issues such as energy efficiency and environmental protection via strengthening the rule of law and mitigating risks associated with energy-related investment and trade. PEEREA (1994) promotes energy efficiency through the creation of a policy framework that supports market mechanisms, reduction of barriers to energy efficiency, and stimulation of investments, promotion of education and awareness, the dissemination and transfer of technologies, and recognizing the vital role of the private sector.

In addition, the University of Colorado Law School lists some 1,500 energy treaties including 498 bilateral energy cooperation treaties between countries, 48 electricity infrastructure and technology agreements, 26 agreements on energy markets, two on energy storage, 92 on fossil fuels, 209 on nuclear energy, 160 on sustainable energy, and 39 on transportation in the period to 2005.[5]

Furthermore, some international mechanisms promote energy efficiency. The Global Environment Facility (GEF), a partnership between the World Bank, UNDP, and UNEP finances energy efficiency projects under its climate change activities. Between 1991 and 2008, it had approved 113 energy efficiency projects (five on global level, 12 on regional level, and the rest in 45 different countries). The total amount of the GEF grants ascended to 710, US $710,333 million (http://www.gefonline.org/projectListSQL.cfm) and Table 4 sums up the project types.

Under the Climate Convention (1997), 60 Activities Implemented Jointly (AIJ) projects focus on energy efficiency. The Clean Development Mechanism (CDM) allows developed country parties to invest in developing countries in return for emission reduction credits since 2001.[6] As of May 2008, 1,071 projects have been registered which are likely to generate 215 million certified emission reductions (CER) annually and more than 1,270 million CERS by 2012. The UNFCCC website shows the distribution of CDM projects by scope. Assuming that energy efficiency is captured under energy demand, only 1.5% of the total number of projects focuses on energy efficiency. Fifty-four percent of the resources go to energy industries and supply; possibly some resources are also used for energy efficiency, showing that this market mechanism has not been very successful in pushing energy conservation and efficiency. Michaelowa et al. (this issue) argue that the CDM has been unable to promote energy conservation and efficiency activities primarily because of the complex methodologies for setting up baselines and monitoring which increase the transaction costs of such projects and propose some solutions. The Climate Convention also promotes technology transfer, and in 2001, an Expert Group on Technology Transfer was established. Thus far, some 72 technology transfer projects in the area of end use energy efficiency are listed on the technology transfer clearing house website, but there may be some double counting with the projects in the other categories mentioned above.[7]

[5] More details on http://cees.colorado.edu/isea/Browse.

[6] Detailed information on http://unfccc.int/kyoto_mechanisms/aij/activities_implemented_jointly/items/2094.php.

[7] See for details, http://ttclear.unfccc.int/ttclear/jsp/.

Table 4 Energy efficiency projects financed by the GEF

Project type	Country
Energy efficiency (generic)	Argentina, Brazil, Bulgaria, China, Croatia, Honduras, Hungary, India, Ghana, Malaysia, Mauritius, Poland, Romania, Uruguay
Sectoral measures (Urban heating and water; brick industry, electric motors, etc.)	Armenia, China, India, Mongolia, Morocco, Russia, Thailand, Ukraine, Vietnam
Remove barriers	Belarus, Croatia, Kazakhstan, Kenya, Lebanon
Market transformation	Brazil, Ivory Coast
Policy and strategy	Bulgaria, Hungary, Vietnam
Capacity building	Bulgaria
Finance for energy efficiency	China, Hungary, Russia

Based on information at http://www.gefonline.org/projectListSQL.cfm

Some national strategies

This section briefly describes some energy efficiency policies in key developed (US and EU) and developing countries (Brazil, China, India, Mexico). The latter have one third of the global population, account for one fourth of global emissions (IEA 2006) and rank among the top 20 countries in terms of emission intensity. By 2025, their emissions will increase by 68%, 118%, 70%, and 124%, respectively (USDOE-EIA 2007).

Energy security drives US strategy, and energy efficient technologies are seen as a key way to achieve security. An Office of Energy Efficiency and Renewable Energy promotes energy security, environmental quality, and economic vitality through public–private partnerships. At present, the government aims to reduce the GHG intensity of the economy by 18% by 2012/2002, implements the Energy Star Programme,[8] and engages the private sector in Climate VISION—Voluntary Innovative Sector Initiatives: Opportunities Now and the Climate Leaders program which stimulates partner industries to make pledges.[9] The Energy Independence and Security Act of 2007 aims to reduce emissions by six billion metric tons by 2030 through, inter alia, efficiency improvements.

Energy security is also a key driver of the European Union's (EU) energy policy. The Commission issued a European Climate Change Programme (ECCP 2005) and a Green Paper (CEC 2006) emphasizing energy efficiency as a way to address security and cost issues. The Energy Intelligent Europe Initiative[10] sees energy efficiency as the number one energy source for Europe. Recent initiatives include the 2006 Energy Services Directive (CEC 2006, memo 2008) and the 2007 Energy Star Regulation (CEC 2007) which obliges the use of energy efficiency criteria in public procurement of office equipment. Several decisions are being taken or discussed including on urban mobility, financing for efficient vehicles, energy technologies, emission performance standards for new passenger cars, energy performance requirements for commodities, services, buildings, and car labeling, among others. While the Commission has many schemes, the greatest challenge within the European Union is the implementation gap (cf. Wettestad 2000).

Key developing countries are also undertaking initiatives in the energy efficiency and conservation area, but most of these are of relatively recent origin. Table 5 sums up some of these initiatives. In 2001, the Brazilian law 10.295/2001 established principles for the "National Energy Conservation Policy and Rational Use of Energy" by setting standards for maximum levels of energy consumption or minimum levels of energy efficiency for energy consuming machines and equipment sold in Brazil and stipulates that energy efficiency should be sought/promoted in buildings constructed in Brazil. Standards were developed for appliances and equipment in order to enhance their performance and energy use indexes (Araujo and Oliveira 2004). As a result of extensive regulatory reform, both requiring energy efficiency as a major practice, as well as incentivizing energy efficiency investments, the capital markets in the country began to partner with the government in financing energy efficiency schemes. The most

[8] See for details http://www.energystar.gov/index.cfm?c=about.ab_index.

[9] See for details http://www.epa.gov/climateleaders/partners/index.html.

[10] See for details http://ec.europa.eu/energy/intelligent/index_en.html.

Table 5 Energy efficiency policies of selected developing countries

Country AND coordinator of EE policies	Laws	Plans and programs	Industrial associations and int. alliances	Projects	Challenges
Brazil National Electric Power Agency (ANEEL)	Law on EE Programmes of Distribution Utilities (1999) EE Law (2001)	PROCEL: to promote EE and conservation in industry, buildings, water, public lighting, municipal energy, CONPET: for rationalization of the use of oil and natural gas derivatives)	Association of Brazilian Energy Service Companies (ABESCO) National Confederation of Industries (CNI) Fed. of Industries in the State of San Paulo (FIESP) Partnership with Canadian Industrial Association (CEIA)	UNEP-WB EE Project CORE CEE3 CDM Labeling Minimum energy performance standard Energy Performance Testing Standard	No tax incentive for EE appliances and equipment Regulations are often vague Conservative banking sector, lack of finance for EE projects
China State Energy Office (CEO)		Top-1000 Enterprise Energy Conservation Action Plan (2006) Special Plan for Medium and Long Term Energy Conservation Plan (2006) National Climate Change Programme (2007)	EU-China partnership in Climate Change EU-China Energy and Env. Programme China-US Energy Efficiency Alliance China Energy Group at the Lawrence Berkeley National Laboratory	CDM (I place) 3CEE GEF World Bank Credits Labelling Minimum Energy Performance Standard Energy Performance Testing Standard	Most policies lack implementation details Most policies are qualitative rather than quantitative (difficult to evaluate) The budget allocation is often separated from the policies.
India Bureau of Energy Efficiency (BEE)	Energy Conservation Act (2001) Electricity Act (2003)	Labelling Programme for Appliances (2006) Energy Conservation Building Code (2007)	Cooperation agreements with Japan and Netherlands. The Ministry of Power and the USAID collaborated to develop the Energy Conservation Building Code Chapter on Clean Development and Climate Change inserted into the Joint Action Plan on the EU-India Strategic Partnership (2005)	CDM 3CEE Labelling Minimum Energy Performance Standard Energy Performance Testing Standard	Implementation of mandatory labelling slow No energy efficiency policy for transport sector Lower administrative barriers for CDM

Table 5 (continued)

Country AND coordinator of EE policies	Law	Plans and programs	Industrial associations and int. alliances	Projects	Challenges
Mexico National Commission for Energy Saving (CONAE)	Law of the National Commission for Energy Saving	Official Mexican Standards for EE (NOM)	Trust for Electrical Energy Saving (FIDE) 1990 EE Industrial Partnership (EEIP) 1995: financed by USAID until 2004, now continues with domestic efforts. USAID program on management of natural resources and EE	CDM GEF Labeling Minimum energy performance standard Energy Performance Testing Standard (23)	Most financial incentives are interest free loans. The effectiveness of instruments may be higher with incentives that reduce the costs of measures to a higher extent. The performance standards are effective since they are comparable to future US standards Introduce tax rebates or subsidies for EE measures Use present subsidies on consumption in the residential sector to subsidize EE measures.

Sources: Babu and Michaelowa (2003), De Tarso (2006), Fisher-Vanden et al., (2004), GOC (2007), GoI (2001 and 2004), Geller et al. (2004), Gupta (2001 and 2008), Gupta et al. (2001 and 2007), IEA (2002 and 2006), IGEC (2005). Kroeze et al. (2004), Lin et al. (2007), Morales (2008), North American Energy Working Group (2006), Osterkonn, M. (2007) Ovalle Araiza (2005), Perkins (2005), Thakur et al. (2005), Teng and Gu (2007)

important result was the appearance of energy service companies (ESCOs) in Brazil (Gomes Pinto et al. 2007). In addition, as a result of avoided energy use, there was considerable reduction in environmental pollution and carbon dioxide production. While Brazil is taking a number of policy measures (Machado 2001, De Tarso 2006), there appears to be only a half-hearted commitment to opening the markets (Geller et al. 2004) and the banking sector (Taylor et al. 2008: 143). China emphasizes energy efficiency to meet security, environmental, and human health concerns (Vennemo et al. 2006; Lin et al. 2007), and while energy intensity has declined since 1978 (Fisher-Vanden et al. 2004; Liao et al. 2007), this trend has reversed since 2003. In 2006, the Government decided to reduce the energy intensity of its economy by 20% over the period 2005–2010 (Lin et al. 2007), and adopted a Top 1,000 Enterprise Energy Conservation Action Plan. Implementation remains a big challenge (Taylor et al. 2008). For India, energy efficiency and conservation can be a key strategy to meet energy shortages. Many policies and laws have been adopted (Srivastava et al. 2007) culminating in the Energy Conservation Act 2001, the Electricity Act 2003, the 2006 Energy Labelling Programme for Appliances, and the 2007 Energy Conservation Building Code. These acts, inter alia, aim to reduce energy consumption by using efficiency and conservation measures through activities promoted by the Bureau of Energy Efficiency (BEE; cf. Bassi 2008 on building code implementation). Mexico too has a number of initiatives coordinated by the National Commission for Energy Saving (CONAE) and the Trust for Electrical Energy Conservation (FIDE) to promote rational electrical energy use and energy saving (Morales 2008) through, inter alia, the FIDE seal (Ovalle Araiza 2005). Since 1995, the Alliance to Save Energy has an Energy Efficiency Industry Partnership (EEIP) programme (Ivanova et al. 2006).

Analysis and conclusions

The key issue—Is there a complementary role for global energy (efficiency) governance, and what should this role look like?—can now be addressed.

We argued first that energy efficiency is uncontroversial unlike coal, large hydro and nuclear power, it helps address energy security, energy poverty (access issues), and the relevant developmental and environmental challenges; and it is equitable, sustainable, relatively cheap, and almost immediately available, and hence a no-regret option for rich and poor alike (see "The importance of global energy efficiency governance" section). There is both scientific consensus (IPCC 2007) and growing political consensus at global (see the "Global governance" section) and national levels (see the "Some national strategies" section) on the importance of energy efficiency and conservation.

The question then is—Why is this option not exploited rapidly? The answer is that, although a wide range of options exist, many of which are no-regret options (see Table 1), there are a number of bottlenecks. Energy efficiency and conservation involve a large number of actors, and unless there are incentives and information that enable such actors to act, these options are unlikely to be used. Energy efficiency projects tend to be small scale, and market mechanisms are unable to accelerate such technology transfers (e.g. CDM; see the "Multilateral treaties" section). Financial resources dedicated to creating a mass awareness of and incentives for efficiency and conservation as ways to both address climate change and save money are still lacking. The political will to exploit every opportunity to support energy efficiency and conserve energy is missing. There appear to be missing vested interests pushing this concept as well.

Hence, we believe that while national and transnational processes may be an effective way to promote energy policy options, there are four reasons that justify a complementary global governance approach. These include (a) global security issues, (b) extraterritorial environmental impacts of energy production, distribution, and use, (c) the need to address the driving forces behind energy use which may often lie outside national borders, and (d) the urgent need for action to reduce greenhouse gas emissions. These call for a global, legally binding framework for collating and promoting best practices. The current energy governance system is diffuse, and we believe the lack of vested interests pushing this option creates a vacuum, and there is need for a dedicated agency to promote a legally binding agreement building on the global consensus for the need for energy efficiency to create the necessary critical political mass to convert a scientific idea into a social movement. Such an

agreement could invite countries to adopt sectoral efficiency targets, or policies and measures from a menu of options building on the recent IPCC report. Countries could be invited to develop instruments in order to implement these targets using lessons learned in designing such instruments (see Table 2). For example, domestic regulation has high environmental effectiveness and is cost-effective when implemented in combination with a monitoring and noncompliance mechanism. Tax exemptions also have high environmental effectiveness and are cost-effective; labeling and certification schemes tend to work well if combined with education and incentives. This will also enable policy idea spill-overs such as the adoption of the idea of the UN Energy Star into an Energy Star in China. Although many countries have efficiency legislation, a global political push could build on and further accelerate domestic measures. A dedicated mechanism focusing on global cooperation on energy efficiency may be more successful than relying exclusively on market forces to do so within the Clean Development Mechanism.

Acknowledgements The first author thanks the Netherlands Organization of Scientific Research VIDI project (contract number: 452-02-031) and the second author the Mexican System of National Researchers (contract number: 11794) and Programme on Climate Change of the INE and UNDP. Both authors thank the anonymous reviewers for their constructive suggestions.

References

Agenda 21 (1992). UN Document, A/Conf.151/26

Araujo, J. L. R. H., and Oliveira, A. (2004). Brazilian Energy Policy: Changing Course? Oil, Gas and Energy Law Intelligence—OGEL, http://www.gasandoil.com/ogel/, v. 02, n. 03, 2004.

Babu, N., and Michaelowa, A. (2003). Removing Barriers for Renewable Energy CDM Projects in India and Building Capacity at the State Level. HWWA Discussion Paper 247. Hamburg Institute of International Economics, Hamburg, Germany.

Bassi, S. (2008). Introduction and Technical Overview of Energy Conservation Building Code for India, Presentation at ICLEI South Asia Workshop on Energy Efficient Buildings in Chennai on 23 May 2008.

Bradford, C. I. Jr. (2007). "World Energy Needs, Climate Change & Global Governance Innovation" Paper presented on the Simposium on "Breaking Global Deadlocks", CGS, Canada.

CEC (2006). GREEN PAPER: A European Strategy for Sustainable, Competitive and Secure Energy, Brussels, 8.3.2006, COM(2006) 105 final.

CEC (2007). Regulation No 2422/2001 on a Community energy efficiency labelling programme for office equipment, Brussels, 2007

Climate Convention (1997), http://unfccc.int/kyoto_mechanisms/aij/activities_implemented_jointly/items/2094.php

De Tarso, P. (2006). "Energy Efficiency in Brazil", Paper, Ministry of Mines and Energy, Campinos, November 27.

Dellapenna, J., & Gupta, J. (2008). Toward global law on water. *Global Governance*, *15*(4), 437–453.

Dernbach, J. C. (2007). "Energy efficiency and Conservation as Ethical Responsibilities: Suggestions for IPCC Working Group III" Widener University, School of Law. Available at SSRN: http://ssm.com/abstracts 1089423

Dossani, R. (2004). Reorganizing the power distribution sector in India. *Energy Policy*, *32*(11), 1277–1289.

EC (2007). Council of the European Union. Brussels European Council, 8/9 March 2007, 7224/1/07

ECCP (2005). The European Climate Change Programme; see http://ec.europe.eu/eurostat/climat/eccpii.htm

Energy Charter (1991). Concluding Document of the Hague Conference on the European Energy Charter, 1991, available at http://www.encharter.org/fileadmin/user_upload/document/EN.pdf#page=211

Energy Charter Treaty (1994). The Energy Charter Treaty, Available at http:// www.encharter.org/fileadmin/user_upload/document/EN.pdf#page=211

Fink, M., & Cramer, A. (2008). Towards implementation of the world commission on dams recommendations. In W. Scheumann, S. Neubert, & M. Kipping (Eds.), *Water Politics and Development Cooperation: Local Power Plays and Global Governance* (pp. 33–54). Dordrecht: Springer.

Fisher-Vanden, K., Jefferson, G. H., Liu, H., & Tao, Q. (2004). What is driving China's decline in energy intensity? *Resource and Energy Economics*, *26*, 77–97.

Geller, M., Schaeffer, R., Szclo, A., & Tolmaswquin, M. (2004). Policies for advancing energy efficiency and renewable energy use in Brazil. *In Energy Policy*, *32*(12), 1437–1450, August.

GOC (2007). *China's National Climate Change Programme*. Beijing: National Development and Reform Commission of the Peoples' Republic of China.

GoI (2001). *Blueprint for power sector development*. New Delhi: Ministry of Power, Government of India.

GoI (2004). *Opportunities & Policy Challenges for Investment in India. Background Paper. OECD India Investment Roundtable*. New Delhi: Department of Industrial Policy and Promotion, Ministry of Commerce & Industry, Government of India.

Goldthau, A. (2008). Preventing the Perfect Storm: How to Reform the Institutional Architecture of Global Energy Supply. *FACET Commentary*, (10):1–3.

Goldthau, A., and Witte, J. M. (2008). *Global Energy Governance: New Trends, New Actors, New Rules*, Internationale Politik, pp. 46–54

Gomes Pinto Garcia, A., Szklo, A. S., Schaeffer, R., & McNeil, M. A. (2007). Energy efficiency standards for electric motors in Brazilian industry. *Energy Policy*, *35*(6), 3424–3439.

Gupta, J. (2001). India and climate change policy: between diplomatic defensiveness and industrial transformation. *Energy and Environment*, *12*(2&3), 217–236.

Gupta, J. (2008). (on behalf of Li Ming and Onno Kuik). Will CDM in China make a Difference?, IHDP Conference, Berlin Conference on the Human Dimensions of Global Environmental Change International Conference of the Social-Ecological Research Programme on Long-Term Policies: Governing Social-Ecological Change, Berlin, 22–23 Feb 2008.

Gupta, J., Vlasblom and Kroeze, C. (eds.) with contributions from Blok, K., Hisschemoller, M. Boudri, C. and Dorland, K. (2001). An Asian Dilemma: Modernising the electricity sector in China and India in the context of rapid economic growth and the concern for climate change. NOP report no. 410200097, NOP, RIVM, Bilthoven, The Netherlands.

Gupta, J., van Asselt, H., Kuik, O., & Evans, C. (2007). Exogenous promotion of sustainable electricity options in India: Opportunities and challenges. *Energy and Environment*, *18*(3&4), 403–420.

IEA (2002). Electricity in India. Providing power to the millions. International Energy Agency/Organisation for Economic Co-operation and Development, Paris, France.

IEA (2006). Plus Five Countries: Energy Efficiency Indicators Project. Joint ESMAP-IEA Project Concept Note

IGEC (2005). CDM Country Guide for China, Institute for Global Environmental Strategies, Tokyo

IPCC (2007). FAR. Working Group III Report: Mitigation of Climate Change (2007), http://www.ipcc.ch/ipccreports/ar4-wg3.htm (last visited June 12, 2008).

Ivanova, A., & Angeles, M. (2006). *Trade and Environment Issues in APEC. Globalization and east Asia: Opportunities and Challenges* pp. 101–126. New York: The Haworth Press.

Ivanova, A., Angeles, M. and Martinez, A. (2006). "Environmental Issues in APEC: the Case of the Latin American Economies" *Heterodox Views on Economics and the Economy of Global Society,* Mansholt Publication Series, The Netherlands: Wageningen Academic Publishers, 269-280.

Klessmann, C., Graus, W., Harmelnk, M., & Geurts, F. (2007). *Making Energy Efficiency Happen. From Potential to Reality.* Utrecht, The Netherlands: ECOFYS&WWF.

Kroeze, C., Vlasblom, J., Gupta, J., Boudri, C., & Blok, K. (2004). The power sector in China and India: Greenhouse gas emission reduction potential and scenarios for 1990–2020. *Energy Policy*, *32*, 55–76.

Kyoto Protocol (1997). Kyoto Protocol to the Climate Change Convention (1997). 37 ILM 22. http://unfccc.int/kyoto_mechanisms/aij/activities_implemented_jointly/items/2094.php

Liao, H., Fan, Y., & Wei, Y. -M. (2007). What induced China's energy intensity to fluctuate: 1997–2006? *Energy Policy*, *35*, 4640–4649.

Lin, J., Zhou, N., Levine, M., & Fridley, D. (2007). Taking out 1 billion tons of CO^2: The magic of China's 11th five-year plan? *Energy Policy*, 36, 954–970 doi:10.1016/j.enpol.2007.10.033.

Machado, F. M. (2001). "Brazilian Efforts Towards Reducing Greenhouse Gas Emissions in the Transport and in the Energy Intensive Industry" Paper, Workshop on Good Practices in Policies and Measures, October 8–10, Copenhagen.

Marauhn, T. (2003). A global energy strategy as a viable means for redressing climate change. *Heidelberg Journal of International Law*, *63*(2), 281–994.

Morales, I. (2008). "Mexico's Energy Policy Options in North America's Continental Energy Markets", Working Paper 119, Universidad de las Americas, Puebla, Mexico.

NEPEG (2001). National Energy Policy Development Group, National Energy PolicY 1-3 (2001), *available at* http://www.whitehouse.gov/energy/National-Energy-Policy.pdf.

North American Energy Working Group (2006). North American Energy Efficiency Standards and Labelling

Osterkonn, M. (2007). "Energy Efficiency for Developing Countries. Strong policies and New Technologies". Paper presented on Seventh Meeting of the GFSE, Vienna, November, 21–23.

Ovalle Araiza, M. E. (2005). "Renewable Energy and Energy Efficiency in México", Paper, Energy Commission, Scotland, Edinburgh, October 8th.

PEEREA (1994). Energy Charter Protocol on Energy Efficiency and Related Environmental Aspects. Available at http://www.encharter.org/fileadmin/user_upload/document/EN.pdf

Pahl-Wostl, C., Gupta, J., & Petry, D. (2008). Governance and the global water system: A theoretical exploration. *Global Governance*, *8*(4), 419–435.

Perkins, R. (2005). Electricity sector restructuring in India: An environmentally beneficial policy? *Energy Policy*, *33*(4), 439–449.

Richards, M. (2003). *Poverty Reduction, Equity and Climate Change: Global Governance Synergies or Contradictions*. London: Overseas Development Institute.

Scheumann, W. (2008). How Global Norms for Large Dams Reach Decision Makers. In W. Scheumann, S. Neubert, & M. Kipping (Eds.), *Water Politics and Development Cooperation: Local Power Plays and Global Governance* (pp. 55–80). Dordrecht: Springer.

Schrumm, A. (2006). The energy blindspot: The absence of global energy governance in the United Nations. *Queen's International Observer*, *3*(2), 14–17.

Sindico, F., & Gupta, J. (2004). Moving the climate change regime further through a hydrogen protocol. *Review of European Community and International Environmental Law*, *13*(2), 175–186.

Srivastava, L., Gupta, J., et al. (2007). *Modernising the Indian Electricity Sector* p. 322. New Delhi: The Energy Research Institute Publications.

Statute of the IAEA, (1956). available at http://www.iaea.org/About/statute.html

Taylor, R. P., Govindarajalu, Ch., Levin, J., Meyer, A. S., & Ward, W. A. (2008). *Financing Energy Efficiency: Lessons from Brazil, China, India and Beyond*. Washington D.C.: IBRD&WB.

Teng, F., & Gu, A. (2007). Climate change: National and local policy opportunities in China. *Environmental Sciences*, *4*(3), 183–194.

Thakur, T., Deshmukh, S. G., Kaushik, S. C., & Kulshrestha, M. (2005). Impact assessment of the Electricity Act 2003 on the Indian power sector. *Energy Policy*, *33*(9), 1187–1198.

UN Energy (2005). The Energy Challenge for Achieving the Millennium Development Goals, UN Energy; available at http://esa.un.org/un-energy.

UNCSD (2001). Report on the ninth session (5 May 2000 and 16-27 April 2001) UN Doc. E/CN.17/2001/19.

UNFCCC (1992). United Nations Framework Convention on Climate Change, U.N. Doc. A/AC.237/18 (1992), reprinted in 31 I.L.M. 849 (1992).

USDOE-IEA (2007). International Energy Outlook, Energy Information Administration, Office of Integrated Analysis and Forecasting, U.S. Department of Energy, Washington, DC.

Vennemo, H., Aunan, K., Jinghua, F., Holtedahl, P., Tao, H., & Seip, H. M. (2006). Domestic environmental benefits of China's energy-related CDM potential. *Climatic Change*, *75*, 215–239.

WCED (1987). *Our Common Future. The World Commission on Environment and Development*. Oxford: Oxford University Press.

Westphal, K. (2005). Energy Security: Challenges to Global Governance, *Paper presented at the annual meeting of the International Studies Association, Hilton Hawaiian Village, Honolulu, Hawaii*, Mar 05, 2005.

Wettestad, J. (2000). The Complicated Development of EU Climate Policy. In J. Gupta, & M. Grubb (Eds.), *Climate Change and European Leadership: A Sustainable Role for Europe, Environment and Policy Series* (pp. 25–46). Dordrecht: Kluwer Academic Publishers.

WSSD Report (2002) Johannesburg Plan of Action. http://daccessdds.un.org/doc/UNDOC/GEN/N02/636/93/PDF/N0263693.pdf?OpenElement