Fossil fuel subsidies in the agenda of the G-20

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Abstract

The debate about fossil fuel subsidies was introduced in the agenda of the G-20 in the Leader's Summit held in Pittsburgh in September 2009, where this issue was linked to that of climate change, and the idea of rationalizing and phasing out—over the medium run—inefficient fossil fuel subsidies which encourage wasteful consumption was put forward. In the Toronto Summit of June 2010 the different countries presented their plans to address this issue: 11 countries submitted strategies and timetables to rationalize and phase out inefficient fossil fuel subsidies, and 8 countries reported that they have no inefficient fossil fuel subsidies to reform in the context of the G-20 mandate.

It must be borne in mind that G-20 countries differ with regard to their contribution to greenhouse gas emissions derived from the use of fossil fuels and to the role these fuels have in their energy balance. Support measures in developed countries consist in production subsidies and, in some cases, in favouring consumption through low tax rates, whereas in developing countries these measures are more aimed at consumption. And even though developed countries devote large sums of money to biofuel subsidies—which would partially counteract the economic and environmental effects produced by the reduction of fossil fuel subsidies—these have not been included in the agenda of the G-20.

The definition of subsidy is an unresolved issue, which is no minor question, since the G-20 debates on this subject do not constitute an academic exercise but may result in the adoption of measures which have consequences on the energy policies of its member countries. The most appropriate definition is that set forth in the WTO Agreement on Subsidies and Countervailing Measures, which was approved by more than 150 countries and which allows the maintenance of a coherent position among the different international negotiation fora.

Energy subsidies are a long-debated issue as regards their efficacy, efficiency and relation to the problem of climate change. This issue has been recently included in the agenda of the G-20; in fact, paragraphs 29 to 31 of the 24–25 September 2009 Pittsburgh Summit Leaders' Statement set forth lines of action for member countries.

Those paragraphs question fossil fuel subsidies on the grounds that they are inefficient and encourage wasteful consumption, thus proposing that both G-20 countries and non-G20 countries assume a commitment to phase them out over the medium term. In turn, said paragraphs explicitly exclude subsidies that favour clean energy, renewables and technologies that reduce greenhouse gas emissions as well as subsidies granted for social purposes.[2] In other

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[2] The relevant passages of the Pittsburgh Leaders' Statement are as follows (G-20, 2009):

words, the Statement links the issue of fossil fuel subsidies with the protection of the environment and the fight against climate change.

Within the framework of the G-20, the leaders asked the International Energy Agency (IEA), the Organization of Petroleum Exporting Countries (OPEC), the Organization for Economic Co-operation and Development (OECD) and the World Bank to make a joint report in order to analyse this issue and provide suggestions to implement the initiative; this report was set forward at the 2010 Toronto Summit.

On the other hand, in January 2010 an *Ad Hoc* Group of Experts on Energy Efficiency was established under the supervision of the Finance and Energy Ministers, with the aim of gathering information about the subsidies that are to be rationalized and phased out, and about each country's implementation plans. The work of this group resulted in a report which summarises each country's plans as regards the measures they intend to implement; this report was also submitted to the leaders during the Toronto Summit.

Paragraph 42 of the Toronto Summit Leaders' Statement attaches importance to the report made by the four international organisations, welcomes the work of Finance and Energy Ministers in relation to the presentation of strategies for the rationalization and phasing-out of each country's subsidies, encourages the implementation of those strategies, and states that the progress made towards this commitment will be reviewed at upcoming summits (G-20, 2010).

Unlike other commitments assumed by G-20 countries which entail actions to be carried out by multilateral organisations, complying with the commitment to phase out subsidies depends largely on the course of action taken by each country. Thus, controlling the degree of compliance should be simpler.

This raises several controversial points: What is the environmental impact of fossil fuels? What are the differences between the emissions of different fuels? What countries are most dependent on fossil fuels? What is the purpose of subsidies? What is subsidized and how is it subsidized? What is the situation of subsidies for alternative sources of energy closely related to fossil fuels, such as first generation biofuels? What is considered a subsidy? And what are the implications of the different definitions that the G-20 is currently discussing?

The aim of this paper is to shed light on these questions and provide a framework for analysis to understand them. Firstly, we present the environmental impact of fossil fuels. Secondly, we describe the energy balance of G-20 countries. Thirdly, we summarise the reasons and the impact of subsidies and other support measures for energy, and subsidies for fossil fuels granted all over the world. Fourthly, we deal with biofuel subsidies, which will be excluded from the phase-out commitment. Fifthly, we analyse the definition of subsidy, in particular the definitions discussed in the G-20 *Ad Hoc* Group of Experts on Energy Efficiency, and describe the tasks of said group. And, at the end of the paper, we include the final considerations regarding the concerns raised by the issue of fossil fuel subsidies.

- Inefficient fossil fuel subsidies encourage wasteful consumption, distort markets, impede investment in clean energy sources and undermine efforts to deal with climate change (paragraph 29).
- Rationalize and phase out over the medium term inefficient fossil fuel subsidies that encourage wasteful consumption (paragraph 29).
- As we do that, we recognize the importance of providing those in need with essential energy services, including through the use of targeted cash transfers and other appropriate mechanisms (paragraph 29).
-This reform will not apply to our support for clean energy, renewables, and technologies that dramatically reduce greenhouse gas emissions (paragraph 29).

1. Global environmental impact of fossil fuels[3]

Fossil fuel consumption has local as well as global impacts. Global impacts are at the core of international negotiations on climate change.[4]

In this respect, there is consensus as regards the responsibility industrialised nations have for most of the carbon dioxide emissions (CO_2) produced by fossil fuels.[5] These global CO_2 emissions increased by 900 million tonnes between 2006 and 2007, primarily due to an increase in developing countries' demand for coal (non-Annex I parties to the United Nations Framework Convention on Climate Change), especially China and India.

Table 1
Key sources of CO_2 emissions from fossil fuels in the G-20, year 2007
in % and in million tonnes, approach by sector

	Electricity generation - coal	Electricity generation - gas	Industry - coal	Road transport - oil	Others [1]	Total emissions	
	%	%	%	%	%	in million tonnes of CO_2	as a % of world total figures
China	48.6	n.a.	27.0	4.6	19.8	6,027.9	20.8
United States	33.9	6.5	2.1	26.5	31.1	5,769.3	19.9
Russia	13.0	19.8	5.6	7.5	54.1	1,587.4	5.5
India	47.0	n.a.	12.4	8.1	32.5	1,324.1	4.6
Japan	18.9	10.0	11.5	17.4	42.2	1,236.3	4.3
Germany	33.8	3.5	4.9	17.6	40.1	798.4	2.8
Canada	18.4	n.a.	2.9	22.2	56.5	572.9	2.0
United Kingdom	22.5	10.3	n.a.	22.8	44.4	523.0	1.8
Korea	27.1	6.6	5.8	16.3	44.1	488.7	1.7
Mexico	6.8	11.5	n.a.	31.9	49.8	437.9	1.5
Italy	11.5	13.1	n.a.	26.4	49.0	437.6	1.5
Australia	52.3	3.7	3.1	16.9	23.9	396.3	1.4
Indonesia	16.6	2.6	21.5	17.4	41.9	377.2	1.3
France	5.9	n.a.	4.2	33.7	56.2	369.3	1.3
Saudi Arabia	0.0	12.1	0.0	24.6	63.2	357.9	1.2
Brazil	2.2	n.a.	8.5	36.7	52.6	347.1	1.2
South Africa	60.8	0.0	12.4	12.4	14.5	345.8	1.2
Turkey	19.1	12.4	17.6	15.7	35.2	265.0	0.9
Argentina	n.a.	14.6	2.2	20.5	62.6	162.6	0.6
Total G-20	33.1	5.3	11.3	16.3	34.1	21,824.6	75.4
European Union - 27	24.5	6.7	3.9	22.9	42.0	3,926.4	13.6
World	28.3	6.7	9.8	16.6	38.6	28,962.4	

[1] The category "others" comprises the remaining combinations of sector (electricity generation, industry, transport and other sectors—including household consumption, commercial services, agriculture and fishing) and fuel (coal, oil and gas).

n.a.: not available

Source: CEI based on IEA (2009 a) and Annexe 1

[3] Based on IEA (2009 a).

[4] The use of fossil fuels accounted for 56 percent of the total of greenhouse gas emissions generated by human activities during 2004 measured in their CO_2 equivalent, while agriculture, deforestation and other changes in the use of soil accounted for 17 percent of said total. (Pachauri and Reisinger, 2007: 5).

[5] Since the Industrial Revolution, annual CO_2 emissions from fuel combustion dramatically increased from near zero to 29 Gt CO_2 in 2007 (IEA, 2009 a).

The emissions from fossil fuels originated in the top-9 emitting countries accounted for nearly two-thirds of world emissions in 2007 (table 1). In turn, China, the United States, the Russian Federation, India and Japan—the top-5 emitting countries—produced together 55 percent of the global CO_2 emissions of said year. Total emissions from the countries comprising the G-20—excluding the European Union as a whole—accounted for 75 percent of the global CO_2 emissions in 2007. Within the G-20, Argentina is the country with the lowest CO_2 emission level, with a nearly 1 to 35 ratio if compared to China and the United States—the largest emitters—and approximately a 1 to 9 ratio with respect to the Russian Federation, India and Japan—the following three largest emitting countries.

In 2007, two sectors—electricity and heat generation, and transport—produced nearly two-thirds of the global CO_2 emissions from fossil fuels; their shares being 41 and 23 percent respectively.[6] While electricity and heat generation draws from various energy sources—either fossil or non-fossil—the transport sector relies almost entirely on oil (in 2007, 94 percent of the energy used for transport came from oil). It is worth noting that not all fossil fuels contribute to increasing CO_2 emissions in the same way (see box 1).

Box 1
Fossil fuel contribution to CO_2 emissions

The default carbon emission factors taken into account by the experts of the Intergovernmental Panel on Climate Change (IPCC) are: 15.3 t C/TJ (tonnes of carbon per terajoule) for gas, 16.8 to 27.5 t C/TJ for oil products, 25.8 to 29.1 t C/TJ for primary coal products. Therefore, as compared to gas, coal is on average nearly twice as emission intensive due to its heavy carbon content per unit of energy released.

In turn, nuclear and hydropower are non-fossil sources of energy, which are considered as non-GHG-emitting.

Source: IEA (2009 a) based on IPCC (1996: 1.11) chapter 1, table 1.1

Within the G-20, this can be clearly observed when analysing the key sources of CO_2 emissions from fossil fuels; key sources which result from combining the emissions of different sectors (electricity generation, industry, transport and others) with the fuels used (coal, oil, gas). Hence, coal-based electricity generation and road transport dependent on oil explain most of the total emissions of the G-20 (table 1).

A particular analysis of some G-20 countries reveals the following facts (table 1 and annexe 1):

- The preponderant use of coal in the Chinese economy. Three-fourths of the total CO_2 emissions are produced by the use of coal: 48 percent from the coal used for electricity generation, and 27 percent from the coal used in industry.

- In the United States, 34 percent of emissions derive from the use of coal to generate energy and 26 percent of emissions are generated by oil products used for road transport. The

[6] The shares of the remaining sectors were as follows: industry (20%), residential (6%) and other sectors including commercial/public services, agriculture/forestry, fishing, among others (10%).

United States are responsible for 42 percent of the G-20 CO_2 emissions produced by the use of oil products for road transport.

- In India, Australia and South Africa, CO_2 emissions from coal-based energy generation continue to account for a large share in the total emissions they produce.

- Other G-20 countries, such as Russia, Japan and Canada, show greater diversification of their CO_2 emission sources.

- In Argentina, 20 percent of emissions derive from road transport, while 14 percent of them derive from natural gas-based electricity generation; the use of coal for electricity generation is only marginal.

This partly helps to understand the trends in transport and energy policies in relation to GHG emissions. For instance, the trends in transport policies are aimed at: (i) improving the efficiency in motor vehicle fuel consumption, (ii) encouraging a change in the means of transport that entails using the car less and promotes the use of public transport and other means of transport—such as trains—that generate fewer emissions, and at (iii) fostering a change towards the use of low-carbon fuels (hydrogen and biofuels) and electricity (hybrid vehicles).

Policies on electricity generation tend towards "decarbonisation" through the use of less carbon intensive fuels—such as gas and renewable energies—among other measures.

2. **Energy balance and fossil fuels**

At world level, the overall demand for primary energy—for electricity generation, industry and transport—depends heavily on fossil fuels (table 2). Transport is the sector that most depends on these fuels—94 percent of this sector is dependent on oil. Furthermore, 76 percent of world electricity generation comes from fossil fuels, and almost 50 percent of this is coal-based electricity. In turn, industry—which continues to depend largely on these fuels—shows a little more diversified demand.

Table 2
Breakdown of global overall demand for primary energy, 2007

a. in million tonnes of oil equivalent

	electricity generation	industry	transport	others [1]
coal	2,167	581	4	110
oil	284	320	2,161	453
natural gas	988	460	75	613
non-fossil	1,118	189	34	818
electricity	n.a.	596	23	794
heating	n.a.	120	n.a.	153
total	4,557	2,266	2,297	2,941

b. in percentage

	electricity generation	industry	transport	others [1]
coal	48	26	0	4
oil	6	14	94	15
natural gas	22	20	3	21
non-fossil	25	8	1	27
electricity	n.a.	26	1	27
heating	n.a.	5	n.a.	5
total	100	100	100	100

[1] The category "others" comprises consumption of households, public services, agriculture and the remaining unspecified sectors.

n.a.: not applicable

Source: CEI based on IEA (2009 e: Annex A); IEA (2009 c: Part II) for transport.

With regard to electricity generation in G-20 countries, some of them depend largely on fossil fuels, while others use sources of energy which emit fewer greenhouse gases (table 3). Among those which use fossil fuels, some rely heavily on coal while others use a cleaner fuel, such as natural gas.

Table 3
Breakdown of electricity generation in G-20 countries, 2007
in %
in descending order, according to fossil fuel share

	coal	oil	natural gas	fossil fuel subtotal	nuclear energy	hydropower	other sources [1]	total [2]
Saudi Arabia	-	55.2	44.8	100.0	-	-	-	100.0
South Africa	94.7	0.4	-	95.1	4.3	0.4	n.a.	99.8
Australia	76.3	0.9	15.4	92.5	-	5.7	1.8	100.0
Indonesia	44.9	26.5	15.7	87.1	-	7.9	n.a.	95.0
Italy	16.1	11.5	56.0	83.6	-	10.7	5.7	100.0
China	81.0	1.0	0.9	82.9	1.9	14.8	n.a.	99.6
Mexico	12.3	20.3	48.8	81.4	4.1	10.6	4.0	100.0
Turkey	27.9	3.4	49.6	80.9	-	18.7	0.4	100.0
India	68.4	4.1	8.3	80.8	2.1	15.4	n.a.	98.3
United Kingdom	35.3	1.2	41.9	78.4	16.1	1.3	4.3	100.0
United States	49.0	1.8	21.2	72.0	19.4	5.8	2.9	100.0
Japan	27.7	13.9	25.8	67.4	23.5	6.6	2.6	100.0
Russia	16.8	1.7	48.0	66.5	15.8	17.5	n.a.	99.8
Argentina	2.2	9.4	54.3	65.9	6.3	26.5	n.a.	98.7
Korea	40.1	5.9	19.3	65.3	33.6	0.9	0.3	100.0
Germany	49.3	1.8	11.6	62.7	22.3	3.3	11.7	100.0
Canada	18.1	1.5	6.4	26.0	14.6	57.6	1.8	100.0
France	5.0	1.1	3.9	10.0	77.9	10.3	1.8	100.0
Brazil	2.3	3.1	3.5	8.9	2.8	84.0	n.a.	95.7
European Union - 27	30.8	3.4	21.8	56.0	28.1	9.3	n.a.	93.4

[1] The category "other sources" includes geothermal, solar, biomass, residual, tidal and wind energy, among others.

[2] For non-OECD countries and the European Union - 27, the total does not reach 100 due to the lack of information about other sources of energy generation.

n.a.: not available

Source: CEI based on IEA (2009 c and d)

South Africa, China, Australia and India are among the countries which rely most heavily on coal, followed by Germany and the United States. In South Africa, 95 percent of the electricity generated in 2007 was coal-based, which explains why most of its CO_2 emissions (64%) for that year were caused by electricity generation. In China, the increase in CO_2 emissions—which tripled between 1990 and 2007—was mainly driven by a growing demand for electricity (IEA, 2009 a).[7]

In India, two-thirds of emissions come from burning coal. Since the efficiency of power stations in the country is low according to international standards, India's power sector is one of the most CO_2-intensive in the world (IEA, 2007).

In the United States, nearly three-fourths of electricity is generated from fossil fuels; the share of coal being 50 percent and that of natural gas, the remaining 25 percent. Natural gas consumption is rapidly growing in the United States, in particular as a source of power generation, and it has now overtaken nuclear energy to become the number-two source of power behind coal (IEA, 2008 b).

Saudi Arabia is the country showing the most intensive use of oil as the main source of electricity. In other important oil-producing countries, such as Indonesia and Mexico, the use of oil barely exceeds one-fourth in the former and one-fifth in the latter.

The countries that most intensively use natural gas as a source of power generation are Italy, Argentina, Turkey, Mexico, Russia, Saudi Arabia and the United Kingdom. Among these, Argentina and Russia use the largest proportion of non-fossil sources to supplement power generation.

Argentine energy matrix is mainly based on thermal and hydropower generation. Nevertheless, as hydropower relies heavily on weather factors—low and high rainfall periods—its share may fluctuate from year to year. In 2006 the figures were different: overall power was generated by thermal power stations (55.9%),[8] hydro-power stations (36.7%), nuclear plants (7.4%), and by a still marginal share of wind sources (0.1%) (Secretariat of Energy, 2006).

One-third of the Russian Federation's electricity and heat generation comes from non-emitting (nuclear and hydro) or low-emitting (natural gas—48 percent—) sources, in spite of the fact that the electricity and heat generation sector represented 55 percent of Russian CO_2 emissions in 2007.

The three G-20 countries that least depend on fossil fuels for electricity and heat generation are Brazil, France and Canada.

Brazilian energy matrix is one of the cleanest in the world, considering the high proportion of renewables and hydropower[9] it uses.

In turn, France relies heavily on nuclear energy (77.9%) to generate domestic electricity (IEA, 2009 b). Thus, the energy generation sector is responsible for less than 10 percent of the CO_2 emissions generated in France.

[7] In said period, 99 percent of China's emissions growth resulted from the use of coal for electricity generation.

[8] Natural gas was the mostly used fuel in thermal generation (90%; its share being of 98.4 percent in 2002); however, its share has declined over the last years as a result of the increased use of fuel oil (whose share was of 10.3% in 2006) and, to a lesser extent, of the use of diesel (2.8%) and coal (2.1%).

[9] According to 2007 data, Brazil was the second producer of hydro-electricity—preceded by Norway—with a share of 84 percent in the total domestic electricity generation (IEA, 2009 b).

Lastly, as regards Canada, although 57 percent of its electricity is generated in hydro-power stations and 14 percent in nuclear plants, 18 percent of it is produced in coal-based thermal power stations; consequently, thermal power stations constitute one of the key sources of CO_2 emissions in said country.

3. Measures to support fossil fuel consumption and production

Fossil fuels benefit from a wide range of support measures. These measures include budgetary transfers, tax benefits and tax deductions—applied both across-the-board and by type of user—cross-subsidies between users, loans at preferential rates, state-guaranteed loans, use of public infrastructure at prices below market levels, use of state-owned renewable and non-renewable resources, price controls and special treatment in the case of environmental and sanitary regulations, among others.

These support measures are granted for different reasons (OECD, 2002):

- to protect indigenous industries;
- to stimulate regional economic development;
- to benefit specific social groups;
- to reduce dependence on imports for energy security reasons;
- to protect the environment.

Regardless of its purpose, any measure which entails market intervention might eventually have an impact on economic efficiency, namely:

- Support measures for producers: fewer incentives to reduce costs and modify technologies. They have an impact on investment and upgrading decisions;
- Support measures for consumers (either intermediate-user prices or consumer prices): greater consumption; less need for a more efficient use; lack of incentives to use less polluting sources.

Consumption measures have regularly been the focus of different studies, whereas production measures—for which gathering data is much more difficult—have received much less attention (Global Subsidies Initiative, 2009).

This type of support is usually quantified in monetary terms using the price-gap method, which is often used to measure energy market distortions (see box 2). This is easier to apply in the case of oil and oil products, since there is price data available which serves to calculate the price-gap between international and domestic prices.

Box 2
The price-gap approach: a simple though biased method

Fuel subsidies are usually quantified using the price-gap approach, which compares consumer prices with reference prices, defined as those that would prevail in undistorted markets in the absence of government support (IEA, 1999: Annex to part A). The reference price corresponds to the export or the import border price—depending on the country—for internationally traded energy products, and to the costs of production for non-traded ones; and in both cases the reference price is adjusted for transport, distribution and marketing costs.

Although this relatively simple method to measure subsidies in the long run can be implemented by a number of countries, and it has become the mostly used method, it has some flaws (IEA, 1999; Koplow, 2009). Firstly, it fails to adequately assess subsidy magnitude when countries apply two measures that go in different directions as regards their impact on the price gap, such as budgetary supports—which widen the gap—and taxes—which narrow it. Secondly, it does not take into account production and consumption subsidies that do not affect consumer prices. Thus, developed countries—where support is given mainly to producers—are not included in studies based on this approach. Thirdly, the values employed might be inaccurate: international prices are not always available, and the prices used for the measurements might be distorted by market intervention.

Two alternative methods allow for the introduction of policy instruments that do not directly affect prices (Koplow, 2004). One is the program-specific approach, which quantifies the value of all budgetary and taxation support as well as of support related to loans and insurances corresponding to the different government programmes. However, though it corrects some of the flaws of the price-gap approach, it poses certain difficulties in making a systematic assessment. For instance, the way budgetary transfers—the most obvious subsidy—are assessed depends on how these transfers are described in the budgetary data and whether they are broken down by type of subsidized product (IEA, OPEC, OECD and World Bank, 2010). The amount of taxes that is not collected due to the granting of tax exemptions and benefits depends on the tax system of each country, which makes it difficult to compare the outcomes among different countries. Hence, these assessments rely heavily on the fact that case studies be carried out.

The other alternative approach is the producer support estimate/consumer support estimate (PSE/CSE). This approach serves to show—in monetary terms—both budgetary and taxation support as well as measures which have an impact on price, such as internal regulations, regulated prices or trade measures. The OECD has been using this approach since 1987 to measure agricultural support (OECD, 2004). As happens with the program-specific approach, this is a barely used approach because it requires data from governments (Koplow, 2004 and 2009).

Below we describe some measures that have an impact on the consumption and production of oil, natural gas and coal.

3.1. Support for consumption and production of oil and oil products

The monetary value of support measures for consumption of oil and oil products—estimated using the price-gap approach—has changed in direct relation to international price fluctuations,

since the aim of these measures is that fluctuations in domestic prices be lower than in international prices.

Excluding implicit subsidies given through lower-than-optimal taxes on fuels,[10] support soared from almost USD 60 billion in 2003 to USD 519 billion in 2008; it subsequently plunged to USD 136 billion in 2009 and is projected to increase again to USD 240 billion by the end of 2010 (table 4).[11] If implicit subsidies granted through lower-than-optimal taxes are included, amounts of support grow significantly: USD 406 billion in 2003, USD 998 billion in 2008, USD 524 billion in 2009 and an estimated USD 742 billion by the end of 2010.

Table 4
Overall global support for oil and oil product consumption[1]

	end of 2003	mid-2008	mid-2009	end of 2010 (projected)
	in billions of USD			
without implicit tax subsidy [2]	57	519	136	240
with implicit tax subsidy [3]	406	998	524	742
	as a % of total support			
without implicit tax subsidy [2]				
advanced countries	0.2	0	0	0
emerging countries	66.0	70.3	60.5	64.6
other developing countries	33.8	29.7	39.5	35.4
with implicit tax subsidy [3]				
advanced countries	36.7	12.7	26.5	22.8
emerging countries	45.6	63.9	52.4	56.7
other developing countries	17.7	23.4	21.1	20.5

[1] It does not include support to farmers.

[2] The support is calculated as the difference between consumer prices and international prices adjusted for transport, distribution and marketing costs.

[3] The difference between fuel taxes and the tax that should be levied if environmental, revenue (optimal tax) and equity considerations were taken into account is used to calculate the implicit subsidy. The optimal tax used is 0.30 USD/litre.

Source: CEI based on Coady *et al*. (2010).

According to the information contained in table 4, developed countries do not grant explicit subsidies for consumption of oil and oil products, but they do apply lower-than-optimal taxes. By mid-2009 developed countries accounted for one-fourth of implicit subsidies granted through lower-than-optimal taxes.

[10] The optimal tax on oil products takes into account environmental, revenue and equity considerations (Coady *et al.*, 2010: 5). Coady *et al.* (2010) use 0.30 USD/litre as optimal tax based on the results of other studies. By mid-2009, out of the 145 countries analysed in said paper, 46 countries—including the United States—charged a lower-than-optimal tax.

[11] By 2008, the International Energy Agency estimated—also using the price-gap approach—that subsidies to oil and oil products totalled USD 312 billion (IEA, OPEC, OECD and World Bank, 2010: 16). This value is lower than that estimated by Coady *et al*. (2010), because the estimate was made using prices corresponding to the end of 2008, which were lower than those corresponding to midyear, and this resulted in a lower subsidy.

The increase in the amount of subsidies granted in 2008 and that projected for 2010 have raised certain concern due to the impact such subsidies have on fiscal costs, and because they encourage the consumption of fuels that emit greenhouse gases (Coady *et al.*, 2010).

The developing countries that give some type of support for oil consumption—either via price controls, budgetary support, tax deductions or preferential loans—are, in decreasing order according to the amount of support granted: Iran, China, Saudi Arabia, Venezuela, Indonesia, India, Egypt, Malaysia, Argentina, Thailand, Nigeria, Pakistan, Brazil, and Kazakhstan (IEA, 2008 a).

As for oil production subsidies granted by developed countries, the United States offers several tax benefits to domestic producers (UNEP, 2004); Canada charges differentiated royalties according to the region where oil is extracted (UNEP, 2004); Denmark exempts oil producers from the payment of royalties (EEA, 2004); Ireland offers a pre-exploration preferential tax scheme for oil (EEA, 2004); and Japan supports technological development at the refining stage (IEA, 2008 c).

Additionally, the different consumption tax rates on oil products charged by each country should also be considered.[12] Even when taxes are seen as incentives to reduce consumption, low tax rates do not favour that aim and, in fact, they might have the same effect as consumption subsidies. An example of this is the 15 percent tax rate imposed in the United States on consumption of unleaded premium gasoline with a 95 octane number (RON); this rate is much lower than that charged in most G-20 developed and many G-20 developing countries, with the exception of some oil-producing countries (table 5).[13] This cannot be dissociated from the fact that the United States accounts for 32 percent of the world consumption of oil products used for road transport,[14] and it also accounts for 32 percent of the world CO_2 emissions generated by road transport based on oil products (annexe 1). An additional element to be considered as regards the low tax rate imposed in the United States is that the tax rate is lower than the optimal tax which should be charged in order to adequately comply with considerations on tax revenue, local and global pollution, traffic and accidents. According to Parry and Small (2002), the optimal tax on fuel consumption for the United States is of USD 0.26/litre (USD 1/gal), whereas the rate charged in 2008 was of USD 0.134/litre (IEA, 2009 f).

[12] These products are charged with excise taxes and general taxes (general sales and value-added taxes).

[13] As consumption taxes on gasoline are usually a fixed amount, their *ad valorem* equivalent varies inversely with respect to gasoline price fluctuations.

[14] In 2007, the United States consumed 522.48 million tonnes of oil equivalent for road transport based on oil products, while world consumption was 1.63 billion tonnes of oil equivalent (IEA, 2009 c and d).

Table 5
Tax on gasoline consumption in G-20 countries[1]
in % of consumer price
year 2008, in descending order

country	excise taxes	general taxes [2]	total taxes
Germany	46.7	16.0	62.6
United Kingdom	47.2	14.8	61.9
France	44.7	16.4	61.1
Turkey	44.5	15.3	59.7
Italy	40.9	16.7	57.6
India	29.3	23.0	52.3
Korea	40.2	9.1	49.3
Argentina[3]	30.2	14.6	44.7
Japan	34.2	4.8	39.0
Australia	25.5	9.1	34.6
Canada	22.9	4.7	27.6
South Africa	23.4	n.a.	23.4
United States	n.a.	n.a.	15.0
Mexico	n.a.	13.0	13.0
Indonesia	0.0	n.a.	n.a.
China	0.0	n.a. [4]	n.a.
Russia	0.0	n.a. [5]	n.a.
Brazil	7.2	n.a. [6]	n.a.
Saudi Arabia	0.0	n.a.	n.a.

[1] *ad valorem* equivalent excise taxes if applicable. Unleaded premium gasoline with RON 95; for China, Korea, India and Japan, non-premium gasoline; for Brazil, gasoline C (gasoline + anhydrous ethanol).

[2] on sales and value added.

[3] data for March 2010.

[4] VAT at 17%

[5] VAT at 20%

[6] ICMS (tax on flow of goods and services): varies from state to state; PIS/Pasep (contribution to social integration programmes): 0.0465 BRL/litre; Cofins (contribution for the financing of social security): 0.21502 BRL/litre.

n.a.: not available

Source: CEI based on IEA (2009 f), Secretariat of Energy (2010) (Argentina), Agência Nacional do Petróleo, Gás Natural e Biocombustíveis (2010) (Brazil) and Montamat (2002).

These different levels of taxation are also reflected in fuel prices. The United States and several oil-producing developing countries have a lower gasoline price than that of other G-20 countries (table 6). Measured in purchasing power parity dollars (PPP USD), the price in the United States is even lower than that recorded in China, Indonesia, Mexico and Argentina. Once again, this shows that subsidies are as important as taxation in causing changes in fuel consumption.

Table 6
Gasoline price in G-20 countries
year 2008, in descending order

country	price[1] in USD	country	price[2] in PPP USD
Turkey	2.47	Turkey	3.22
Germany	2.05	India	3.17
Italy	2.02	South Korea	2.27
France	1.98	South Africa	1.95
United Kingdom	1.96	Brazil	1.72
South Korea	1.54	United Kingdom	1.60
Japan	1.52	Indonesia	1.59
Australia	1.25	Germany	1.59
India	1.16	Italy	1.59
Canada	1.15	Argentina	1.55
South Africa	1.09	China	1.50
Brazil	1.04	France	1.48
Russia	0.90	Japan	1.34
United States	0.89	Russia	1.31
Indonesia	0.86	Mexico	1.20
China	0.82	Canada	1.00
Argentina	0.82	Australia	1.00
Mexico	0.80	United States	0.89
Saudi Arabia	0.16	Saudi Arabia	n.a.

[1] unleaded premium gasoline with RON 95; for Brazil, China, Korea, India and Japan, non-premium gasoline.
[2] price in purchasing power parity. Unleaded premium gasoline with RON 95; for China, Korea, India and Japan, non-premium gasoline. For Argentina, Brazil, China, India, Indonesia, Russia, Saudi Arabia and South Africa, the exchange rate of the local currency against the USD was taken from the IMF World Economic Outlook Database .

n.a.: not available

Source: CEI based on IEA (2009 f), GTZ (2009) (Saudi Arabia), Secretariat of Energy (2010) (Argentina), Agência Nacional do Petróleo, Gás Natural e Biocombustíveis (2010) (Brazil).

3.2. Support for coal production and consumption

Both developed and developing countries grant support to coal. The developed countries that subsidize production are Germany, Japan, Spain, the United Kingdom and the United States (International Monetary Fund, 2008; OECD, 2002; IEA, 2008 b). Budgetary support and tax benefits given in European Union countries are aimed at protecting domestic industries from competition with cheap foreign coal imports (EEA, 2004); in the United States these support measures are given to favour technology enhancement and exploration projects (IEA, 2008 b), while in Japan, their aim is to foster the development of cleaner technologies (IEA, 2008 c).

The developing countries that grant support to coal—though in the consumption phase—are China, Kazakhstan, Ukraine and the Russian Federation (IEA, 2008 a). According to estimates made by the International Energy Agency (IEA, OPEC, OECD and World Bank, 2010: 16) based on the price-gap approach, the support given over 2008 would total USD 40 billion.

3.3. Support for natural gas production and consumption

Some developed countries subsidize natural gas production and distribution (EEA, 2004; International Monetary Fund, 2008). The United States gives preferential tax treatment to domestic production; Denmark abolished the payment of royalties on gas and oil production; the Netherlands and the United Kingdom offer tax benefits for gas extraction; Denmark, Spain, Greece and Ireland subsidize the gas network infrastructure, apart from the subsidies granted by the European Union through structural funds and preferential loans. In turn, Japan grants supports to exploration and subsidies to convert coal-burning facilities into natural gas-burning facilities (IEA, 2008 c).

Russia, Iran, Ukraine, Kazakhstan, Pakistan, China, Argentina, India and Egypt are among the developing countries that give support for natural gas consumption (IEA, 2008 a). For 2008, the International Energy Agency (IEA, OPEC, OECD and the World Bank, 2010: 16) estimated the value of said support at USD 204 billion.

4. Biofuel subsidies: direct and indirect distortions

First-generation biofuels, such as biodiesel and bioethanol, are produced by blending vegetable products—ethanol, oil—with fossil fuels—gasoline, diesel fuel. Consequently, these fuels are considered to be less polluting at the global level than pure fossil fuels (Childs and Bradley, 2007). This is the reason why subsidies granted for biofuel production and consumption are exempt from the phase-out commitment set forth in the Pittsburgh Declaration signed by the G-20 Leaders.

Nevertheless, these subsidies continue to favour both local and global emissions of pollutants, and bring about distortions both in the fossil energy market and in the markets of the agricultural raw materials involved. Apart from these distortions, we should also consider the impact produced by the subsidies granted to said raw materials as part of the agricultural policy.

Moreover, in relation to greenhouse gas emissions, using biofuels instead of fossil fuels helps countries show a higher emission reduction than the actual one. This is so because CO_2 emissions from burning biofuels are not included in the emission inventory of the countries that use them, because this type of emission is not listed as a source of emission in the Kyoto Protocol[15] and, consequently, does not count toward meeting GHG emission reduction commitments (Estrada Oyuela, 2008).

4.1. The distortions caused

The policy encouraging biofuels brings about different direct and indirect market distortions.

a. Direct:
   i. they refer to incentives to increase the demand for subsidized biofuels.

b. Indirect:
   i. they include incentives boosting the demand for fossil fuels which are blended with vegetable raw materials. Thus, fossil fuels indirectly receive a subsidy which may make

[15] According to the Kyoto Protocol, the CO_2 emissions released into the biosphere from biofuel combustion do not count because these emissions—unlike CO_2 emissions from fossil fuels which were "confined" in the earth's crust—were already present in the biosphere, contained in the agricultural raw material.

up for the direct subsidy they will stop receiving if subsidies granted to fossil fuels are to be reduced or phased out.

ii. they provide incentives to increase the demand for the agricultural raw material that will be used for the blend. Through these distortions producers of cereals, sugar and oilseeds benefit from subsidies that lie beyond the scope of the agricultural policy and the multilateral disciplines limiting it.

At the same time, subsidies for agricultural raw materials are, in fact, indirect subsidies for biofuel production since they reduce the price of raw materials.

4.2. Biofuel efficiency in CO_2 reduction

Biofuel efficiency in reducing greenhouse gas emission relies on the characteristics of the production process and on the energy involved. With the aim of encouraging the reduction of these gases, the United States and the European Union have established that in order for biofuels to benefit from already existing tax preferences and for their consumption to be able to meet the domestic minimum mandatory targets for biofuel consumption, they must emit—during their life cycle—fewer greenhouse gases than the fossil fuels they substitute: 35 percent fewer emissions in the EU, and 50 percent fewer emissions in the United States.

Nevertheless, biofuel subsidies would not be a cost-effective way of reducing these greenhouse gas emissions: the total value of the subsidies required to reduce a tonne of CO_2 is greater than the social cost estimates for emitting a tonne of CO_2[16] and than the price of a CO_2-equivalent offset on the European Climate Exchange and the Chicago Climate Exchange (Steenblik, 2007: 48).

Moreover, biofuels are not fossil fuel substitutes so far but rather complements to them, since fossil fuels are consumed as blends with biofuels and they are also used in the biofuel production process. Some estimates show that in the United States and European countries the cost of subsidies required to displace a litre of fossil fuel is higher than the pre-tax price of displaced gasoline and diesel (Steenblik, 2007). Thus, a more efficient way of reducing fossil fuel consumption can be achieved by using them in a more rational way.

4.3. Types of direct support measures

Measures that directly favour biofuels employ energy, trade and environmental policy instruments, namely:

i. Energy policy: budgetary contributions, tax deductions for biofuel production and consumption, and a mandatory share of biofuels in overall fuel consumption (mandatory blend). While in the first two measures taxpayers must bear the cost of the support, in the last measure this cost is borne by consumers.

ii. Trade policy: differential import duties according to the type of biofuel (biofuels based on agricultural raw materials which are strongly protected and subsidized tend to be subject to higher tariffs) and technical standards regarding the characteristics of biofuels, which are stricter for biofuels based on raw materials competing with local raw materials.

[16] The social cost is defined as the cost of the damages derived from the climate change caused by a tonne of CO_2, expressed in terms of the present value of future costs and benefits.

iii. Environmental policy: pollution emission requirements, such as minimum greenhouse gas emission reductions as compared to the fossil fuels that biofuels substitute.

Below we present a brief summary of the measures used by the different G-20 countries, except for Saudi Arabia and Japan, for which no information on promotion measures has been found.

Argentina

i. Energy policy: a) as from 2010 the mandatory blend required for diesel is of 5 percent of biodiesel, and that required for gasoline is of 5 percent of bioethanol, and b) tax benefits: VAT drawback and accelerated depreciation on income tax, and exemptions from the payment of water infrastructure tax, liquid fuel tax, and other taxes on transfers either by free gift or for good and valuable consideration or on imports of diesel.

Australia

i. Energy policy: while there is no federal minimum mandatory blend for fossil fuels, there are provincial mandates ranging from 2 to 10 percent. Ethanol and biodiesel producers receive a grant that exactly offsets the fuel excise duty. This grant, which is not available for imported ethanol, will be progressively phased out between 2011 and 2015 (Quirke *et al.*, 2008). Ethanol producers and distributors also receive ethanol infrastructure grants.

During the fiscal year 2006–2007, support for ethanol was estimated at AUD 36.2 million (USD 29 million), and that for biodiesel at AUD 31.4 million (USD 25 million) (Quirke *et al.*, 2008).

Brazil

i. Energy policy: several of the support mechanisms launched in 1975 through the National Alcohol Program—Pró-Álcool—were abolished. It is still mandatory that gasoline contain between 20 and 25 percent of ethanol (Kutas, Amaral and Nassar, 2007). Diesel must contain a 2 percent mandatory biodiesel blend. Biodiesel also benefits from the different levels of fuel tax exemption (Pimentel T. Prates *et al.*, 2007).

Canada

i. Energy policy: there is a federal minimum mandatory blend of 2 percent of biodiesel in diesel for the year 2012, and a blend of 5 percent of ethanol in gasoline as from 2010. In some provinces the minimum mandatory blend is higher. At the provincial level, biodiesel is exempt from fuel taxes. Moreover, federal, provincial and municipal governments grant subsidies for the production of biofuels in each stage of the biofuel production chain.

The support granted in 2008 for ethanol was estimated at CAD 366 million (USD 342 million) and that for biodiesel at CAD 100 million (USD 93 million); measured in litres, this support accounted for 27 percent of ethanol retail price and 69 percent of biodiesel retail price (Laan *et al.*, 2009).

China

i. Energy policy: although there is no national minimum mandatory blend, ten Chinese provinces have a 10 percent mandatory bioethanol blend in gasoline. Biodiesel is exempt from

VAT, while bioethanol is exempt from fuel consumption taxes; and subsidies are granted to grow feedstock on marginal land and to compensate for losses incurred in ethanol production.

In 2006 the government granted USD 114 million in subsidies for ethanol, that is, nearly USD 0.40 a litre (Global Subsidies Initiative, 2008). Total support for ethanol and biodiesel is expected to reach USD 1.2 billion by 2020. This amount does not include support totalling USD 437 per hectare per year, available as from 2007 for farmers growing feedstock on marginal land, so that their output is used to produce biofuels.

South Korea

i. Energy policy: tax deductions on biodiesel until 2010. A 0.5 percent mandatory biodiesel blend in diesel has been established until 2012, and there is a proposal to raise it to 3 percent (Ehrlich, 2007). The government grants subsidies for rapeseed production which is destined to biofuel production, with the aim of cutting the country's dependency on foreign raw materials.

United States

i. Energy policy: mandatory minimum standard of 15.2 billion gallons (57,538 million litres) of biofuels for 2012, and 36 billion gallons (136,274 million litres) for 2022; tax deductions given to blenders of ethanol and gasoline, and to blenders of biodiesel and diesel.

ii. Trade policy: tariffs on ethanol have a specific component which is only charged when ethanol is used in fuel blends, thus protecting domestic products against similar imported products. This prevents imported ethanol from benefiting from tax credits for ethanol-gasoline blends.

iii. Environmental policy: biofuels must meet a minimum greenhouse gas reduction target (50%) to be able to meet the blending target of renewable fuel into fossil fuels (Galperín and Pérez Llana, 2010).

Subsidies are granted throughout all the production and consumption stages. During 2007, measures promoting ethanol ranged from USD 6.94 billion to USD 8.39 billion, and those promoting biodiesel ranged from USD 1.2 billion to USD 1.54 billion (Koplow, 2007). It is to be expected that the amount will increase substantially as the new standards set forth in the Energy Independence and Security Act of 2007 regarding minimum use of biofuels for transport are being met, and also as the agricultural support for corn set forth in the 2008 Farm Bill is being granted.

India

i. Energy policy: according to the National Biofuel Program (September 2008), no taxes will be imposed on biodiesel. Financial incentives are given in the form of tax deduction only to second-generation biofuels (Indian Ministry of New and Renewable Energy, 2008). Biofuels will fall into the category "Declared Goods", which implies the imposition of uniform tax rates throughout the whole country and the exemption from both value added and sales taxes imposed on the biodiesel component used in blends. The blending target of bioethanol into gasoline is 10 percent; this target has been set at 20 percent for 2017.

Indonesia

i. Energy policy: subsidies are granted to state-owned companies which blend fuels to offset the losses they incur as a result of the high costs of producing biofuels; subsidies are also granted for biofuel infrastructure and raw material development. Income tax deductions are applied to biofuel investments, and the biofuel component in gasoline and diesel is exempt from VAT. It is estimated that biofuel support amounted to USD 197 million between 2006 and June 2008 (Dillon *et al.*, 2008).

Mexico

i. Energy policy: according to the Biofuels Promotion and Development Law (February 2008), the government will provide budgetary support for biofuel development through public expenditure—in order to promote sustainable biofuel input production—and through tax exemptions (Chavez and Jeff, 2007). Subsidies for biofuels would represent 55 percent of the price of a litre of biofuel (Diario El Porvenir, 2008).

Russian Federation

There is neither a legislative framework to regulate biofuels nor subsidies to industries (Vassilieva *et al.*, 2007).

South Africa

i. Energy policy: by 2013, two percent of fuel production shall come from biofuels (AFP, 2007). Biodiesel shall be made from soybean, canola or sunflower oil, and ethanol, from sugar cane or sugar beet. Although at the beginning corn had been excluded as feedstock, the government subsequently indicated that the use of surplus corn may be allowed for ethanol production. A 50 percent fuel tax exemption is granted for biodiesel and a 100 percent exemption, for ethanol (Biofuels Digest, 2008).

European Union

i. Energy policy: biofuels shall account for at least 10 percent of fuels in all member states by 2020. Apart from the mandatory target, there is a reduced tax on fuel consumption, and in some member states producers receive direct payments, subsidies to capital, low-rate loans for infrastructure, and funds for research and development. Some member states that have demanded a minimal participation of biofuel in the fuel market have started to set aside fuel tax exemptions. For instance, in France and Germany biofuel tax incentives will come to an end in 2012 and 2015 respectively. In 2006, support measures benefiting biofuels totalled around EUR 3.7 billion (Kutas, Lindberg and Steenblik, 2007).

ii. Trade policy: ethanol pays greater tariffs than biodiesel, which can be explained as a way of protecting the ethanol industry and its raw materials. There is a technical standard setting a limit on the iodine content of biodiesel; this actually acts as a barrier to imports of soybean-based biodiesel, which competes with Community rapeseed-based biodiesel.

iii. Environmental policy: biofuels must meet certain sustainability criteria in order to be able to comply with the national mandatory renewable energy target and to receive financial support, that is, tax benefits (Galperín and Pérez Llana, 2010). The most important criterion is that biofuel energy shall reduce greenhouse gas emissions by at least 35 percent.

Pre-established arbitrary values have been set for different biofuels. Soybean-based biofuels do not meet this requirement.

From this analysis follows that all G-20 countries, except for Russia, use one or the three types of energy policy instruments (see summary in table 7), but they differ in terms of the scope of the instrument and of the amount of support involved. These measures show the importance of regulations and budgetary support to buttress biofuel demand. In relative terms, these measures would be more important than support to fossil fuels: Global Subsidies Initiative (2010) estimated that, measured by kilowatt-hour (kWh), biofuels are subsidized at a greater rate than fossil fuels in developing countries, since biofuels receive an average of 5.1 US cents per kWh, while fossil fuels receive an average of 0.8 US cents per kWh.[17]

Table 7
Energy policy instruments to promote biofuels in G-20 countries

Country	Blending targets	Subsidies	
		Tax benefits	Budgetary support
Argentina	Mandatory blend	Exemptions	
Australia	No federal obligatory mandates	Compensation scheme	Support to farmers
Brazil	Mandatory blend	Exemptions for biodiesel	
Canada	Federal blending mandate	Exemptions for biodiesel	Production subsidies
China	No national mandates	Exemptions	Subsidies to grow crops and to compensate for losses
South Korea	Mandatory blend	Biodiesel tax reduction	Subsidies for raw materials
United States	Minimum standard	Tax deductions for blenders	Subsidies for production and agricultural inputs
India	Blending targets	Exemptions for biodiesel	
Indonesia	Non-mandatory blending targets	Exemptions	Subsidies for agricultural raw materials and for blenders
Mexico		Tax exemptions	Public expenditure to promote production
Russia	No regulatory framework		
South Africa	Mandatory blend	Tax exemptions	
European Union	Mandatory blend	Tax deductions	

Source: CEI based on Quirke *et al*. (2008), Pimentel T. Prates *et al*. (2007), Kutas, Amaral and Nassar (2007), Laan *et al.* (2009), Global Subsidies Initiative (2008), Koplow (2007), Galperín and Pérez Llana (2010), Ministry of New and Renewable Energy of India (2008), Dillon *et al.* (2008), Chavez and Jeff (2007), Vassilieva *et al*. (2007), AFP (2007), Biofuels Digest (2008) and Kutas, Lindberg and Steenblik (2007).

[17] In order to calculate the rate of subsidies for biofuels, Global Subsidies Initiative (2010) considered subsidies granted in Australia, Canada, China, the United States, Indonesia, Malaysia, Switzerland and the EU, as well as world biofuel production. The analysis of fossil fuel subsidies was based on the total amount of consumption subsidies granted in developing countries during 2007, which was estimated by the International Energy Agency using the price-gap approach and the overall energy generated in said countries.

5. The controversy over the definition of inefficient subsidy encouraging wasteful consumption

5.1. What is considered a subsidy?

In order to specify what subsidies are to be phased out, the G-20 *Ad Hoc* Group of Experts on Energy Efficiency has deemed it necessary to define what is considered a subsidy. There is no agreement on this issue in the literature; differences are found, especially, as regards the types of measures to be included, the non-subsidized baseline to determine the level of implicit tax subsidies, the inclusion of measures which are exclusive of the energy sector or the inclusion of general support measures, and the introduction of measures in other sectors which have indirect effects on energy demand (Koplow, 2004).

These differences give way to two distinct definitions of subsidy: one focused on the financial transfer involved and another focused on the effects subsidies have.

i) *Focused on the financial transfer*: it refers to government financial support for producers and/or consumers of a particular good; this support may be in the form of a direct transfer of funds or a tax deduction.

This is the idea underlying the definition set forth in the WTO Agreement on Subsidies and Countervailing Measures, according to which a subsidy consists in: a) a financial contribution given by the government in the form of a direct transfer of funds, government revenue foregone, government provision of goods and services—excluding infrastructure—and b) any form of income protection or price support which increases exports or reduces imports.

Furthermore, this Agreement stipulates that the subsidies subject to disciplines be specific subsidies; that is, those that are limited to certain enterprises or industries. It excludes general subsidies, such as the tax rate change applied *erga omnes*, either nationally or regionally.

Since this Agreement on Subsidies is related to foreign trade, it prohibits export subsidies or those subsidies that are dependent on the use of domestic rather than imported products. Subsidies that are not conditioned by foreign trade transactions, but all the same cause injury to domestic industries, or that are detrimental to other countries' exports in third markets, or limit imports into the country granting the subsidy (actionable subsidies) are subject to countervailing duties.

Laan (2010) presents an illustrative list of fuel subsidies classified according to the categories set forth in the WTO definition of subsidy. The subsidies included under transfer of funds are, among others, direct payments linked to production volumes or sales; transfers from the government to compensate for the sell of fuel below cost; subsidies to intermediate inputs; government loans granted with preferential conditions; government spending on research and development; and assumption of liabilities for closure and post-closure risks. In turn, the subsidies included under government revenue foregone are, among others, tax expenditures: reduced tax rates, tax credits and exemptions or deferrals; accelerated depreciation allowances; and reduced royalty payments. Under government-provided goods or services Laan includes, among others, under-pricing of government-provided goods and services; government procurement at above-market rates; and access to government-owned natural resources or land. Lastly, under income or price support, the author lists maximum prices for consumers; minimum prices for producers; mandated feed-in tariffs—special tariffs that power plants

should pay to some of their input suppliers, in particular to renewable energy suppliers—and consumption mandates of a certain type of energy, among others.

ii) *Focused on the effects*: a subsidy is any government action that lowers the price paid by consumers, raises the price received by producers in relation to the reference price—i.e., the free-market price without government intervention—or lowers production costs.[18]

Measures with direct effects on prices as well as those with indirect effects fall within the scope of this definition. The former include financial transfers and tax benefits; the latter refer to tariff and non-tariff trade measures, public investment and market regulation.

This is the definition generally used in the studies carried out by the IMF and the International Energy Agency.

5.2. The definitions proposed and their consequences

One of the first tasks carried out by the G-20 *Ad Hoc* Group of Experts on Energy Efficiency (see box 3) was to provide a clear definition of subsidy. Though presenting certain variations from country to country, most of the definitions proposed during the debates held within the *Ad Hoc* Group of Experts follow the definition focused on the effects.

In their proposal for a joint report submitted in May 2010, the international organisations summoned to study this issue (IEA, OPEC, OECD and World Bank, 2010) put forward a definition focused on the effects. In turn, Canada suggested the following text: "A fossil-fuel subsidy is any government measure or program with the objective or consequence of reducing the effective cost for fossil fuels paid by consumers or of reducing the costs or increasing the revenues of fossil-fuel producing companies." The Canadian text has been endorsed by the United States and Australia. This definition triggered different reactions in the remaining G-20 countries, which were as follows:

i) to place the emphasis on the price paid by the consumer (South Africa, Japan);

ii) to make it clear that 'consumer' refers to end user (United Kingdom, France, Spain);

iii) to stress that the change must be artificial (Brazil);

iv) to suggest that measures to enhance efficiency should be left aside and that the consumer price must be lower than the cost of production (Saudi Arabia, Turkey, Indonesia);

v) to eliminate the explanation stating that any government measure shall be included (Germany);

vi) to add explicit reference to budgetary support (India);

vii) to state that the measures concerned should be those that encourage inefficient and wasteful consumption (China). In this case, the definition would include the two conditions these subsidies must have according to the G-20 Leaders' Statement, namely, be inefficient and encourage wasteful consumption;

[18] IEA (1999: 43) and Coady *et al*. (2010) adopt this definition.

viii) to use the definition of the WTO Agreement on Subsidies and Countervailing Measures (Argentina).

The definition focused on the effects would involve all types of measure, including import and export duties, since the former increase the producer's proceeds, and the latter reduce the price domestic consumers must pay. Thus, there would be fewer fossil fuel-related energy policy measures available, unless these were justified by social and environmental reasons.

The second problem underlying this definition of subsidy is that it involves any economic policy measure. Extrapolating this definition of subsidy to other areas could seriously limit the state's flexibility to apply industrial and agricultural policy measures, beyond the binding commitments assumed within the WTO.

On the other hand, an advantage of this approach is that subsidies defined in this way can be measured using the price-gap approach which—despite the limitations discussed in section 3—is the most widely used approach and constitutes the easiest way to make an assessment.

As for the definition proposed by the WTO as compared to that proposed by most countries, it is worth noting that:

i) It outlines what government actions should be changed—budgetary and tax measures;

ii) The specificity requirement makes it possible to distinguish between actions with an impact on relative prices and general measures, such as an across-the-board VAT reduction;

iii) Prohibited and actionable subsidies are useful categories in order to circumscribe subsidies to those subsidies related, either directly or indirectly, to foreign trade. Regarding this last point, the spirit of most G-20 countries is not to limit their scope to subsidies with an impact on foreign trade;

iv) At the level of international negotiation fora, G-20 countries would all maintain a coherent position as regards what measures are to be considered subsidies. If the definition focused on the effects were to be adopted, it would come into conflict with WTO rules. And thus, the G-20 would be adopting commitments which are not mandatory according to WTO rules.

v) It has a disadvantage since it cannot be used to measure the subsidies granted by all countries throughout time, because the necessary budgetary data is not always available. In order to solve this lack of transparency, an internationally agreed protocol would be required to gather and systematize the data on each country's subsidies (Laan, 2010).

Box 3
The work done by the G-20 Group of Experts on Energy Efficiency

In January 2010, an *Ad Hoc* Group of Experts on Energy Efficiency was formed under the supervision of the Finance and Energy Ministers. This Group was in charge of gathering information on the subsidies each country had identified and on their implementation plans to rationalize and phase out said subsidies. This data was summarised in a report which was submitted to the Leaders during the Toronto Summit.

Since there was no consensus as regards the definition of subsidy, the countries adopted their own definition of subsidy when trying to identify their measures and, on the basis of such definition, they reported what subsidies they do apply, whether they are inefficient and what strategies they employ to modify them and/or to phase them out. Out of the 19 countries, eleven—Argentina, Canada, Germany, India, Indonesia, Italy, Korea, Mexico, Russia, the United States and Turkey—have identified inefficient subsidies and they have put forward plans to rationalize them and/or to phase them out, whereas eight countries—Australia, Brazil, China, France, Japan, Saudi Arabia, South Africa and the United Kingdom—reported that they have no inefficient subsidies encouraging wasteful consumption as outlined in the commitments assumed within the G-20; yet, Brazil and China have all the same set forth plans to reduce measures affecting fossil fuel consumption.

5.3. What is deemed inefficient and what is wasteful consumption?

After reaching a common definition of subsidy, it would be also appropriate to agree on what is considered an "inefficient" subsidy, and what is considered "wasteful consumption", since these are the two conditions subsidies must meet in order to enter the category of subsidies to be phased out.

Regarding inefficiency, a basic microeconomic analysis shows that all subsidies entail a certain degree of inefficiency since, by nature, they artificially change relative prices and distort resource allocation. As was already mentioned in section 3, subsidies modify producers' and consumers' decisions, and they may lead to a greater production and consumption of a certain type of energy to the detriment of other less polluting energy sources or to the detriment of a more efficient use of said energy source.

Nevertheless, a subsidy could also attenuate or reduce inefficiency. This is the case of subsidies which, through incentives to consume fewer fossil fuels, are aimed at reducing the externalities of atmospheric pollution. There is a problem when subsidies intend to replace a certain inefficiency with another inefficiency of a lower magnitude. This is the case with subsidies granted to replace a fossil fuel, such as oil, with a cleaner fossil fuel, such as natural gas. Phasing out natural gas subsidies would entail greater negative environmental externalities. This issue has been raised at the *Ad Hoc* Group of Experts, but they have not come up with any solution yet.

As for wasteful consumption, the consequent reduction in either costs or prices—depending on the subsidy in question—causes fuel consumption to be higher than if there were no subsidies. The magnitude of consumption that would make it wasteful has yet to be determined, and since it is a subjective question, any attempt to specify a quantitative value would be extremely arbitrary and dubious.

In the report submitted by the four international organisations (IEA, OPEC, OECD and World Bank, 2010: 33–35), they set forth the issue of rationalizing and phasing out inefficient subsidies which encourage wasteful consumption in operative terms, that is, in terms of what decision criteria policy makers should adopt. Inefficient subsidies were defined as subsidies that do not reach the goal for which they were created, or subsidies that achieve it but with a net negative benefit. Wasteful consumption was defined as that which encourages much more consumption, but does not satisfy basic needs. The report proposes that those measures which pass the test of inefficiency and wasteful consumption should pass the cost-effect test, which assesses whether subsidies are the best measure to achieve the intended goal or whether they should be better designed in order to meet the objective of subsidy rationalization put forward by the G-20.

6. Final comments

The question of fossil fuel subsidies is a very complex issue and the way it is being dealt with within the G-20 has raised concerns.

Firstly, developed countries are trying to reduce fossil fuel consumption as part of their policy to address the issue of climate change. This policy is reflected in support to renewable energy, mandatory standards for biofuels used for transport, and measures aimed at enhancing energy efficiency. In this regard, there have been several proposals to reduce certain subsidies. For example, in the United States, during the debates over the Energy Independence and Security Act of 2007, there were proposals to phase out subsidies for gas and oil, so as to compensate for tax incentives given to energy efficiency and renewable energy.

Secondly, if G-20 countries eventually agree on the elimination of incentives to fossil fuel consumption and production, they would be explicitly assuming greenhouse gas emission reduction commitments, regardless of those they might or might not have assumed pursuant to the post-Kyoto agreement on climate change. A decision along these lines might be incompatible with the objectives and principles contained in the United Nations Framework Convention on Climate Change establishing differentiated obligations according to each member's level of development. This would be a way of involving large GHG emitters, such as China, India and Russia, which have committed only to mitigation measures, but are as yet unwilling to assume emission reduction commitments.[19]

Thirdly, the definition of subsidy is no minor issue because the G-20 debates on this do not constitute an academic exercise, but may result in the adoption of measures with consequences on the energy policies of G-20 countries. The definitions proposed so far by the international organisations that prepared the special report and by several countries stray from the definition agreed upon within the WTO. Why using a different definition? The definition laid down in the WTO Agreement on Subsidies and Countervailing Measures:

i) was negotiated in the Uruguay Round;

[19] On this topic, see Estrada Oyuela (2010).

ii) was the result of debates held over several years;

iii) was intended for goods—and fuels are goods;

iv) was accepted by the 153 WTO members;

v) has precedents in the 1979 Tokyo Round discussions, when members approved a Subsidies Code, whose article 11.3 already contained examples that planted the seed of the definition agreed upon later, in the Uruguay Round.

Fourthly, not all fossil fuels contribute the same to CO_2 emissions. Energy generation derived from coal as well as road transport running on oil products account for most G-20 emissions. However, a distinction should be made at country level: although most G-20 members depend on fossil fuels to generate energy—at least 62 percent of the energy is generated from these fuels in 17 out of the 20 countries—some of them rely heavily on coal, while others resort to cleaner fuels, such as natural gas, as in the case of Argentina. Therefore, the greatest impact on greenhouse gas emission reductions should be achieved by changing both explicit subsidies and measures—*e.g.*, financial transfers and tax deductions—and implicit ones—*e.g.*, very low tax rates—which encourage the use of coal to generate electricity and of oil products for transport. In the last case, low taxes on private fuel consumption cause prices for fuel in purchasing power parity terms to be far below the average price in G-20 countries and, therefore, encourage the use of private means of transport instead of public means with lower unitary fossil fuel consumption levels.

Fifthly, excluding subsidies for renewable energy sources means disregarding the significant support currently given to biofuels, which in the case of the United States and the European Union amounts to several billion dollars and is expected to substantially grow as the increasingly demanding national mandatory targets regarding the use of biofuels are met. Since these subsidies entail a direct incentive to the demand for fossil fuels to be used in biofuel production—gasoline to be blended with ethanol and diesel-oil to be blended with biodiesel—as well as an indirect incentive to the demand for fossil fuels used in the production process, they would at least partly offset the incentive implied in the reduction in fossil fuel subsidies and their effect on greenhouse gas emissions.

In sum, the G-20 initiative could help countries find the best way to reduce greenhouse gas emissions generated by the use of fossil fuels. Thus, we propose adopting a sectoral approach so that the policy reforms involving subsidies, taxation and relative price changes are first targeted at those sectors that are the largest emitters of greenhouse gases, and that the process be voluntary and decided by each country in view of its particular needs.

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Annexe 1
Key sources of CO2 emissions from fossil fuels in the G-20, year 2007 in million tonnes of CO2

	Electricity generation - coal	Electricity generation - gas	Industry - coal	Road transport - oil	Others [1]	Total emissions
China	2,928.9	n.a.	1,626.8	276.0	1,196.3	6,027.9
United States	1,956.5	372.4	120.0	1,526.2	1,794.2	5,769.3
Russia	206.2	314.5	88.8	118.6	859.3	1,587.4
India	622.7	n.a.	164.4	107.2	429.8	1,324.1
Japan	234.2	123.2	142.3	214.6	522.1	1,236.3
Germany	270.3	28.3	39.0	140.8	320.2	798.4
Canada	105.2	n.a.	16.8	127.2	323.9	572.9
United Kingdom	117.6	53.9	n.a.	119.2	232.4	523.0
Korea	132.4	32.4	28.6	79.6	215.7	488.7
Mexico	29.6	50.4	n.a.	139.8	218.1	437.9
Italy	50.4	57.5	n.a.	115.3	214.4	437.6
Australia	207.3	14.9	12.3	67.2	94.7	396.3
Indonesia	62.6	9.9	81.1	65.7	157.9	377.2
France	21.9	n.a.	15.4	124.3	207.7	369.3
Saudi Arabia	-	43.5	-	88.1	226.3	357.9
Brazil	7.8	n.a.	29.5	127.3	182.6	347.1
South Africa	210.2	-	42.8	42.8	50.0	345.8
Turkey	50.5	32.8	46.8	41.6	93.3	265.0
Argentina	n.a.	23.8	3.6	33.4	101.8	162.6
Total G-20	7,214.1	1,157.4	2,457.9	3,554.8	7,440.5	21,824.6
European Union - 27	962.8	263.4	153.5	898.1	1,648.6	3,926.4
World	8,207.5	1,930.4	2,847.4	4,806.3	11,170.8	28,962.4

[1] The category "Others" comprises the remaining combinations of sector (electricity generation, industry, transport and other sectors—including household consumption, commercial services, agriculture and fishing) and fossil fuel (coal, oil and gas).

n.a.: not available

Source: CEI based on IEA (2009 a)