Climate Justice in Israel

Inequality in Greenhouse Gas Emissions from Domestic Electricity Consumption and Private Car Use

Dan Rabinowitz and Carmit Lubanov

January 2011 - Position Paper no.1

The Association of Environmental Justice in Israel (AEJI)
האגודה לצדק סביבתי בישראל المنظمة للعدل البيئي

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This paper is based on a study undertaken at the Department of Sociology and Anthropology at Tel-Aviv University in collaboration with the Association of Environmental Justice in Israel (AEJI). The project was supported by funding from the Minerva Centre for Human Rights and the Institute for Social Research at Tel Aviv University.

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1. General

Climate policy tools, including legislative, financial and technological measures designed to curb emissions, have considerable social, economic and political consequences that emanate from differences in current use of fossil fuels by different sub-groups. This paper, which presents a first analysis of some of these disparities in the case of Israel, is part of a larger project that covers four areas of consumption: electricity consumption (DEC); transport; food consumption and solid waste. A first phase of that project, it looks at inequalities in greenhouse gas (GHG) emissions in two sectors that between them are responsible to more than 70% of Israel's energy and transport.

Using data produced by Israel's Central Bureau of Statistics and the Israel Electric Corporation, this paper focuses primarily on CO_2 emissions emanating from domestic electricity consumption (DEC) and private vehicle use (PVU). It has three analytical objectives. One, methodological in nature, is to develop indicators for comparisons of CO_2 emissions levels across different populations. Second is to apply these indicators for a comparison between emission levels of individuals belonging to the top and bottom income deciles in Israel. Third is to demonstrate the importance of environmental justice and its logic for the design and implementation of an effective and acceptable corrective climate policy.

The results presented below suggest that when it comes to DEC and PVU, individuals belonging to the top income decile emit approximately 25 times more GHG than those belonging to the bottom income decile. This astounding gap, which as approximately 4 times bigger than the monetized consumption gap between the two said groups, illustrates the extent to which CO_2 functions as a multiplier of inequality.

2. Methodology and Results

2.1 CO_2 Emissions associated with Domestic Electricity Consumption (DEC)

Background and Methodology: Electricity generation in Israel was responsible in 2008 for GHG emissions totaling about 42.4 million tons CO_2 (CBS 2010a: 934)[2]. This amount represents ca. 54.3% of total GHG emissions in Israel for that year[3]. Energy generation is therefore the single largest sector contributing to GHG emissions in Israel.

In 2009 electricity consumption in Israel amounted to 48,947 million kw/h, of which 15,117 million kw/h were in homes – 30.1% of the total (IEC 21:2010, Table 31a). Upwards of 95% of electricity in Israel is generated by IEC power plants, which burn coal (around 60% of total generation), natural gas and a small amount of fuel oil. The amount of GHG emitted from burning fossil fuels at IEC power stations in 2008 was, on average, 885 grams CO_2 (IEC 2008)[4].

Table 1 is based on IEC's published data on average annual electricity consumption per household by income deciles in 2009. These figures, divided by the average number of persons per household[5], yield electricity consumption per capita by decile. This was then used to calculate a **Carbon Inequality Index** (emissions of CO_2 from domestic electricity consumption DEC). The index takes average CO_2 per capita emissions (DEC) in the bottom income decile as a standard, and calculates the ratio between this figure and average per capita emissions in the upper decile.

2 Adapted from CBS 2010a, Table 27.6. The figure is the sum of the emissions in the table accounted to 'Energy Industries'.

3 Adapted from CBS 2010a, Table 27.6.

4 This seems to be in line with the raw data mentioned for the national aggregate of generation of 49 million kw/h and emissions of 42.4 million tons GHG by the energy sector. Dividing these figures shows emissions of 866 grams CO_2 per kw/h.

5 As the research deals with consumption, it used the figure of 'persons per household' rather than 'standardized number of persons per household' as the latter is relevant for production more than consumption in household, primarily production of income.

Table 1: Carbon Inequality Index (emission of CO_2 per capita from Domestic Electricity Consumption DEC) – Comparison of Top and Bottom Income Decile, Israel 2009

Decile	Annual kw/h consumed per household (1)	Number of persons per household (2)	kw/h per capita	CO_2 emissions from DEC (kg. CO_2 per kw/h) (3)	Annual per capita CO_2 emissions (Kg)	Carbon Inequality Index (DEC) (4)
Top	19,687	2.7	7291	0.885	6453	**24.25**
Bottom	1,564	5.2	301	0.885	266	**1**

Notes and sources, Table 1:

1. IEC (2010) statistical report for 2009.
2. CBS (2010a) statistical abstract of Israel. Table 5.32, p.297.
3. IEC Environmental report (2008). See also http://tinyurl.com/y9f4bk9.
4. The ratio of CO_2 emissions per capita (DEC) in the top income decile to CO_2 emissions per capita in the bottom income decile.

2.2 Carbon Inequality (CO_2 emissions from DEC) as a multiplier of inequality in consumer spending

The **Carbon Inequality Index** (CO_2 emissions DEC) as previously calculated, was used as the basis for the calculation of carbon inequality as a multiplier of inequality in consumption. To achieve this, the **Carbon Inequality Index** (CO_2 emissions from domestic electricity consumption) was divided by the **Inequality Index in Consumer Spending** - per capita expenditure (in Shekels) in the top income decile divided by per capita expenditure in the bottom income decile. The ratio between the indices expresses **Carbon Inequality** (CO_2 emissions from DEC) as a multiplier of income inequality. The magnitude of the multiplier, 3.91, can be seen in Table 2.

Table 2: Carbon Inequality (CO_2 emissions from DEC) as a multiplier of consumption inequality: Comparison of top and bottom income deciles, Israel 2009

Decile	Carbon Inequality Index (DEC) (1)	Total expenditure per household (NIS) (2)	Persons per household (3)	Expenditure per capita (NIS)	Expenditure Inequality Index (4)	Carbon Inequality (DEC) as multiplier of expenditure inequality
Top	**24.25**	21130	2.7	7825	**6.20**	**3.91**
Bottom	**1**	6560	5.2	1262	**1**	**1**

Notes and sources, Table 2:

1. Source: table 1 above.
2. CBS 2010a: 288, Table 5.27 (in Hebrew)
3. CBS 2010a: 297, Table 5.32
4. Ratio between per capita comparison (NIS) in top and bottom income deciles.

2.3 CO_2 Emissions from Private Vehicle Use (PVU)

In the first half of 2010 the number of private cars registered in Israel went over the two million mark[6]. Since 2000, the fleet of private cars grew by nearly 40%[7]. Since 2006 it grew by 15%[8]. The current level of motorization in Israel is 326 vehicles per 1000 people, of which 258 are private cars[9].

In 2008, the last year for which official Israeli figures for overall GHG emissions y sector exist, Israeli vehicles emitted a total of 15,884 tons CO_2 equivalent (CBS 2010a: 934)[10]. This amounts to 20.4% of total GHG emissions in Israel that year[11], placing the transport sector as second only to electricity generation in terms of GHG emissions. Approximately 50% of CO_2 emissions emanating from the transport sector (7,408,000 tons) came from petrol engines[12], a share which is consistently rising in recent years (Ibid).

Private vehicles in Israel, the great majority of which are petrol powered[13], travelled a total of 31,989,000,000 (nearly 32 billion) kilometers in 2009[14]. Dividing the total CO_2 emissions from petrol engines (7,408,000 tons) by the total distance traveled by private cars (ca. 32 billion kilometers) yields an average emission of 232 grams CO_2 per kilometer travelled (g/km). Dividing the transport emissions total for 2009 by the number

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6 In 2009 the fleet of private cars consisted of around 1,947,000 vehicles (CBS 2010b: 13). The Hebrew financial newspaper 'Globes' reported on August 3, 2010 that in the period until July 2010 an additional 103,224 private cars were sold. http://www.globes.co.il/news/article.aspx?did=1000579257

7 CBS 2010a: 893.

8 The number of private cars in 2006 amounted to 1,685,000 and in 2009 to 1,947,000 vehicles. (Adapted from CBS 2010b: 13).

9 The term *motor vehicles* includes private cars, taxis and mini buses. Israeli vehicle ownership is low compared to Western Europe, USA and Japan. Average (general) vehicle ownership in Western Europe is over 500 per 1000 people and in the USA, 840 vehicles per 1000 people (CBS 2010b: 15). Vehicle ownership (private cars only) in Western Europe is around 460 (in Italy around 600), in Japan 325, and in the USA, 450 (CBS 2010b: 39).

10 The figure is adapted from CBS 2010a, Table 27.6, and uses the total emissions figure as being derived entirely from 'transport'.

11 Adapted from CBS 2010a, Table 27.6

12 CO_2 emissions from petrol engine, which in 2005 represented 48.2% of all transport emissions, rose to 51.2% in 2009. (CBS 2010b: 107).

13 2.8% of the Israeli fleet of privately owned cars were diesel powered (around 55,000 vehicles in 2009), emitting a slightly smaller amount of GHG in comparison (CBS 2010b: 13) (in Hebrew). Because of the low number and the relatively low difference in GHG emissions, the current paper does not make a distinction between petrol and diesel private vehicles.

14 CBS 2010a: 894 (in Hebrew).

of private vehicles that year (1,947,000) yields average annual emissions of 3.8 tons CO_2 per private vehicle in Israel.

These figures relate to Israel as a single entity, without distinguishing between sub- groups. Bearing in mind how ownership and use of private vehicles reflect consumer inequality, this paper seeks to move on from generic statements about emissions in Israel as a whole to a more nuanced analysis that highlight GHG emission by particular subgroups.

In order to compare CO_2 emissions (PVU) in different income deciles, we need to calculate for each decile (a) the average distance traveled per year per capita and (b) the average CO_2 emission per kilometer travelled (g/km). Multiplied by each other, these two figures yield the average total emission per person (PVU), and thus can serve as basis for comparisons between populations.

This calculation however requires statistical data not all of which is readily available. Statistics on vehicle ownership and usage in Israel are presented by vehicle segment (privately owned cars, other cars, buses, freight vehicles, two wheelers); year of manufacture; country of origin; manufacturer; engine volume; and distance traveled. Data also exists for privately owned vehicles by owner's address. But integrated data on vehicles by income brackets (e.g. ownership percentages, age of fleet, engine volume, distance traveled, type of use, emissions levels, etc.) is still lacking. To bridge these gaps this paper uses available aggregate data, integrated through a number of operational assumptions that are detailed below.

Vehicles per household: In 2008, 92.7% of households in the top income decile in Israel owned at least one vehicle, with 48.4% owning two or more (CBS 2010b:298). A deeper examination, based on the CBS social survey for 2008[15] reveals that of the 194,982 households in the decile that own vehicles (92.7% of total households), 18.1% owned a single car, 66% owned two cars, 12.2% owned three cars, 3.1% owned four cars and 0.5%

15 These data were produced using the central bureau of statistics' social service table generator available at: http://surveys.cbs.gov.il/Survey/surveyE.htm. The first variable used was income decile and the second, number of cars per household. The authors wish to thank Anat Oren for her help in producing this table.

owned five or more cars. These figures yield, between them, 386,970 cars for the 210,300 households in the decile – a weighted average of 1.84 cars per household. In the bottom decile, on the other hand, only 21.4% owned a car in 2008, and a further 0.8% owned two cars. The weighted average for the bottom decile is therefore 0.23 cars per household.

Average annual distance traveled**:** The average annual distance traveled per private car in Israel (2009) was 16,700 kilometers (CBS 2010b: 13). The operational assumption made here was that vehicles belonging to households in the top income deciles (many of which carry commuters from suburban areas on a daily basis) travel 25% more than the average, reaching 20,875 kilometers per year. Vehicles belonging to the bottom income decile, on the other hand, are assumed to travel 25% less than the national average, covering 12,525 kilometers per year[16].

Average CO_2 emissions per kilometer traveled**:** This variable is influenced primarily by the efficiency and size of engines. Year of production is of course seminal here, as technological breakthroughs of the early 21st century considerably enhanced engine efficiency, forcing a concomitant decrease in emission levels.

Our operational assumption here is that households in the bottom income decile tend to own vehicles that require least capital input, even at the cost of higher running and maintenance costs. Consequently, we assume, cars owned by bottom income decile household will tend to be older and to have smaller engines, while top income decile households will own newer cars with larger engines.

Average age of cars in the top decile: Our calculations are based on the assumption that households in this income decile replace a car once every three years. Following from this assumption is the assertion that one third of all cars owned by these households in 2009 will have been manufactured in 2009, one third from 2008 and one third from 2007.

[16] With average income per household at approximately 2500 NIS, travelling 1,000 kilometres per month in a car that consumes ca. 15 litres of gasoline per 100 km would represent expenditure of almost half the household's income.

Clean Green Cars[17], which provides data for average emissions by manufacturer for the years 2009 and 2010[18] suggests that the range of emissions per kilometer travelled for cars produced in 2009 was between 133 g/km and 248 g/km, with an average for all manufacturers of 152 g/km. According to this source Mazda, which happened to be the best selling brand in Israel in 2009, averages at 156 g/km for all models. We use this figure here as representative of the average 2009 produced car in Israel.

Clean Green Cars also reports an average 4.76% decline in CO_2 emission from 2009 to 2010 for all manufacturers combined. Assuming a similar improvement in the previous two years too, we calculated 163 g/km for vehicles manufactured in 2008 and 171 g/km for those manufactured in 2007. These figures, once integrated with numbers of vehicles per each production year, yield a weighted emission average for private cars owned by top income decile households of 163 g/km.

Another variable to consider in this decile are SUVs and luxury vehicles. 10,000 SUVs were delivered to customers in the first half of 2010,[19] suggesting an annual figure of 20,000. To this we added an assumed additional figure of 14,000 luxury vehicles other than SUV, yielding a total of 34,000 SUV and other luxury cars delivered p.a. Multiplied by three production years the figure is 102,000, or 26.3% of all vehicles in the top income decile. Average emission for this segment (cars produced in 2009) was calculated at 235 g/km[20]. Average for 2009 and the two preceding model years is 246 g/km. The weighted average emission for the 73.7% of cars in this decile that are not in the luxury and SUV segment (163 g/km) combined with that of the 26.3% of luxury and SUV cars (246 g/km) yields 185 g/km for all cars in the top income decile.

Typical emissions levels: A baseline figure for vehicles owned by households of the bottom income decile is that in 2009 169,000 of the cars registered in Israel had been

17 www.cleangreencars.co.uk
18 http://www.cleangreencars.co.uk/jsp/co2_manufacturer.pdf
19 http://www.globes.co.il/news/article.aspx?did=1000579257
20 Using data from Clean Green Cars (2009) for Nissan Pathfinder 264 g/km, Land Rover 247 g/km, Chrysler 212 g/km, giving an average for the segment of 235 g/km for 2009 and respectively 246 g/km for 2008 and 258 g/km for 2007. This gives a weighted average for the three years of 246.3 g/km.

manufactured in 1993 or before (CBS 2010b: 40). Households in the bottom income decile owned a total of about 45,000 vehicles in 2009[21]. We assume that the vast majority of cars owned by households in this decile are 17 years old or older.

Most sources offering data on motorcar emissions levels restrict themselves to models manufactured since 2000. Carbonfootprint.com however enables calculation of emissions from older vehicles too, but does it not by manufacturer and year but by fuel type and engine volume[22]. Using this carbon calculator for a hypothetical representative pre-2000 vehicle with an engine smaller than 1400cc that travels 12,525 kilometers p.s. (variables consistent with our operational assumptions regarding car usage by households in the bottom income decile) the resulting average for annual CO_2 emissions of 2.5 tons per car translates to a weighted average of 200 g/km.

The average distance traveled per year (20,875 km) and average emission level (185 g/km) for cars owned in the top income decile, and the average distance traveled per year (12,525 km) and average emission level (200 g/km) for cars owned in the bottom decile were inserted into table 3 as bases for the Carbon Inequality Index (CO_2 emissions from PVU). As with the Carbon Inequality Index (CO_2 emissions from DEC), the index takes average CO_2 per capita emissions (PVU) in the bottom income decile as a standard, and calculates the ratio between it and average per capita emissions in the upper decile.

21 0.22 cars per household, 201,800 households.
22 http://www.carbonfootprint.com/calculator.aspx.

Table 3: Carbon Inequality Index (Per Capita CO_2 Emissions from Private Vehicle Use (PVU)) - Comparison the top and bottom income decile, Israel 2008.

Decile	Cars per household	Persons per household [4]	Cars per capita	Km. traveled per year	Emission (Kg CO_2 per Km)	Kg. CO_2 per car p.a.	Kg. CO_2 per capita p.a	Carbon Inequality Index [6]
Top	1.84 [2]	2.7	0.68	20,875 [5]	0.185 [5]	3862	2632	**26.3**
Bottom	0.22 [3]	5.2	0.04	12,525 [5]	0.200 [5]	2505	100	**1**

Notes and sources - Table 3:

1. Private Vehicle Use (PCU)
2. Adapted from CBS 2010a, table 5.32
3. Ibid.
4. Ibid.
5. Explanation of the methodology for this calculation is in the text.
6. This is the ratio of CO_2 emissions (PVU) per capita in the top income decile to the CO_2 emissions (PVU) per capita in the bottom decile.

2.4 Carbon inequality (CO_2 emissions PVU) as a multiplier of inequality in total expenditure

The Carbon Inequality Index (CO_2 emissions from PVU) calculated in table 3, was later divided by the Total Expenditure Inequality Index (the total per capita expenditure in the top income decile divided by total per capita expenditure in the bottom one). This ratio illustrates carbon inequality (CO_2 emissions from PVU) as a multiplier of income inequality. The magnitude of the multiplier effect- 4.24 – is presented in table 4. It is even higher than the respective figure for domestic electricity consumption

Table 4: Carbon Inequality (CO_2 emissions from PVU)[(1)]) as a multiplier of inequality in total expenditure: Comparison between top and bottom income deciles, Israel 2009

Decile	Carbon Inequality Index (PCU) [(1)]	Total household expenditure (NIS) [(2)]	Persons per household [(3)]	Expenditure per capita (NIS)	Expenditure inequality index	Carbon inequality (PVU) as a multiplier of expenditure inequality
Top	**26.3**	21130	2.7	7825	6.2	**4.24**
Bottom	**1**	6560	5.2	1262	1	**1**

Explanations and sources for Table 4:

1. Source: Table 3 above
2. CBS 2010a: 288, table 5.27
3. CBS 2010a: 297, table 5.32

3. Discussion: The Climate Justice Challenge

The current debate on climate change and on the ways towards global agreement on mitigation measures and adaptation to the immanent "post-normal climate conditions" point to climate injustice as a major obstacle for progress. Climate change involves deep global, regional and local inequalities. Anthropogenic climate change, triggered by rising concentration of Greenhouse Gases, primarily CO_2, in the atmosphere, is a result of rapid industrialization that started in the Global North[23]. Meanwhile, poorer nations in the Global South, and weaker populations in wealthier countries, are more vulnerable to the biospheric, economic, social and political risks of global warming. Desertification and failing crops have already caused grain price to raise considerably, forcing tens of millions below the hunger line. Disruptions in the water cycle partly due to climate change are set narrow the supply of safe and healthy drinking water in many developing and least developed countries. Tropical storms are likely to be more numerous and powerful, and viral diseases transmitted by insects could spread more widely, affecting populations that were safe before. Sea level rise due to shrinking continental ice shelves in Greenland and Antarctica could prove fateful to hundreds of millions of inhabitants in coastal areas, particularly in slums in and around large cities with inefficient civil infrastructure. Poorer populations are more exposed to the financial fallout of these processes[24], and the list goes on. Climate change clearly encroaches on basic human rights, including freedom, personal security and the very right to life.

Given these projections, the international community's efforts to reach an ambitious, fair and binding global framework that could replace the Kyoto protocol in early 2013 hinge on a sensible incorporation of climate justice principals.

This paper, which reveals astounding inequalities between wealthy and poor populations in Israel in terms of GHG emissions, suggests that in the realms of Domestic Electricity Consumption and Private Vehicle Use, CO_2 emission functions as a multiplier of existing inequalities by a factor of approximately 4.

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23 http://homocombustans.com/2009/11/13/400
24 http://tinyurl.com/33fospz.

In early 2010 the Israeli government set up a high level committee to design measures to curb GHG emissions, in line with Israel's self declared targets at the 15th Conference of the Parties to the UN Framework Convention on Climate Change (UNFCCC) in Copenhagen in December 2009[25]. An early presentation of the plan by the committee chair, the Director General of the treasury, before the Knesset Environment and Health committee in December 2010 revealed that the process is yet to take into account environmental justice in general and climate justice in particular.

The data presented here illustrates how important it is that the effort undertaken by the government should be informed by differences that exist between sub-groups in their respective patterns of energy and fossil fuel consumption. Give these differences, we argue, policy tools could have divergent economic, cultural and social implications for different populations. It follows then that when governments move to design new regulations for emission cuts, they must be mindful of existing gaps between sub-groups in terms of size and composition of carbon footprint. The economic, social, cultural and political consequences of reducing carbon footprints[26] need to be accounted for in the case of each group separately.

The Association of Environmental Justice in Israel, which views a comprehensive climate policy for Israel with utmost importance, has recently set up a team of academics, including economists, to review the measures for climate legislation, including fiscal legislation, now under consideration. The team, which is expected to present conclusions by late 2011, will focus on existing carbon inequalities in Israel, analyzing the costs and benefits of various policy tools for specific populations.

25 The Israeli commitment as delivered by president Shimon Peres at the Copenhagen summit, is a 20% reduction in CO_2 emissions by 2020, as compared with the "Business as Usual" scenario.

26 See for example: Timmons Roberts and Bradely Parks (2006), Rabinowitz (2009).

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The Association of Environmental Justice in Israel (AEJI) is a non-partisan, independent body, set up in 2009, focusing on basic issues of environmental justice. It focuses on the inter-connectedness of society, environment and the decision-making framework in Israel to produce policy recommendations that are real and acceptable while promoting the strengthening of democracy, equality and environmental justice values. It also aims to promote active deliberated civic participation especially of minorities and residents of the periphery. The Association is active in three main fields:

A. Data collection, initiation of research and working papers that attempt to elucidate the core issues of society, environment and the decision-making framework and develop acceptable solutions.

B. Development of policy tools that promote a policy based on the values of democracy, equality and environmental justice.

C. Increasing civic participation in matters of environmental justice and decision making processes regarding environment and society, as well as empowering civil society especially among vulnerable groups such as minorities and residents of the periphery.

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