The Association of Environmental Justice in Israel (AEJI)
المنظمة للعدل البيئي העמותה לצדק סביבתי (ע"ר)

Climate Justice and Economic Policy - Report No. 2

Suggestions for Israel's Climate Policy - Behavioral Tools and the Possible Introduction of Carbon Tax

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Introduction

The government of Israel had decided on comprehensive budget cuts for the years 2013-2014, including a three year freeze of its National Plan for the Reduction of Greenhouse Gas (GHG) Emissions. The original plan was ratified by late 2010, and had allocated a total sum of NIS 2.2 billion to be used between the years 2011-2020. The plan was adopted as part of the effort to meet Israel's commitment, made by President Peres at the Copenhagen Climate Summit (COP15, 2009), to mitigate its GHG emissions by 20% from a business-as-usual scenario by 2020. Although the measures included in the original plan and its budgeting would not have sufficed to adhere to Israel's commitment[1], the plan came to be a significant landmark, since it was the first time that substantial steps have been taken within a framework of a multi-annual program to mitigate emissions. As a consequence of the plan's suspension in 2013, it has become evident that at the present rate, Israel will not be able to meet its GHG emission reduction targets.

The great deficit in the national budget, which led to the plan's suspension, does not alter the fact the GHGs continue to accumulate in the atmosphere, and that Earth's climate is changing, as stated by the latest IPCC report:

> "*This evidence for human influence has grown... It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century*" (IPCC 2013, 12).

Israel must mitigate its GHG emissions as per its international commitment, and because it might be adversely affected by climate change, including by means of damage to its agriculture, diminished precipitation quantities, more extreme weather events, forest fires and health hazards associated with increasing heat waves.

Additionally, an early transition to a low carbon economy is likely to be beneficial for Israel, both by giving the country a comparative advantage in the international market for clean technologies and improving the efficiency of local industries. Furthermore, it stands to reason that in the future Israel will be required to mitigate its emissions, and therefore should preferably begin the process in a gradual manner.

[1] Ronen, Yaniv – Tracking the Execution of Government Decision – National Plan for the Reduction of Greenhouse Gas (GHG) Emissions – Decision No. 2508, Knesset Research and Information Center. Submitted to the Joint Interior-Labor Committee for Environment and Health. 1.2.2012; Report from the Durban Conference and Follow-up on the Implementation of the National Plan for Energy Efficiency and the GHG Reduction Plan, Joint Interior-Labor Committee for Environment and Health, Protocol 67, 2.12.2012. (In Hebrew)

The halt of the National Plan for the Reduction of GHG Emissions (despite its long term significance and its impacts on numerous government ministries[2]) had motivated the Association of Environmental Justice in Israel (AEJI) to initiate the research presented in this document, as part of its ***Climate Justice Research Project***. In this paper we discuss two measures that could enable the State of Israel to mitigate GHG emissions originating from households, with no need for new budgetary resources. We further examine the implications of each of these measures in the context of environmental justice.

The first part of this document focuses on behavioral measures to mitigate emissions. A growing number of studies in recent years discuss the fact that often a change in the behavior of individuals can be achieved without exercising material incentives. We examine the relevance of literature on behavioral economics to environmental issues and its implications regarding environmental justice, and explore in which cases behavioral measures might be applied in Israel. The second part of the document focuses the discussion onto one of the measures considered to be most effective for mitigating emissions – a carbon tax. We explore the impact of said tax on different income deciles in Israel, and the possibility of applying an equitable carbon tax in the country.

1. Behavioral Economics

1.1 Background

In recent decades, there was a spike in the extent of studies and research fields addressing behavioral economics, which examines the actual behavior of individuals while focusing on decisions that seem irrational. In other words, decisions which do not consistently maximize benefits for the individual and might arise from different reasoning and considerations, including: changing emotions, cognitive limitations, value considerations or social influences.

There appear to be several reasons for the growing importance of behavioral economics. First, it is perceived to be more realistic. The classical economic model presumes people are entirely rational decision makers, whereas the daily experiences of most people suggest this to be less than an accurate description. Secondly, behavioral economics is experiment-based. In fact, the premises of the rational model (such as: that individuals will choose the optimal option; that they behave in a consistent manner; and that the manner in which options are presented is insignificant), become assumptions, to be tested by experimentation in the behavioral paradigm (Gowdy, 2008). Lastly, an

[2] Suspension of the National Plan for the Reduction of Greenhouse Gas Emissions, Internal Affairs and Environment Committee, Protocol 39, 4.6.2013. (In Hebrew)

additional advantage to behavioral economics is the integration of different fields and disciplines, including economic models, psychological testing, neuroscience research findings and biological research. Through the interdisciplinary conclusions, behavioral economics aims to increase the ability of abstract classical models to predict actual decisions.

The study of behavioral economics is not merely gaining prestige within the fields of economics and psychology, as reflected, for instance, by Daniel Kahneman's Nobel Prize; it had also become common public knowledge through popular science literature. Thus Thaler and Sunstein's "Nudge" (2010) suggested that 'a little nudge', or encouragement, by the government, would improve decisions made by the public pertaining to health, savings and happiness related issues. These principles influence decision makers too – Sunstein was recruited to advise the White House, whereas British Prime Minister Cameron was induced by the book's ideas and formed a special division to explore their implementation.

Yet despite its growing significance, it seems that thus far the field has had limited impact on public policy. Regulators still mostly prefer to use classical tools, including laws and regulations; economic incentives (taxes, subsidies, customs, quotas etc.); or technological means, such as investment in research and development. However, it is likely that over the next few years behavioral economic tools will be used increasingly, and one of the challenges facing the field is the interpretation of conclusions, which often arise from controlled and limited experiments within a specific context, held in laboratory conditions, into measures that might be relevant for an entire country (Shogren 2012).

Behavioral economics can be particularly relevant for issues pertaining to environmental protection and climate policy. Environmental problems are complex and include social elements and cooperation challenges. For example, environmental pollution sometimes generates "a free-rider problem" – individuals want to live in a clean environment, but since the benefits of cleaning are shared by all, whereas in the act of cleaning a single individual pays the full price of the action, individuals may have no vested interest to not pollute. The insights of behavioral economics concerning social considerations in decision-making processes are particularly pertinent to these problems. Additionally, environmental problems have a very important time aspect, therefore the preferences of individuals should be identified at different points in time (inter-temporal choice). For instance, it is clear that the damage caused by climate change accumulates and will take several decades to manifest, yet the cost of GHG mitigation should be borne at present. Behavioral economics professes that individuals' behaviors are inconsistent over time, and can therefore impact climate policy (Brekke and Johansson-Stenman 2008). Furthermore, with regard to natural resources, often there are no clear market mechanisms in place to encourage consistent and rational decision making, making the classical economic model less relevant.

It is timely to start a discussion regarding the use of behavioral economic tools in Israel's climate policy as well. Foremost, because these tools have the potential for a significant quantitative impact on Israel's GHG mitigation efforts. In the USA it is estimates that households could reduce 20% of GHGs they emit, or 7.4% of total national GHG emissions, based on the use of behavioral

measures with no new regulation in place (Dietz et al. 2009). Additionally, behavioral economic tools can sometimes be as effective and attain the same policy goals at a lower social cost, i.e. with lesser harm to more vulnerable populations. Finally, in light of the suspension of Israel's National Plan for the Reduction of GHG Emissions (2013) and the dramatic budget cuts, it is evident that plans with budgetary costs will be far more difficult to approve. Behavioral economic tools require almost no budgets, and are therefore particularly relevant at the present time.

1.2 Insights of Behavioral Economics

In this section we briefly describe a series of behaviors that deviate from the rational behavior anticipated by the classical economic model. Climate is not addressed directly in this section, but it is important to be acquainted with the findings of behavioral economic, as a first step before discussing the implementation of its tools for GHG mitigation. Throughout the years, many anomalies have been identified in the classical economic model. We focus on prominent deviations from the model, which are also pertinent to climate issues, and present them briefly.

Loss Aversion, Ambiguity Aversion and Status Quo Bias

Many experiments have identifies that individuals have a fear of loss, or *Loss Aversion*. This differs from risk aversion, which the rational model accounts for. While it is likely that individuals would prefer to avoid risk even at the cost of decreasing their benefit expectancy, it is surprising that they are willing to take chances when the reference is to profits, yet avoid taking risks which might incur loss. This phenomenon integrates into a prospect theory model, which describes decision making under risk. This model asserts that people make decisions based on the change anticipated, rather than basing them on the final outcome (Kahneman and Tversky 1979).

A similar phenomenon that was noted is the *Status Quo Bias*. Research finds that in many cases people tend to maintain whichever option is defined as 'default', which means they do not necessarily actively choose their most preferable option. Furthermore, as per the endowment effect, people tend to attribute a higher value to things that are in their possession. For instance, in a known experiment, participants were asked to evaluate the worth of a coffee mug. Half of the participants were given mugs, and then all participants had the opportunity to trade mugs. In practice, great disparities were found between prices demanded by mug-holders for their mugs, and the price that the rest of the participants were willing to pay (Kahneman, Knetsch and Thaler 1990). This phenomenon is dubbed the *Willingness to Pay (WTP) – Willingness to Accept (WTA) Gap*, which is the disparity between the amount people demand for a particular service or product, and the sum they would be willing to pay for it. Considering it is the very same product, there

should not be a difference between these amounts[3]. The gap seems to derive from the fact that people prefer to avert loss, so once they are in possession of property, giving it up entails loss compared to the present situation.

Another phenomenon observed in this context is *Ambiguity (or Uncertainty) Aversion*. A prominent experiment, originally suggested by Ellsberg (1961), features a ball being pulled out of basket. Participants could bet on the color of the ball, and were rewarded if their wager was right. One basket was known by participants to contain 50 red balls and 50 black balls; whereas the other contained 100 balls, each of which might be either red or black. Although in terms of the expected payoff there is no difference between these two baskets, experiments found that participants prefer to gamble on a choice of ball in the first basket, and even pay part of the expected earnings from betting on this basket, because they have certainty regarding their chances of winning with the first basket. Numerous other experiments have proven that people have an uncertainty aversion to an extent (Camerer and Weber 1992).

The Challenge of Complex Calculations and Probabilities

Another cognitive limitation is associated with the difficulty people have to perform complex calculations, in particular when it comes to risks and probabilities (Carlsson and Johansson-Stenman 2012). Often, in order to tackle complex calculation, people use rule of thumb, personal experience or intuition to make their decisions, a phenomenon dubbed heuristics. Any calculation is made based on the most accessible information, such as similar events or the prominence of information. The use of intuition can lead to various biases. People tend to attribute more weight to the chance that a particular event will take place if they have previously experienced it or they can easily imagine it, especially if it is particularly moving or frightening, such as an airplane accident (NEF 2005). In this context, it is often claimed that people attribute a higher likelihood than is realistic to the chance an event of very small likelihood, such as winning the lottery, will actually occur (Cabinet Office and Institute for Government 2010). On the other hand, the opposing claim in this context is the *Certainty Effect*, according to which people tend to think a certain outcome is definite, and ignore the possibility that it might not transpire, if the chances are small enough (Tversky and Kahneman 1986).

It is important to note that according to Kahneman, counterpart to the intuition-led decision making mechanism, a system which is capable of making more calculated decisions also exists, but it is only deliberately used for decisions deemed important enough (Kahneman 2002).

[3] In fact, there might be a small disparity resulting from the individual's final income after the deal is made (the income effect), but in any case experiments resulted in a far bigger gap.

Framing

One of the prominent insights psychology contributed to behavioral economics, is that framing and context influence decision making. Contrary to what is expected by the neo-classical theory, individuals will be inconsistent and make different decisions in similar situations, given different framing of the issue. In a memorable experiment by Kahneman and Tversky, participants were told that a new ailment is expected to kill 600 people, and they could choose between definitely saving 200 people, and saving the entire population with a probability of one third and no one with a probability of two thirds. A great majority of people chose to save 200 people. On the other hand, in a different version of the experiment, another group of responders could choose between the option that 400 people would die, and the option that zero people would die with a probability of one third, and 600 would die with a probability of two thirds. Although the latter two options are, in fact, identical to the two options presented in the previous version, most responders chose the second option, in contrast to choosing the first option in the previous version of the experiment. Clearly the preferences of individual are not consistent in this case. The change probably stems from the fact that the status quo was perceived differently in each of the two versions of the experiment. In the first version, people focused on the survivors. They viewed the variations in relation to this initial situation, and were unwilling to risk these people (as suggested by the status quo bias). However, in the second version, participants focused on people who would die, and were willing to take risks in order to save them (Kahneman and Tversky 1984).

The influence of framing could be sensitive to the use of a few single words. For example, responders change their answers in opinion polls when asked whether the State should prohibit a certain phenomenon, or if it should be disallowed, although the actual meaning of both questions is the same (Schuman and Presser 1996); and questionnaires have shown that people prefer a hamburger made from 75% lean meat to one with 25% fat, although the products are, in fact, identical (Levin and Gaeth 1988).

Fairness

One of the greatest problems of the classical economic model, is the assumption that people only act to maximize their own benefit. In practice, time and again it emerges that people have other considerations as well, including fairness. This insight is exemplified by two game theory classical experiments. In the Dictator Game, one of the participants receives a sum of money and can choose how much of it to pass on to the second participant. The economic person, described by neo-classical models as Homo Economicus, would aspire to maximize his/her own benefit, and will therefore not transfer any funds to the second player. However, experiments show that participants do transfer a significant share of their money, even when the experiment is held under complete anonymity, and when other players including the experimenter himself have no

knowledge of how much money was being transferred (Hoffman, McCabe and Smith 1996). The behavior of individuals might result from altruistic considerations, and it might derive from the importance individuals place on their perception of selves; but clearly, in any case, they are motivated by more than mere materialistic considerations (Carlsson and Johansson-Stenman 2012). It is interesting to note that changing the experiment in a way that had subjects "earn" the money (by providing correct answers to a quiz) and only then decide whether to share it, led to different results, in which participants hardly shared any of the money (Cherry, Frykblom and Shogren 2002). The outcome emphasizes how deeply the context impacts decision and the perception of fairness.

The ultimatum game is similar to the dictator game, but consists of two stages. In the first stage, one player receives money and decides how much of it to transfer to the other player; in the second stage, the second player decides whether to accept the offer. Should the offer be accepted, each of the players receives the amount that was determined; should the offer not be accepted, neither of the players receive any money. According to the classical theory, we would expect the first player to offer the second a minimal amount and for the second player to accept, because a small sum is preferable to not profiting at all. But in practice, participants refuse sums that are too small, because they feel they have been wronged. In other words, considerations of fairness and feelings of anger at another player lead to players declining money being offered to them (Thaler 1988).

The ultimatum game demonstrates one of the most important values for individuals when they define fairness – reciprocity. When people feel they have been wronged they are willing to avenge, and when the other player helps them they are willing to reciprocate, even if such an action is not materially worthwhile for them (Fehr and Gachter 2000). Reciprocity is an issue in the trust game as well, in which player A transfers money to player B, the sum is tripled, and then player B can choose to refund some of the money to player A. experiments show that player A usually transfers money to player B; player B does return money to player A, and that there is a correlation between the sum being transferred to player B and the amount being returned, although in both cases the narrow economic interest of each of the players is to keep the entirety of the sum (ibid).

Despite findings indicating the altruism of individuals, it is important to note that when a game is repeated several times, the behavior of players tends to become more selfish and less considerate of other individuals. Additionally, in reality players often act in a normative manner not merely due to considerations of fairness, but since there is a social system that is punitive to selfish behavior. Finally, it should be noted that sometimes individuals will prefer to avoid situations in which they are placed under social pressure to behave fairly (Carlsson and Johansson-Stenman 2012).

One of the interesting insights from behavioral economic studies is that sometimes the commercialization of normative acts, that is setting a system of monetary incentives for 'appropriate' behavior, might actually crowd out people's motivation to act in accordance with value considerations. In a well-known field experiment held in kindergartens in Israel, it was decided that parents who are late picking up their children will pay a fine. Rather than the fine deterring parents and resulting in less tardiness, after the policy change, lateness was actually

perceived as legitimate (since the parents are paying for it), and more parents were late picking up their children from kindergarten than before (Gneezy and Rustichini 2000). Similarly, a laboratory experiment testing the willingness of individuals to mitigate GHG emissions, has shown that when a carbon tax is levied, individuals are less willing to contribute in the short term to reducing emissions (Goeschl and Perino 2012). In other words, payment as compensation for actions which have been undertaken unrewarded, such as volunteering or blood donation, might in fact be somewhat harmful for the effectiveness of these systems (NEF 2005).

Social Considerations

Beyond considerations motivated by personal values, individuals can be influenced by social norms and decisions made by others. In many cases, Individuals do not activate a sophisticated set of considerations in their decision making process, but simply replicate decisions made by other individuals (NEF 2005). For instance, a study observed how much money people donate to a radio station. When listeners called in to contribute, they were told that another listener contributed a certain amount. They higher the stated amount was, so grew the average donation. Furthermore, the very fact that callers were told over the phone that a previous listener had already donated money, increased the probability that they would donate in the following year (Shang and Croson 2009).

Of course society's influence over the individual is not uniform. People are especially influenced by other individuals belonging to the same group, people of authority or experts (Cabinet Office and Institute for Government 2010). More importantly, people often see themselves as belonging to a certain group, and will perceive other groups as foreign or hostile (a perception of "us" vs. "them") (Gowdy 2008). In such situations, people will aspire to imitate members of their own group, but will not be influenced or would rather choose to behave differently from the other group.

Not only are people impacted by the actions of others, but how they are perceived by others is also important to them. In a field research held in the US, letters were sent to households detailing the history of election participation of other households in the area, promising that similar letters will be sent in the future. Among households that had received the letters (and were aware that in the future their neighbors will know whether they had committed their civic duties and voted), voting rates were up 8% compared to a control group, and 6% compared to households receiving a letter that merely called them to vote (Gerber, Green and Larimer 2008).

Inconsistent Time Preferences

In classical economic models, it is customarily assumed that people have a preference of the present over the future, and that these preferences are consistent over time. For instance, it might be presumed that for any additional year, an individual will demand to receive a 4% interest on a payment, so that the payment will be equivalent, from the individual's perspective, to receiving the same sum in the present, interest free. However, studies show that time considerations of individuals are far more complex, and not as consistent as is anticipated by the theory. Individuals can say during time period *t* that they would prefer *a* at time period *t*+2, over *b* at time period *t*+1; but once *t*+1 arrives, they would still choose *b* over *a*. Procrastination is an everyday example of the phenomenon. The conclusion is that at some stage, the preferences of individuals change (Kirby and Herrnstein 1995).

It seems that the most significant change happens when decisions immediately impacts individuals. People can think about the long term when the benefits and pricing are in the future, but think mainly about the short term if the costs or benefits are immediate. It appears that people have a *present bias* which affects their judgment. In order to model individuals' preferences, economists generated a new model of inconsistent time preferences, called *hyperbolic discounting*.

1.3 Implications for Environmental Policy

The presentation of varied behavioral economics theories enables a discussion of their implications to environmental and climate policies. In this chapter we focus on behavioral changes among households. We do not address the ramifications of the theories discussed above on the behaviors of decision makers or the industry, both because they are beyond the scope of this report, and because at times firms and states can act more rationally than households; although some of the abovementioned studies are relevant to these players as well (see for instance Venkatachalam 2008).

While the first part of the report focused on laboratory testing, this section focuses on field experiments. It should be noted that some of the policies presented below are already implemented in practice, including in the UK, which in recent years places a great emphasis on the use of behavioral tools.

Encouraging Environmental Behavior by Emphasizing the Behavior of Others

Since people aim to act in a way similar to the behavior of others, the publishing of information regarding acceptable environmental conduct could thus have an influence on people's actions. When hotel guests encountered a message according to which most of the guests participate in an environmental protection plan by reusing their towels, the rate of guest cooperation increased significantly compared to a standard environmental message. It is particularly interesting to note that the most effective message was one mentioning that most people who had slept in the *same room* as the guest partook in the program (Goldstein, Cialdini and Griskevicius 2008).

It is likely that people would emulate environmental behavior, once they find out that people resembling them act in a similar manner. Another option is to emphasize initial efforts toward environmental conduct by people who are perceived as leaders of their community (Carrico et al. 2011).

However, it is important to remember that often people will emulate the herd, and will do so in any case, even when those common behaviors are not conducive to addressing climate change. In this way, when electricity bills presented comparisons between the customer's own account and the average electricity bill, residents who consumed more than average mitigated their electricity consumption, but if they consumed less than average, they rather increased their electricity consumption (probably resulting in greater GHG emissions) (Schultz et al. 2007). Therefore, when non-environmental behavior is commonplace, rather than emphasizing the magnitude of the problem, it would be advisable to accentuate the desirable behavior (Carrico et al. 2011). For example, a message in a park intending to prevent tree theft by emphasizing how common theft was, would be far less effective than a message underscoring it was an inappropriate phenomenon (Cialdini 2003).

Providing Information, Feedback and Framing of Environmental Issues

It seems that on climate issues, the manner of framing options and providing information to consumers are of particular significance, considering that the urgency of action needed to mitigate GHG emissions is not always awarded much attention. Additionally, the choice to mitigate GHG emissions mostly entails a cost of some kind, and whereas the costs gain prominence in the short term, the benefits often remain vague. As mentioned, behavioral economics asserts that prominence and priming of a particular problem influence decision making.

Therefore, decision makers should aspire to minimize the inherent imbalance between the advantages of a climate policy and its costs. The damage resulting from GHG emitting actions should be made more prominent and information on GHG emissions from products, buildings or vehicles should be provided, along with their level of energy efficiency and ecological and carbon

footprints. Such initiatives are accelerating, often by means of voluntary initiatives of businesses, and at times with the encouragement or under obligation of government regulation. For example, in Israel it was decided within the framework of the green taxation of vehicles, to obligate automobile companies to publish the pollution rating of vehicles.

In this context the framing of the information can determine its effect and even the choice of words is significant. For example, when subjects in an experiment were asked if they were willing to purchase a product that was more expensive than a standard product due to a carbon *tax*, the rate of consenters was significantly lower than the number of participants who agreed to purchase a product more expensive than standard as a result of carbon *offsetting* (Hardisty, Johnson and Weber 2010).

Finally, it is not merely the provision of information which is of importance, but also its frequency and the feedback to consumers. Users who have access to real time costs of their actions are more likely to change their behaviors. Presently, most consumers are unaware of the quantities of electricity consumed by them, and cannot identify how their daily behaviors influence this quantity. But this situation can be changed. For example, many countries are presently in advanced stages of developing smart electricity grids, which, among other things, will enable users to observe their accurate electricity consumption in real time. A study by the Oxford University Environmental Change Institute, undertaken for DEFRA (UK Department for Environment Food & Rural Affairs), has indicated that direct feedback increases savings by 5-15% (Darby 2006).

Defaults

Another way to encourage frugal behavior is by setting of defaults. A default constitutes a form of 'soft paternalism' or libertarian paternalism (Sunstein and Thaler 2003). The default makes a choice for households regarding the more appropriate selection, but enables them to change this decision. Seeing as in any case some kind of default needs to be set, and considering that the final decision remains in control of the households, determining a default can be perceived as legitimate and yet have the ability to change the behavior of some individuals. This way, in a conference on energy behavior and climate change held in Washington DC in 2009, it was decided to make the vegetarian dish default, while those wanting meat could have asked for a special dish; unlike the 2008 gathering (and most other conferences), where the meat dish was default. Whereas on average only 5-10% of participants usually eat a vegetarian dish in such conferences, and in a previous conference 17% of participants had a vegetarian dish, in 2009 some 80% of participants had a vegetarian dish, and only 20% had the meat dish[4]. The meat industry is responsible for a substantial

[4] Highlights of the 2009 Behavior, Energy, and Climate Change Conference

share of GHG emissions, especially methane, and therefore a similar change on a larger scale could generate substantial mitigation of GHG emissions.

Sunstein and Reisch list numerous environmental defaults: setting printers for duplex printing; automatically switching off lights when no motion is detected in a room; determining that electricity consumers are provided green energy unless they specifically request otherwise; defining efficient lights-bulbs are installed as default when renovating buildings and more. The impacts of the default might result from consumers considering it to be a suggestion for making the right choice; in other words they assume that the state supports this option. Another explanation is that individuals maintain the default due to inertia or because they want to avoid the effort involved in changing it. Loss aversion in relation to a default might at times also cause people to adhere to this option. It is important to note that defaults will be effective only when the option they suggest is not particularly extreme or undesirable by consumers. The researchers concluded that in cases when actions are worthwhile both environmentally and economically, green defaults should be relied upon. However, when the default incurs heavy costs, an examination should be held to consider whether the advantages definitely outweigh the damages before using green defaults, or alternatively, consumers should be actively encouraged to make the desired decision themselves (Sunstein and Reisch 2013).

Commitment

Due to hyperbolic time considerations, people have a tendency to want to perform a variety of actions but defer their execution, since short term considerations outweigh long term ones. This problem can be overcome by using commitment devices, which will obligate us to execute a particular action in the future. In fact, many people already execute actions of this kind, for example, when they pay in advance for a gym activity at a particular time. Because such registration limits their future options and allows less flexibility of choice, it increases the probability they will actually exercise (Allcott and Mullainathan 2010).

Another reason commitment influences the behavior of individuals, is that people are affected by their own expectations, and do not like to feel they are being inconsistent. When their behavior is inconsistent with their values or personal stances, people may change their values and rationalize their actions. But if the individuals have already given an advanced commitment to act in a particular manner, it would be more difficult for them to change things in retrospect and they are more likely to meet their commitment. Public, written and group commitments tend to have a stronger influence in this context. Furthermore, when individuals make small commitments, they are more likely to make bigger ones in the future (NEF 2005).

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http://www.apa.org/science/about/psa/2010/01/becc.aspx

Back in the 1980s, experiments have shown that public commitments might be used to promote environmental values. A series of experiments demonstrated that when people make a commitment, either privately or publicly, to promote an environmental policy, it is more likely that they will in fact change their behavior. This way participants recycled more, used public transportation more and saved energy, following different commitments they had made (Dwyer et al. 1993).

1.4 Behavioral Economics and Environmental Justice

In recent years diverse research literature had developed in the field addressing the relationships between behavioral economics and environmental policy; and yet more studies are needed to examine the impacts of the use of behavioral measures on inequality, in particular as it pertains to environmental policies. The studies undertaken do not paint an unequivocal picture, for instance with regard to behavioral measures aiming to mitigate the consumption of water or energy.

A number of initial studies in the field have shown that there is no correlation between the extent of the impact such behavioral measures have and income (Brandon and Lewis 1999; Costa and Kahn 2013). However, a research in Canada, in which 420 households underwent energy evaluations and personal energy saving plans were constructed for them, concluded that low income households were more likely to substantially minimize their energy consumption over time. Possibly, when more vulnerable households were exposed to the option of supporting the environment while reducing their energy bills, they chose to take advantage of the opportunity, whereas higher income households had a 'rebound' effect, according to which improved energy efficiency led to higher demand for energy consumption (Parker, Rowlands and Scott 2005). On the other hand, a research that studied the campaign instructing residents to "save a drop" in Jerusalem, demonstrated that the campaign succeeded in reducing water consumption by some 6%, with higher impacts among the majority group and lower amongst minorities. Also, in larger apartments and among educated residents, a more substantial reduction of consumption was noted compared to smaller apartments. In other words, it might be deducted from the study that the measures impacted mostly stronger populations with access to more capital (Grinstein and Nisan 2009).

Evidently there is great uncertainty concerning the social impacts of behavioral economics. This section focuses on studies offering preliminary conclusions, as well as the analysis of conclusions from the abovementioned studies, in order to provide a framework for the evaluation of the relationship between behavioral tools and inequality.

Behavioral Measures Can Encourage High Income Households to Consume Green Products…

By using the varied tools described in the previous section, the state can help consumers make the "right" decisions, but leaves the final decision up to them. The distinction is of particular importance when the material interests and the environmental interests differ, for instance when environmental products are more expensive.

In such cases, the state can ensure that individuals are aware of the environmental harm of products at the time of purchase, yet enables individuals to purchase these products nevertheless. The fact that the final choice remains up to the consumer, allows weaker households that cannot afford to purchase green products if they are too expensive, to forgo such purchases. In fact, it might be alleged that in this manner the state sets an unofficial progressive tax of sorts. Stronger households will be able to purchase green products, out of environmental considerations as their financial situation allows it, or because of social status considerations (such as wanting to be seen in a hybrid car); whereas weaker households could avoid purchasing the more expensive product, if the economic burden is too heavy. This theoretical conclusion indicates a potential for behavioral tools, but it is important to test it empirically, before final conclusions can be drawn.

One apparent outcome of such policy is that greener decisions would be identified with higher social-economic classes, and as a result higher income households may be perceived as more environmentally moral. On the other hand, ethically, it might be fairer that higher income households, which were mostly responsible for greater GHG emissions in the past and are also more easily capable of changing their behaviors, would take responsibility to address the problem.

…But More Expensive Defaults Might be Regressive

As mentioned, defaults can be used as an effective measure for the promotion of environmental behavior. However, when the default that had been set is perceived not to be particularly desirable, as might be the case when the default is substantially more expensive, it gets rejected by consumers. Surprisingly, it would often actually be residents who are less educated, not as financially savvy and have lower incomes, who would not change presets and adhere to the default. The reasons for weaker households not changing preset defaults might possibly be due to lower awareness, a shortage of time or insufficient mental recreative capacity to deal with the defaults (Sunstein and Reisch 2013; Brown, Farrell and Weisbenner 2011).

The conclusion is that when a product which is more economical (like an energy saving lightbulb) is selected as default, the default can minimize disparities and assist weaker households. In fact, in such cases the default can help residents overcome a much documented and researched phenomenon, according to which consumers do not take action to improve energy efficiency even

when it is economically beneficial to them (this very phenomenon attests that individuals do not always follow the neo-classical economic model) (Allcott and Mullainathan 2010). Similarly, making use of stairs, rather than taking an elevator, a default (in building design), is worthwhile and might be actually helpful to populations that are less aware and have less time to maintain physical fitness.

However, when consumers are being offered as default products that are green, but are also more expensive in the long term, efforts should be made to avoid situations in which the more vulnerable populations are actually the ones adhering to the default, and end up carrying the majority of the economic burden entailed by the products' consumption, thus potentially increasing inequality.

Replacing Environmental Taxes by Behavioral Measures Can Reduce the Economic Burden of Vulnerable Households…

Behavioral economics shifts many decisions from the state level to that of the household. Behavioral measures can lead to significant mitigation of GHG emissions, and can therefore in some cases be used as substitute to more extreme environmental taxes, which are enforced by the state on the entirety of its citizens (Carrico et al. 2011).

Environmental taxes, such as taxes levied on carbon, electricity or gasoline, are essentially regressive, because weaker populations spend a higher rate of their income on the consumption of these products, as well as a higher rate of their total consumption on energy. (We discuss the possibility of imposing a non-regressive carbon tax in the second part of this report). In other words, if a reduction in energy use can be encouraged through reduced consumption or switching to more efficient appliances without raising prices, consumers from vulnerable households would especially benefit from this change.

…But There Might Also be a Danger in Relinquishing Certain State Responsibilities

Despite the advantages of transferring decisions from the individual level to the consumer level, there is also a clear danger in relinquishing responsibility by the state. In an interview held in 2011, Levinson, an economics and psychology professor and one of the leading experts in the field of behavioral economics, said:

> "I've come to the view that behavioral economics solutions are often being used as a substitute for more fundamental efforts… Behavioral economics has a lot of great

insights to contribute to public policy, but it will be unfortunate if it substitutes tried-and-true approaches involving taxes and regulation"[5].

A more poignant position paper was prepared following the British Government's strategy to promote national public health. The position paper criticizes the government for misinterpreting the term 'nudge' to be an alternative to regulation, and that it uses behavioral measures instead of regulations. The authors further claim that the government's interpretation might ensue from ideological considerations, since the focus on the individual unit enables it to not deal with social inequality and its causes (Bonell et al. 2011).

Two major conclusions arise thus far. One, that it is possible that due to the use of behavioral economic tools, the state would overly minimize its use of more traditional measures, thus in fact harming the efforts to mitigate emissions. In other words, if the state takes less responsibility for reducing emissions, there is a danger that the climate will continue to change rapidly, and therefore also concerns that extreme weather events will be particularly detrimental to weaker households that are not as well protected.

Two, that there are short term risks resulting from the transfer of state responsibilities to the behavior of individuals. We can learn about these threats from the literature on recommendations for the use of behavioral measures to improve human health, such as encouragement to maintain physical fitness, sustain better nutrition and cessation of smoking. Whereas such measures have evident advantages (Thaler and Sunstein 2010), it is maintained that focusing on the behavior of individuals in lower classes might be problematic, since it accuses them of their own conduct, while disregarding the responsibility of the state for decisions made by individuals. This approach might diminish the support of the state for issues such as a universal approach to preventive healthcare (Adler and Newman 2002). Likewise, focus by the state on the behavior of individuals and encouraging them to make the right decisions, must not lead to ignoring the role of the state and its responsibilities for creating appropriate and suitable infrastructures, such as the provision of proper accessible public transportation servicing weaker communities.

The use of behavioral tools to encourage eating healthier food is also criticized, while many households in developed countries suffer from nutritional insecurity. In this situation, the behavioral measures are in fact unhelpful for the weakest social classes (who do not choose to eat unhealthy foods), and might actually harm them, if they come at the expense of subsidies. Even with regard to households that do not have nutritional insecurity, behavioral tools might conceal the structural inequality that affects weaker households. For example, the lack of available time, which leads to buying fast and less healthy foods in these households, will not change even if healthier foods would be featured at the top of a menu or in a more prominent location in the supermarket (Salazar 2011).

[5] Futrelle, David – How Your Emotions Can Cost You Money. CNN Money. 30.9.2011.

Similarly, many households suffer from 'energy poverty' (the investment of a substantial rate of their income in essential heating of the home). These households consume a lot of energy due to lack of choice, and behavioral tools would not necessarily help them, unlike governmental support. The assumption that behavior modification is possible without reducing energy prices or direct assistance to households would be detrimental to the weakest households, who often suffer from fundamental financial difficulty, and are in need of economic means rather than encouragement or nudging by the government.

In summation, it seems that there is no unambiguous answer concerning the regulative impacts of behavioral measures, especially if they replace regulatory and economic ones. Environmental taxes are harmful to vulnerable households, and replacing them by behavioral tools might increase inequalities; as opposed to subsidies, which at times are directed at the weakest households and must not be abandoned.

Table 1: **Summation of Select Impacts of Behavioral Measures on Inequality**

Tool	Advantage	Disadvantage
Use of defaults	Sometimes the default can also result in a wiser decision for the consumer, such as purchasing energy efficient appliances, which are good for the environment and are economically sensible.	When a default is not economically sensible, weaker households might adhere to it at higher costs.
Data use, framing and other "soft" behavioral tools	The use of information has the potential of encouraging residents from strong populations to purchase environmental products even if these are more expensive, and yet enable residents who cannot afford them to avoid purchase.	If mainly stronger populations purchase greener products, the "green sphere" might become identifiable with the higher social classes.
Replacing traditional measures by behavioral ones	Environmental taxes are especially regressive and harmful to weaker social classes, therefore the possibility of avoiding their use is an advantage.	A fundamental danger of relinquishing responsibility by the state and transferring the solution of environmental problems to the household level. The danger is especially severe if behavioral measures come at the expense of regulatory tools that assist weaker households.

1.5 Conclusions

In this section we present a number of preliminary conclusions to promote the use of behavioral measures as part of Israel's climate policy, while emphasizing the use of tools that will not contribute to the exacerbation of inequality in the country.

Money Isn't Everything

The most important conclusion arising from this research is that decision makers should not make use of economic measures exclusively, and that the decisions of individuals can be influenced by behavioral tools as well.

Actions by the state to mitigate water consumption constitute a good example. Due to a water shortage over the last decade and a number of draught years, the government took action to mitigate water consumption by households using two main measures – raising water prices (by means of an excess-consumption levy) and advertising. Studies have shown that the behavioral measures had a non-negligible affect (Grinstein and Nisan 2009), and that even the daily Kinneret (Sea of Galilee) status report had an influence on water consumption (Lavee et al. 2013). It is important to note that the draught levy also substantially reduced consumption (ibid.), but clearly if behavioral measures can influence consumption, then they might also be used to mitigate the use of taxes and levies.

For the most part, raising prices of basic products (energy and water) with the intention of mitigating GHG emissions is a regressive action, which would mostly harm the lower classes. In cases where households in this status only consume a minimal amount of energy which is essential for them, neither behavioral measures nor financial incentives would prove to be very effective. On the other hand, if household are able to mitigate their consumption, it seems that behavioral measures are effective for weakened households too. Therefore, in order to not burden households from vulnerable populations, the use of behavior measures should be as extensive as possible, before resorting to raising prices of basic products, despite the temptation of increasing state revenues.

Governmental Investment in Infrastructure for Accessibility of Information

Studies demonstrate how the accessibility to information and provision of consistent feedback can impact consumer behavior. It is therefore appropriate to encourage the construction of infrastructure which will enable the provision of accessible information on all matters pertaining to energy consumption. The prominent arena is naturally household electricity use, and thus the development of a smart electricity grid would enable residents to receive direct feedback regarding their electricity consumption, and understand in which cases they are consuming a lot of electricity. It is likewise appropriate to encourage the development of similar systems for the car industry. It is possible that if people knew the quantity of GHGs emitted every time they drive, or even the cost

of gasoline for each and every journey in real time (and not only when they fill their tanks), they might reduce their travel mileage.

Smart Use of Defaults

In many cases it is possible and appropriate to make use of a default that would result in the mitigation of GHG emissions, but decision makers should use caution when applying this measure, and consider that often consumers, particularly from weakened populations, will not alter the default even if such change is preferable for them. The default can be applied in the framework of utilities provided for residents. Power utilities could be demanded to connect households to the TBLT tariff (Tariff Based on Load and Time Hour Clusters, which encourages replacing energy consumption when there is high load on the system with consumption when there is a lighter load on the system), unless they request differently. Additionally, it should be demanded that new product defaults be defined according to the more efficient options for use. For example, it might be required that electrical appliances be automatically switched off after one hour, and that washing machines operate using cold water, unless the consumer changes these definitions (Houde and Todd 2011).

Applying Measures that Overcome Inconsistent time Preferences

Inconsistent time preferences might particularly harm low income households, for instance by purchasing energy efficient appliances. These products are economically viable for the households as they reduce expenses in the long term, and therefore consumers are likely to plan to buy these products in the future, but more urgent needs always emerge at present. Therefore, mechanisms can be created to assist these households to save some money every month, intended for the purchase of such appliances. In this way, for example, Northern Ireland has a stamp-buying program which eventually allows residents to buy low cost heating fuel (Pollitt and Shaorshadze 2011). The stamps constitute a practical commitment by the households, and prevent alternate uses of the money at present. A similar mechanism could be established in Israel, enabling households to make small monthly savings intended for the purchase of an expensive and more efficient electrical appliance (such as a refrigerator or air conditioner). In addition to the behavioral measures, economic tools should also be used in order to encourage savings, such as a governmental matching funds plan.

Providing Smart Information – Simplifying Calculations and Complex Processes

Information supply solves three problems: first, if gives prominence to the problem. This way, by labeling the environmental impacts of products, it is harder for consumers with high environmental awareness to overlook the implications of their own consumption. Secondly, providing data to consumers saves them the effort of obtaining information, which might at times inhibit them from buying products that have a harmful impact on climate. It is important to note that neo-classical economics also acknowledges that the costs of acquiring information should be taken into account when analyzing decision making processes, but behavioral economic studies indicate that even small steps of seemingly minimal costs, might have a disproportionate influence over decision making (Carrico et al. 2011). In the environmental field, which is accompanied by great uncertainty as it is, the problem is particularly severe (Shogren 2012) and situations sometimes occur in which residents, who want to purchase a more environmental product or service, don't know which product to choose. They need to take into consideration its production process, its energy usage, its longevity, the environmental impacts of discarding it at the end of life and so forth.

Furthermore, smart labeling could also ease the complex calculations required from consumers. Often even environmentally unaware consumers find it economical to buy energy efficient products even though they are more expensive, since the reduction in their electricity bills would be more substantial than the price disparity between appliances. However, as mentioned, consumers find it difficult to make such complex calculations at every purchase and for every product.

Smart labeling would provide consumers with the information they need, while clearly signaling the desirable behavioral action and using as simple an indication as possible. Thus the adoption of a clear standard, enabling consumers to understand the impacts of each product on climate change, should be considered; for instance by a clear indication of the product's carbon footprint and its rating relative to other products. Smart labeling should also take loss aversion into account, and thus the non-use of a more efficient product could be labeled in terms of loss; so rather than noting "an efficient light bulb would save NIS X a day", it might suggest: "the use of a lesser efficient light bulb leads to a loss of NIS X every day" (Houde and Todd 2011).

It is important that process simplifications be applied not only to products, but to services as well. Studies show that often complex processes prevent people from taking action even if it is economically beneficial, and so, for example, both in Israel and the USA many residents who are entitled to collect negative income tax do no actualize their entitlement due to the bureaucracy entailed in the procedure. It seems that residents from weakened populations are often harmed by bureaucratic difficulties and especially complex processes, such as the procedure of applying for student loans in the USA (Dynarski and Scott-Clayton 2006). It is therefore desirable that services in the field of energy efficiency (like appliance replacement procedures) would also be as simple as possible.

Using Altruism and Social Considerations

Much like in other countries, it is possible to encourage behavioral change in Israel by publicizing the desirable behavior taken by others. Furthermore, social activities or competitions between households can be encouraged to inspire environmental behavior. Such competitions might award prizes (Pollitt and Shaorshadze 2011), but would mostly have a symbolic value, once residents take pride in succeeding to lead energy efficiency in their neighborhoods. Thus for instance, households that want to educate their children to save on their energy consumption, could mark their doors with official stickers proudly presenting the amounts of energy they had saved.

Another option could be enabling consumers to purchase more expensive environmental services for ethical reasons, for example by paying their electricity provider more, so that their entire consumption will be renewable energy based. There is also a disadvantage to such a mechanism. Experiments indicate that people who included environmental considerations in their decisions, allowed themselves to be less altruistic in making other decisions. In an experiment held in Memphis, households that consumed small amounts of energy and then joined a program in which they paid slightly higher electricity rates, but more of their electricity was to be renewably sourced, have subsequently increased their consumption. Possibly, because they knew that they were bettering the environment through one channel, they let themselves be less cautious via another channel. It is also important to note that even after this behavioral change, the participation of these individuals in the program had generated GHG emission savings (Jacobsen, Kotchen and Vandenbergh 2012). It is similarly important to beware of environmental taxes delivering a message that it is legitimate to pollute, since the costs are already being paid for via the tax.

Research Examining Behavioral Measures That Address Climate Change Should be Held in Israel

It is important to note that most studies this document is based on were held outside of Israel, most of them in the USA or UK. However, there clearly are differences between impacts of behavioral measures in different countries (Thaler and Sunstein 2010). The State of Israel should consider active encouragement of such studies, for instance by setting up a behavioral research laboratory (Allcott and Mullainathan 2010). These studies must also address social implications of the researched measures, an area which is particularly lacking in contemporary active research.

1.6 Summary

This document presents a theoretical framework for the use of behavioral economics for the promotion of environmental goals, as well as a number of principles for policy measures, which should be considered for implementation in Israel. It is also important to recognize the limitations of the research. For the most part, we did not examine the possibility of integrating a number of measures from different fields at the same time, such as combining behavioral measures with environmental taxation, and it is probable that in practice decision makers will have to use a wide array of available tools (Shogren 2012). It should also be noted that the principles explored by this paper are primarily based on small scale field researches and lab studies. Examples for behavioral policy measures that function on a large scale and a duration of time are still lacking (Pollitt and Shaorshadze 2011).

And yet, the available outcomes leave much room for optimism and should not be ignored. The studies indicate that a series of behavioral measures can lead to the mitigation of GHG emissions resulting from household activity, achieved without substantial fiscal investment by the state or regulations that blatantly intervene in the decisions of individuals. It is likely that after implementing these measures, in some of the cases household behaviors would only change briefly (e.g. only for the duration of a water saving campaign), , but it is evident that in many cases even a short term change could generate new habits (such as recycling), which are fixated for the long term.

Due to the great potential embodied by such steps and the relatively small risk involved, it seems appropriate to integrate these measures into Israel's climate policy, with continued examination and follow-up regarding their environmental and social impacts.

2. Carbon Tax

2.1 Background

Following the extensive discussion regarding varied behavioral economic tools, in this second part of the report we present an in depth analysis of a more traditional tool – the carbon tax. Many economists agree that the most effective way to mitigate GHG emissions is by setting a price on carbon, in particular via a carbon tax. Since a carbon tax impacts the entire economy, and leads to price increases on products that emit plentiful greenhouse gases, it creates a direct incentive for the mitigation of emissions, starting in industry and through to the individual household level (Stern 2007; Fullerton, Leicester and Smith 2011). Furthermore, in the long term, a tax on carbon generates incentive for investment in research and development of efficient technologies that lead to the reduction of emissions. A carbon tax could also generate great revenues for the state, which might be used to expand the budget, minimize deficits during periods of economic crisis, decrease other taxes, as well as generate investments in additional measures addressing the climate crisis.

In fact, a tax on carbon leads to the internalization of external damage caused by pollution, thus it increases economic efficiency while many other taxes are destructive to it, such as the income tax that might lessen the incentive to work. Therefore, raising the tax on carbon and lowering other taxes could improve total economic productivity (a phenomenon dubbed *the double dividend effect*) (Parry 1995; Parry, Williams III and Goulder 1999). However, it should be noted that a claim, which is still under theoretic scrutiny, was made that carbon taxes might be less effective when they are levied in a system where tax distortions already exist (second-best analysis) (Parry 1995, Parry, Williams III and Goulder 1999).

Despite the many advantages of a carbon tax, its critics point to two important problems associated with a tax – potential harm to local industry competitiveness, and a regressive impact on households (Fullerton, Leicester and Smith 2011). Production costs of industries that depend on large scale GHG emissions would rise, and their competitiveness would decline in relation to similar industries around the world. As a result, companies might transfer out of the tax imposing country to countries that inflict less limitations on pollution. In this way, rather than mitigating GHG emissions, the tax might actually encourage greater emissions in countries with less stringent regulation, a phenomenon dubbed *carbon leakage*. Thus not only would the tax not achieve its purpose, but it will also be detrimental to the local economy.

Two primary measures might address this problem. Carbon customs could be imposed on imported products, while taxation on exported products is reduced. In other words, the tax will be imposed not only on local production, but also on the import of a product, in case there was no similar carbon tax in place in the country of its production. Similarly, if a product is being exported to a country where there is no tax, it is also possible to not impose a tax at origin, enabling equal

opportunity for it to compete with products manufactured in a tax-less country. Another option could be to ease the taxation burden for very competitive industries that are particularly dependent on fossil fuels, by means of exemptions for the duration of a certain adaptation period, levying lower taxes or providing assistance to companies (CBO 2003).

Another disadvantage of a carbon tax is that it might be particularly detrimental to weaker households, due to its regressive nature. Considering that on average lower income deciles both save less and spend a higher rate of their total consumption on energy, a carbon tax would have a higher impact on these deciles. This issue can be addressed by using the tax revenues to assist vulnerable households, or providing other tax breaks that will help lower deciles in particular (Burtraw, Sweeney and Walls 2009; Stone and Shaw 2009). It is also possible to lower the carbon tax itself for weakened populations, but then a smaller mitigation of total emissions might also be expected. In this paper we explore two measures to lessen the regression of the taxation – *carbon dividends* (Boyce and Riddle 2007) and VAT reduction.

2.2 International Comparison

In recent years there have been quite a few developments with regards to carbon pricing. In this section we briefly review the pricing mechanisms in a number of key countries, while reviewing steps taken to minimize the regressive impacts that might result from the tax.

In the **European Union** the largest system of emission trading was established in 2005. The system applies in the 28 member states of the Union, and further includes Lithuania, Iceland and Norway. The system is based on the cap-and-trade principle, according to which the quantity of emission permits is predetermined, permits are either given to companies free of charge or auctioned (in 2013, 40% of permits were auctioned, and the rate is gradually rising), and companies can trade permits. Companies which are exposed to competition are entitled to more free permits. The system applies to 11,000 power stations and production plants, as well as flights within the union, and covers some 45% of GHG emissions[6]. The main problem of the emission trading system is that following the economic crisis in Europe, industrial activity decreases, along with the quantity of emissions. As a result, the emission quantity limits sanctioned by the EU became inconsequential, and permit prices plummeted to less than EUR 5 per ton of carbon.

In **Ireland**, it was decided in 2010 to impose a carbon tax on all non-trading sectors which are not covered by the European Union – agriculture, transportation, waste and heating. In practice, the tax covers about one third of the country's GHG emissions. The tax was set at EUR 15 per ton of CO_2 in 2010, and EUR 20 in 2012. Every EUR 5 of tax, increase the prices of gasoline and natural gas by 1-2%. The tax was beneficial to Ireland and had increased the country's tax revenues during a period of income deficiency due to the economic crisis, as was demanded by the Troika

[6] The EU Emissions Trading Scheme - http://ec.europa.eu/clima/policies/ets/index_en.htm.

representative. In order to assist weaker households, it was decided to invest some of the tax income in subsidizing energy efficiency improvements in households (primarily insulation installations). Furthermore, it was decided to increase grants awarded to households eligible for heating fuel purchase. However, these grants were later curtailed due to the continuation of the economic crisis (Convery 2013).

In **Australia**, the highest western per capita emitter, it was decided to institute carbon pricing as of July 2012. Originally it was decided that during the first three years of the program carbon will have a fixed price, thus it would in fact constitute a carbon tax. The tax was to be imposed on the 200 highest emitting companies, excluding the agriculture and transportation sectors. After the initial three years, Australia was supposed to switch to an emissions trading system associated with the European system, whereas the permit prices would be market based, in accordance with the total emission permits as defined by the government.

A number of measures to assist weaker households were applied within the taxation framework, including a tripling of the income tax threshold and direct payment transfers to eligible households[7]. Furthermore, as part of its pricing, six business compensation programs were established. These include granting a substantial rate of the permits free of charge, based on the competitive level of factories; production industry grants for the promotion of clean technology; temporary coal industry assistance to reduce emissions; temporary steel industry assistance; funding the closure of particularly polluting power stations and backing companies developing clean energy; and finally relief for all small businesses (EDO 2011).

Carbon pricing is one of the most controversial political issues in Australia, and climate policy is often a decisive factor in elections. When Australian Prime Minister Gillard was replaced following an internal Labor Party struggle, the new PM, Rudd, declared that the transition from a taxation system to flexible pricing for carbon will be made one year earlier than planned (Australia Government 2013). After Rudd lost the general elections in September 2013, new Prime Minister Abbott from the right wing Liberal Party promised the abolition of the carbon tax as one of his first concerns in office. At the time of writing this document it was too soon to tell if and how such a move will be executed.

New Zealand activated a carbon trading system in 2008, which has been developing gradually. The system applies to all sectors excluding agriculture, and includes forests which are accredited for mitigating GHGs. In the framework of the system companies are granted free permits, and they can trade these permits or buy additional permits as needed. It is claimed that an emissions trading system is preferable to a carbon tax due to its flexibility; the price of emissions fluctuates according to demand, and the system provides greater environmental certainty with regard to the total emission level expected countrywide[8]. However, unlike other countries, there is no real limitation

[7] The Clean Energy Advance – http://www.humanservices.gov.au/customer/services/centrelink/clean-energy-advance

[8] Climate Change Information New Zealand – Questions and Answers about the Emissions Trading Scheme – http://www.climatechange.govt.nz/emissions-trading-scheme/about/questions-and-answers.html

to the quantity of emissions in NZ. The state does allocate a limited amount of permits, but the system is associated with the Kyoto Protocol, thus enabling companies to buy additional permits in the international market. During the adjustment period, which was recently extended with no time limit, the price of emissions was capped at NZD 12.5 per ton for most industries (the price is actually limited to NZD 25, but the companies are obligated to hold only one permit per two tons of emissions). The system received harsh criticism from environmental organizations for the many respites it offers industry, such as free permits, a long adjustment period and the absence of any real limitation to the quantity of emissions.

The efforts to set up a trading system of emission permits in the **United States** have failed during Obama's first term in office. The House of Representatives had approved historic legislation to establish an emissions trading system in June 2009, but the Democrats were unable to consolidate a sufficient majority for similar legislation in the Senate. Recently the carbon tax made headlines, partly due to the growing American debt and insufficient progress in the efforts to mitigate GHG emissions. A number of democrats have submitted bills promoting a carbon tax; the impacts of which were examined by the Congressional Budget Office (CBO), an agency conducting independent estimates and providing information to Congress (CBO 2013). Additionally, many articles by senior officials who support the tax were published broadly in the American press[9].

At the same time, there are at least two prominent GHG pricing programs operating in the regional or State level in the USA. In 2008, 10 states in the North East of the US established a cap and trade system for GHG emission permits (presently 9 states partake in the program following New Jersey's withdrawal). The program applies to large power stations, and unlike other programs, a vast majority of the permits are auctioned, rather than provided free of charge to companies. Most profits are used for investments in energy savings or renewable energies. Permit prices are relatively low, at about USD 2-3 per ton. The reason for the low prices is that supply of permits is higher than the demand (partly due to a rapid development of the US natural gas industry). Due to the excess supply, many permits were sold for the auction's minimum bidding price, and many were never sold (Potomac Economics 2013). It was decided, starting in 2014, to reduce the number of permits significantly, and introduce elements that make the program more flexible (such as retaining a permit reserve in case prices soar)[10]. Despite the low price, the accumulated revenues from permit sales reach close to one and half billion dollars[11].

In 2013, a cap and trade system for emissions by large companies was introduced in California as well. The system was first applied to power stations and heavy industry, and will gradually be applied to some 85% of GHGs in the state. The number of permits will lessen annually, and some of the sectors, whose competitiveness might become vulnerable, will be given most of the permits for

[9] Schultz, G. P. and Becker, G. S. – Why We Support a Revenue Revenue-Netural Carbon Tax. Wall Street Journal 7.4.2013; Kolbert, E. – Paying for It (Comment), The New Yorker. 10.12.2012; Mankiw, N. G. - A Carbon Tax That America Could Live With. The New York Times 31.8.2013.

[10] Regional Greenhouse Gas Initiative- Summary of RGGI Model Rule Changes: February 2013.

[11] Regional Greenhouse Gas Initiative – Auction Results – http://www.rggi.org/market/co2_auctions/results

free. The province of Quebec in Canada has announced that it would join this system in 2014. The minimum permit price was set to be USD 10 per ton, with a real increase of 5% per annum. In tenders held thus far, all permits were sold for slightly higher than the minimum price ($10-12). In California a substantial rate of the permits is given to privately owned utilities, which are required to use profits from permit sales to benefit their customers, in particular households, small businesses and competitive industries. The ultimate use of the state's revenues from permit sales is yet to be determined, but it is likely to be invested in environmental causes, prioritizing weakened communities. According to a preliminary recommendation, the investments would focus on sustainable communities and clean transportations, energy efficiency and renewable energies, and natural resources and waste treatment (State of California 2013).

Canada has no carbon tax, but carbon pricing systems exist on the local level. In British Columbia, a Canadian province of some 4.5 million inhabitants and a largely resource dependent economy, a carbon tax was imposed in July 2008. The initial price was decided at CAD 10 per one ton of CO_2-equivalent emissions. The price rose gradually every year, for the economy to ease into the tax. After the last planned increase in 2012, the tax was CAD 30[12]. The tax isdefined as revenue neutral; in other words, all tax revenues will be used either to mitigate other taxes or to increase subsidies. Therefore, the first two income tax brackets were lowered, tax reliefs were provided to low income households and assistance was transferred to households in the periphery. Additionally, steps were taken to assist businesses, including lowering the corporation tax, raising the tax threshold and lowering tax payments for small businesses. Following a 2013 evaluation of the tax, it was decided that the principles of the tax operate successfully, and that it will continue to function in the same manner with no great changes planned[13]. With the advantage of good advertising and focusing on assistance to households, the tax also appears to be popular, with opinion polls indicating that it is supported by the majority of the public, and that it actually helped the Liberal Party get reelected in the province. The British Columbia tax might be used as a model for the correct implementation of a carbon tax.

In summation, it seems that there has been an increased use of carbon pricing tools worldwide. In addition to the abovementioned systems, an emissions trading system was established in Kazakhstan in 2013, and systems are also planned in South Korea in 2015; even China started a carbon pricing pilot program in 2013. Presently systems are in operation in some 35 countries, representing 30% of the global economy (these include member states of the European Union but exclude countries in which regional systems are in place, such as the USA, Japan and Canada) (Flannery, Beale and Hueston 2012). Most systems also take into consideration the risks of carbon pricing, and enact to ensure that it does not lead to increasing disparities in the country; though in many cases polluters are still given numerous permits, and as a result the systems might become less effective and less equitable.

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[12] Carbon Tax Review, and Carbon Tax Overview – http://www.fin.gov.bc.ca/tbs/tp/climate/carbon_tax.htm

[13] Carbon Tax Review, June Budget Update – 2013/14 to 2015/16 – Tax Measures, pp. 63-65.

Despite the increased use of carbon pricing, it appears to still have some teething problems. In carbon trading systems, the price is often initially set to be too low, thus it is clear that the system has a rather limited impact; and taxation systems still incur prominent political risk as was evident by the outcome of the Australian elections. Despite these issues, humanity will have to mitigate emission levels dramatically, and carbon pricing is probably the most efficient measure to reach this goal. Therefore carbon pricing systems would probably eventually encompass a considerable rate of global GHG emissions. If the countries would successfully manage to overcome the political perils of introducing new taxation, it could hopefully become a dominant fixture. As noted by the Economist:

> *"The right thing in climate policy for all the big countries is a carbon tax, which is simpler and less vulnerable to fluctuations in emissions than cap-and-trade schemes. For years, such a tax has been a non-starter politically. But as the alternatives are tested to destruction, it deserves to be looked at again. Current environmental policies will not keep the rise in global temperatures to below 2°C—the maximum that most climate scientists think safe. A carbon tax, if stiff enough, could. Big polluters should assume that such a tax will one day arrive, and start planning for it now."*[14]

2.3 Carbon Pricing in Israel

In Israel, the National Plan for the Reduction of GHG Emissions does not include a tax on carbon, nor the establishment of a carbon trading system. A report by the Samuel Neaman Institute critiqued the absence of economic incentives in the plan, and maintained that the integration of a carbon tax was necessary, since it is the tool that has the most substantial contribution to mitigation, and because it is the cheapest measure in both the short- and long-term (Samuel Neaman Institute 2011). The Ministry of Environmental Protection examined the possibility for Israel to be included in the international GHG emissions trading mechanisms, as well as the option of levying a carbon tax[15].

Limited explorations were held to study the impacts a carbon tax would have on Israel. A research published in 2008 had indicated that a double dividend outcome is attainable in Israel, and that a tax on carbon would lead to growth in employment, beyond its environmental benefits (Palatnik and Shechter 2008). Follow-up research by Shechter et al. constructed a model enabling an examination of the relationships between different sectors of the economy, and which generated simulations for the year 2020. According to the model, by imposing a tax valued at EUR 15 per one ton of CO_2-equivalent GHG emissions, as well as a tax on coal worth 16% of the price per ton, Israel

[14] Economist – Tepid, Timid: Climate-change policy in America, Europe and China. 29.6.2013.

[15] Ronen, Yaniv – Tracking the Execution of Government Decision – National Plan for the Reduction of Greenhouse Gas (GHG) Emissions – Decision No. 2508, Knesset Research and Information Center. Submitted to the Joint Interior-Labor Committee for Environment and Health. 1.2.2012. (In Hebrew)

could reduce 20% of its GHG emissions, compared to a business as usual scenario (as per the commitment made by President Peres in Copenhagen in 2009), at the cost of approximately half of one percent of GDP (Shechter et al. 2011).

Contemporary literature is important in terms of evaluating the impacts of carbon taxes on the entirety of the Israeli economy, but for the most part it does not address the impacts such taxes might have on inequality. The Climate Justice Research and Policy Project, an initiative of the Association of Environmental Justice in Israel, focuses on these impacts. Rabinowitz studied GHG emissions by different deciles in the country, and demonstrated that on average higher deciles are responsible for emitting more GHGs (Rabinowitz 2012). A follow-up report focused on the different GHG mitigation measures, and examined which of the measures would amplify inequalities, and which might decrease them. According to the report, in the case of carbon pricing, it is preferable to rely on a carbon tax over a cap and trade system, and in any case, if a trading scheme is used, it should rather not allocate numerous free permits to industry (Levy, will be published in 2015). Whereas the first report discusses a broad array of potential measures, the current document focuses on a more detailed analysis of the impacts of carbon pricing on the different deciles in the economy.

2.4 Methodology

In this section we explain the steps in this research through which we have examined how a 2011 carbon tax priced at about NIS 130 per ton of CO_2e would influence prices, household CO_2 emissions and the expenditures of different deciles in the economy. The tax was studied in reference to 2011, due to the availability of sufficient data to perform the examination for that year.

A. Determining the Price and Scope of the Tax

In every study examining the changes resulting from the application of a carbon tax, the value and scope of the studied tax must be decided. In this study we focus on a tax levied on carbon dioxide, rather than all greenhouse gases. The decision to do so is due to the fact that carbon dioxide is the most common greenhouse gas, and based on the availability of data for carbon dioxide. This is a common assumption in other studies as well (Shammin and Bullard 2009).

The assumption regarding the value of the tax examined in this paper is almost arbitrary. It is impossible to anticipate the price of a carbon tax, should it be levied in Israel. However, the assumption is not of great consequence, considering this study focused on the distributional influences of the tax, rather than the totality of its impacts. Yet it is desirable to examine a carbon tax that would be as realistic as possible.

The price of a carbon tax might be determined by the social harm caused by carbon. According to a new report by the International Monetary Fund (IMF), the estimates in literature vary widely and range between USD 12 and USD 85. The IMF chose to rely on a sum of USD 25 per ton (IMF 2013). It should be noted that the IMF's assumption was based on work of the Interagency Working Group on Social Cost of Carbon. Since then, an updated Working Group document was published, which had raised the price estimate significantly. According to the new document, the social cost of one ton of CO_2 is USD 11, USD 33 and USD 52 for discount rates of 5%, 3% and 2.5% respectively (IWGSCC 2013). Considering most GHG damages will be determined in the future, the cost is extremely influenced by the discount rate. The change in the estimated cost of carbon represents an increase of some 48%-134% compared to previous assessments.

Another option would be to examine the change required in Israel. According to the study by Shechter et al., a EUR 15 tax would not suffice to generate the GHG emission mitigation Israel had committed to (unless a tax on coal is added) (Shechter et al. 2011). The Ministry of Environmental Protection estimates the cost of CO_2 externalities at NIS 103 per ton, as of December 2011 as well as January 2013[16].

Based on this data as well as the taxes in British Columbia, Ireland and Australia, and keeping in mind the value suggested by the Ministry of Environmental Protection, we have decided to examine the introduction of a tax at NIS 110 (approximately USD 31) per ton of CO_2. We have added 18% VAT to this tax, so that the final cost would be NIS 129.8 per ton. VAT was added since in Israel, the part of the product price originating in another tax is also billable by VAT; in this manner VAT is levied on the gasoline excise tax.

It should be noted that while the final value is higher than the costs obtained by some previous studies undertaken in Israel, it is still lower than other suggestions that were made around the world (see for instance the price setting in the UK, Price, Thornton and Nelson 2007), as well as the costs that were used to examine the impact of a carbon tax on inequality in the USA (Boyce and Riddle 2007).

B. The Impact of Carbon Tax on Prices

We have examined how the tax might influence the prices of electricity, gasoline, cooking gas, heating fuel and public transportation. As is customary, we assume that while the tax is imposed on electricity producers or the import of resources, it will be fully expressed in consumer product prices. In order to calculate the influence of the carbon tax, we first looked into the quantity of carbon dioxide emitted by burning different fuels[17]. In the case of electricity, GHG emissions

[16] Update of values of external costs of air pollutants as of 1.1.2013. Economics and Technology Cluster, Economics and Regulation Division, Ministry of Environmental Protection, 27.1.2013. (In Hebrew)
[17] For gasoline and diesel fuel for transportation:

depend on which fuels are used. Instead of independently calculating GHG emissions, we have decided to rely on data supplied by the Israel Electric Corporation (IEC)[18].

After calculating the additional costs supplemented to the product price should a tax be imposed, we have examined the price of fuels[19] and electricity[20] in 2011, and then compared the new tax with the original price, in order to value the price increase in percentages. Additionally, we examined the change in the price of diesel fuel for transportation[21], from which we deducted 50% of the excise being refunded to public transportation as part of the 'diesel fuel arrangement'[22], and we estimate that 23% of fuel transportation costs are due to diesel fuel[23]. Finally, we assumed that the increase in public transportation costs would be identical to the increase of bus travel prices.

We further examined the tax (as of September 2013) currently levied on varied fuels, the excise[24]. By using the data for GHG emissions of gasoline, we converted the tax to monetary terms in NIS for every ton of CO_2, in order to enable a comparison with the carbon tax.

We did not examine in this project the influence a carbon tax might have on additional products – industrial products, foods and services. Clearly a carbon tax could lead to rising product prices, either due to direct CO_2 emissions or the costs of using more expensive fuels and electricity. Studies examining these changes have shown that prices of other products are indeed expected to rise, but the increase is relatively very small, compared to price variations in the energy sector (Metcalf 2008; T. Dinan and Rogers 2002). Impacts on other product prices were not examined due to lacking data (similarly to other studiesCallan et al. 2009). While it is possible to examine the relationships between different sectors of the economy using input-output tables of the Central Bureau of Statistics (CBS), data to bridge between the input-output tables and products reviewed in household expenditure surveys is lacking.

US Energy Information Administration – Energy Voluntary Reporting of Greenhouse Gases Program – Table 2: Carbon Dioxide Emission Factors for Transportation Fuels. http://www.eia.gov/oiaf/1605/coefficients.html#tbl2

For natural gas and heating diesel fuel:
US Environmental Protection Agency – Greenhouse Gas Equivalencies Calculator Calculations and References
http://www.epa.gov/cleanenergy/energy-resources/refs.html

For Coal and LPG (cooking gas):
US Energy Information Administration – Carbon Dioxide Emissions Coefficients
http://www.eia.gov/environment/emissions/co2_vol_mass.cfm

[18] Israel Electric Corporation – Carbon Dioxide (CO_2) Calculator – data for 2011
https://www.iec.co.il/environment/pages/pollcalculator.aspx

[19] The costs of heating fuel and LPG were calculated based on a weighted average of monthly data by the Central Bureau of Statistics – Average Prices of Select Consumer Products and Services.

The costs of gasoline was calculated based on a weighted average in accordance with price changes based on – Ministry of National Infrastructure, Fuel and Gas Administration, Consumer Price at the Gas Station – for supervised products, 95 octane unleaded gasoline for 2011.

[20] Electricity costs were calculated based on a weighted average of the kWh rates on different dates during 2011. The electricity rate changed on 16.3.2011, 14.8.2011 and 1.11.2011.

[21] The base cost of diesel fuel was calculated in accordance with the average prices file of the Central Bureau of Statistics. However, large diesel fuel consumers are awarded substantial price discounts (Agmon, Tamir – Analysis of the Implications of Supervision on the Price of Diesel Fuel, Knesset Research and Information Center, 31.7.2011. In Hebrew). We have assumed the discount rate to be 25%.

[22] Calculation of the rate of excise to be refunded – the diesel fuel arrangement, Israel Tax Authority.

[23] Price Index of Input in Buses 2011, Central Bureau of Statistics.

[24] Fuel excise tax rates as of 1.99.2013.

C. Tax Impacts on Households in Different Deciles

In the next stage we examined the influence the price increase would have on households in different deciles. We executed the examination by means of the CBS expenditure survey for 2011[25]. We further used the expenditure survey to calculate the total expenses and total income for each of the deciles, basing the allocation into deciles on net income per household[26]. In order to evaluate the impacts of the tax on distributional justice, we examined the increase in expenses amongst households in relation to household income in each decile.

D. Using Tax Revenues

We had examined three alternatives for the tax revenues. In scenario A, the tax payments are used to increase state revenues, for instance by enlarging the overall budget or decreasing the national debt. According to this option, the totality of taxes is larger, and most likely there is also more involvement of the state in society (as is expressed in different indices such as the rate of taxation in relation to GDP). The two following options are neutral in terms of state revenues and do not generate either a reduction or an increase of the budget.

In scenario B we examine the impact of refunding all revenues to households equally. 'The tax dividend', the amount refunded to each household, equals the total income from the carbon tax divided by the number of households.

In scenario C, VAT is reduced so that state revenues are not altered as a result of the carbon tax. Through the expenditure survey, we valued the rate of expenses incurring VAT among different deciles, according to the total consumption by each decile, similarly to the methodology used by the Knesset Research and Information Center[27]. In order to improve the accuracy of the calculation, we subtracted the expenses on fruit and vegetables, rent and overseas travel, which do not incur VAT, from the consumption data. Thus we had estimated the distribution of VAT payments between different deciles. We calculated the total VAT reduction according to the total increase in

[25] We thank the Social Sciences Database of the Hebrew University in Jerusalem for distributing the data of the CBS's expenditure survey. The data was analyzed using Stata.

[26] In order to work with one consistent database, we have only used the data of the expenditure survey (much like the CBS work on the tables relating to expenditure).It should be considered that calculating net fiscal income according to the expenditure survey is more equitable than calculating income based on the integrated revenue survey. In other words, as a result, the outcome of this study are conservative, and the gaps between deciles as a result of a carbon tax might be greater in practice.

[27] Bar, Ilanit – Examining the Tax Burden by Income Deciles. Knesset Research and Information Center. 31.7.2011. (In Hebrew)

state revenues following the carbon tax, and divided the deduction to deciles according to the calculated distribution.

After calculating the tax refunds for each of the alternatives, the final impact of the tax on households can be calculated, according to the way tax refunds are used. It is important to mention that in this section we focus on direct profits and losses in monetary terms for households in different deciles – the loss emanating from higher expenses of consumers on tax, and the profits resulting in case some of the taxes are refunded to households. We calculated the direct effects of the tax assuming households do not change their behavior. In practice, households will reduce their consumption of energy (albeit not significantly in the short term) as we discuss in the next section. However, reducing energy will also decrease the households' welfare. Therefore instead of calculating the demand function and indirect welfare effects which are problematic to estimate properly, we focused on total direct effects. The losses to the households (described in tables 5, 6) can also be thought of as the maximum negative welfare effects (composed mostly in increase in income and partly in reduced consumption).

Similarly, we had not addressed the long term benefits for households resulting from less CO_2 being emitted (which is the reason for levying a carbon tax in the first place). Much like in other studies (Boyce and Riddle 2007; Callan et al. 2009), we decided to not measure the last two influences mentioned, and adhere to direct and fiscal impacts; although it should be added that an investigation of the environmental benefits might have yielded a more favorable result.

E. Mitigating Greenhouse Gas Emissions

It might be assumed that following price increases of various products, households would somewhat curtail their consumption. In order to estimate the decline in demand for products, the flexibility of demand, which describes the rate of consumption decrease per percentage of price increase, should be estimated. It is customary to distinguish between short term and long term flexibilities. In this study we focus on the short term.

Literature on the flexibility of demand for electricity is ambiguous, and its values span a relatively wide range of between -0.92 and 0 in the short term, with a tendency towards values closer to zero (Lijesen 2007; Labandeira, Labeaga and Lopez-Otero 2012). With regard to fuel, studies suggests that short term flexibility is between -1.36 and 0 (Lin and Prince 2013), and it seems acceptable to use values between -0.3 and -0.2 (Graham and Glaister 2002). However, using earlier research might be misleading, considering that a new study indicates that fuel flexibilities may be in decline, and while they used to be between -0.34 to -0.21 during 1975-1980, they have plummeted to range between -0.077 and -0.034 in 2001-2006 (Hughes, Knittel and Sperling 2006).

Previous researches studying the impacts of carbon tax, have used flexibilities of 0.2 for electricity and natural gas, 0.27 for heating fuel and 0.26 for gasoline (Boyce and Riddle 2007); or 0.32 for

electricity, 0.2 for natural gas, 0.2 for heating fuel and 0.1 for gasoline (Burtraw, Sweeney and Walls 2009); and other studies assumed flexibility to be zero in the short term (Metcalf 1999).

In this current research we use similar data to that used by Boyce and Riddle, and assume the flexibility for electricity and heating fuels is -0.2 and the flexibility for gasoline and public transportation is at -0.25. We have considered using a lower estimate for gasoline flexibility, but seeing as there are not enough studies confirming the decline in the flexibility of demand for gasoline, and there are new studies that do not reach the same result (Brons et al. 2008; Gillingham 2011), we prefer to rely on the data that was consensually used by most research thus far.

Interestingly, prior reports presumed that flexibility is cohesive among households, rather than varying by decile, and due to the absence of established evidence proving otherwise, we do the same in this research too. There are studies indicating that flexibility is higher in lower income populations, though this is an equivocal conclusion, and other studies point to a more complex relationship between income and flexibility (Gillingham 2011; Fullerton, Leicester and Smith 2011, 468).

After calculating the flexibility, we could estimate the reduction of household CO_2 emissions. First we estimated the consumption of various products in 2011. We divided the expenditure on electricity, gasoline, cooking gas and heating by the costs of these products, to estimate the amount purchased (an evaluation of emission reductions in public transportation was not executed, because the methodology is less accurate for this sector), and could calculate GHG emissions per product. After using demand flexibility to evaluate the decline in demand following the price increase, we could calculate the decline in emissions following the tax on carbon. Finally we evaluated the mitigated emissions as a share of total national emissions[28]. We estimated that the share of household emissions due to the consumption of electricity and energy is about 32.6% of total emissions resulting from electricity and energy consumption[29] and that the share of household emissions emanating from transportation is approximately 25.1% of total transportation emissions[30].

[28] Total CO_2 emissions and total emissions from burning energy, total emissions in the energy sector and total emissions in the transportation sector were calculated by – table 27.6: Greenhouse Gas Emissions by Source. Israel Statistical Abstract 2013. (In Hebrew)

[29] The calculation was based on the IEC statistical report for 2011. Table 30a presents electricity consumption by type of consumption. We calculated the rate of household consumption of total consumption, excluding East Jerusalem.

[30] Mekdasi, Elad – 'Who Pollutes and Who Pays in the Automobile Sector'. Chapter 20 in the State Revenues Administration Report 2007. (In Hebrew)

According to table 20-8, in 2006 private vehicles and motorcycles emitted some 24% of total GHG emitted by private cars, motorcycles, trucks, buses, taxis and minibuses.

2.5 Results

Changes in Product Prices

Prior to discussing the effects of the new tax, it is interesting to examine current taxes imposed on fuel products. Table 2 presents the excise on fuels (as of September 2013) in original units, as well as in terms of NIS per CO_2 units.

Table 2: **Energy Excise Taxes in Israel**

Product	Present Tax in NIS	Present Tax, NIS per Ton of CO_2
Gasoline (kiloliter)	3,056.13	1,298.40
Diesel fuel (kiloliter)	2,928.11	1,092.03
Coal (ton)	45.85	19.80
Natural gas (ton)	17.27	6.43

Table 2 indicates that taxes presently levied on transportation fuels are high, whereas taxes on fossil fuels used for the production of electricity are particularly low. The table raises an interesting question – considering taxes are already levied on GHG emitting products, why is there a need for new taxes? It seems that decisions on taxes were often made based on political considerations (taxes raised at times of budgetary deficiency; lowered due to public pressures), and do not reflect the price of carbon. Contemporary taxes do not appear to respond only to the goal of mitigating GHGs, as is reflected by the great disparity between the tax levied on different products in GHG units, as well as by the low taxation rates on coal. It should be remembered that although these products are already being taxed, burning fuels generates environmental and health damages not only related to climate change, primarily the amplification of local air pollution and car accidents, and current taxes partially reflect this damage. In this study we chose to focus on the impacts of a new tax. Since in any case it is impossible for a tax on CO_2 emissions to be the sole environmental tax levied on fuels, due to the multiple damages they are responsible for, the fact that there are already taxes in place on these products is reasonable and does not contradict the new tax.

Table 3 presents the changes in product prices following the infliction of a carbon tax at NIS 110 (NIS 129.8 including VAT) per ton of CO_2.

Table 3: **The Change in Product Prices Following a Carbon Tax**

Product	CO_2 Emission (ton)	Carbon Tax in NIS	Price in 2011	Price Change
Gasoline (kiloliter)	2.356	305.86	7,280.41	4.20%
Coal (ton)	2.316	300.58		
Natural gas (1,000 cubic meters)	1.909	247.80		
Electricity (1,000 kWh)	0.733	95.14	502.65	18.93%
LPG (ton)	1.379	357.21	11,883.54	3.01%
Heating fuel (kiloliter)	2.702	350.74	7,254.00	4.84%
Diesel fuels for public transport (kiloliter)	2.681	348.04	4,326.43 (estimation)	8.04%
Public transportation				1.88%

It is evident from table 3 that electricity prices would be most substantially influenced by a carbon tax. The explanation appears to be twofold – a significant rate of the electricity is generated by coal, which is considered to be an especially polluting fuel, and current taxation of natural gas and coal is very low. In 2011, some 50% of the electricity was generated by natural gas, 38% by coal and the rest using mostly fuel oil and diesel fuel. Over the years it is likely that the rate of natural gas will rise while that of diesel fuel lessens, and thus the impact of a carbon tax would be somewhat reduced. The rate of increase in the price of diesel fuel for public transportation is relatively high, but that is mainly because the current price is low to begin with, due to the 'diesel fuel arrangement', through which half of the excise on diesel fuel for public transportation is being refunded. In this study we assume that a similar arrangement will not be made possible concerning the carbon tax. Still the anticipated rate of price increase is lowest for public transportation, since a significant rate of expenses in public transport is not spent on fuels, but on drivers, vehicles, spare parts and additional expenses.

The table above already leads to an interesting first conclusion, that if the tax on carbon is not low it is bound to have a sizeable impact on households, albeit not an extraordinary one. A 4% increase in fuel prices is not high, and in fact occurs often in accordance with global fuel price fluctuations. The increase in electricity prices will be more substantial, and would definitely impact households; but such an increase is not unprecedented either, in fact, between August 2011 and May 2013 electricity costs rose by a rate greater than 25%. In other words, it would seem that the price increase will affect households, but could be coped with. However, in order to evaluate the social impacts of the carbon tax more accurately, it is important to identify its influence on different deciles as presented in the next section.

Immediate Impact of a Carbon Tax on Households in Different Deciles

Table 4: **Expenditure on Energy and Transportation by Deciles**

Decile	Income	Expenditure	Household electricity and energy[1]		Gasoline and public transportation[2]	
			Expenditure	Rate of total income	Expenditure	Rate of total income
1	2,466	5,538	208.14	8.44%	137.79	5.59%
2	4,365	7,531	255.71	5.86%	269.20	6.17%
3	6,045	9,685	326.19	5.40%	401.54	6.64%
4	7,751	10,799	340.36	4.39%	419.92	5.42%
5	9,659	12,102	372.35	3.85%	483.22	5.00%
6	11,900	14,178	393.03	3.30%	630.82	5.30%
7	14,409	15,117	387.60	2.69%	650.46	4.51%
8	17,745	17,642	445.55	2.51%	767.35	4.32%
9	22,133	20,792	506.29	2.29%	869.12	3.93%
10	34,912	26,297	559.92	1.60%	932.76	2.67%
Average	13,136	13,967	379.48	2.89%	556.16	4.23%

[1] The column was calculated based on the summation of household expenditure on LPG (q382), centrally connected cooking gas (q383), electricity (q381) and private expenditure on heating (q386).

[2] The column was calculated based on the summation of household expenditure on public transportation (q865) and fuels and oils (q894).

Table 4 indicates, as expected, that the expenses on electricity, energy, fuel and public transportation are higher among higher deciles. However, an examination of expenditure as a rate of income suggests that the rate of expenditure on these items actually diminishes as income increases. In transportation the decrease is inconsistent and unequivocal, and it is actually among the third decile that the rate of expenses is the highest (probably since the use of vehicles is very limited in the lowest deciles). However, when considering the expenditure on household electricity and energy, the gap between the deciles is more prominent. Whereas the first decile dedicates about 8.4% of its income to these expenses, the rate is only 1.6% in the tenth decile.

Table 5: **Anticipated New Expenditures on Carbon Tax**

Decile	Expenditure on Electricity	Expenditure on Gasoline and Public Transportation	Total New Expenditures	Rate of New Expenditure of Total Income
1	33.60	4.30	37.90	1.54%
2	40.73	9.03	49.76	1.14%
3	53.50	14.06	67.56	1.12%
4	55.42	15.32	70.74	0.91%
5	61.29	17.93	79.22	0.82%
6	64.88	23.86	88.74	0.75%
7	64.10	24.62	88.72	0.62%
8	74.92	29.76	104.67	0.59%
9	83.11	34.31	117.43	0.53%
10	93.62	36.78	130.41	0.37%
Average	**62.51**	**20.99**	**83.51**	**0.64%**

Diagram 1: **New Carbon Tax Expenditure and Fiscal Income of Different Deciles**

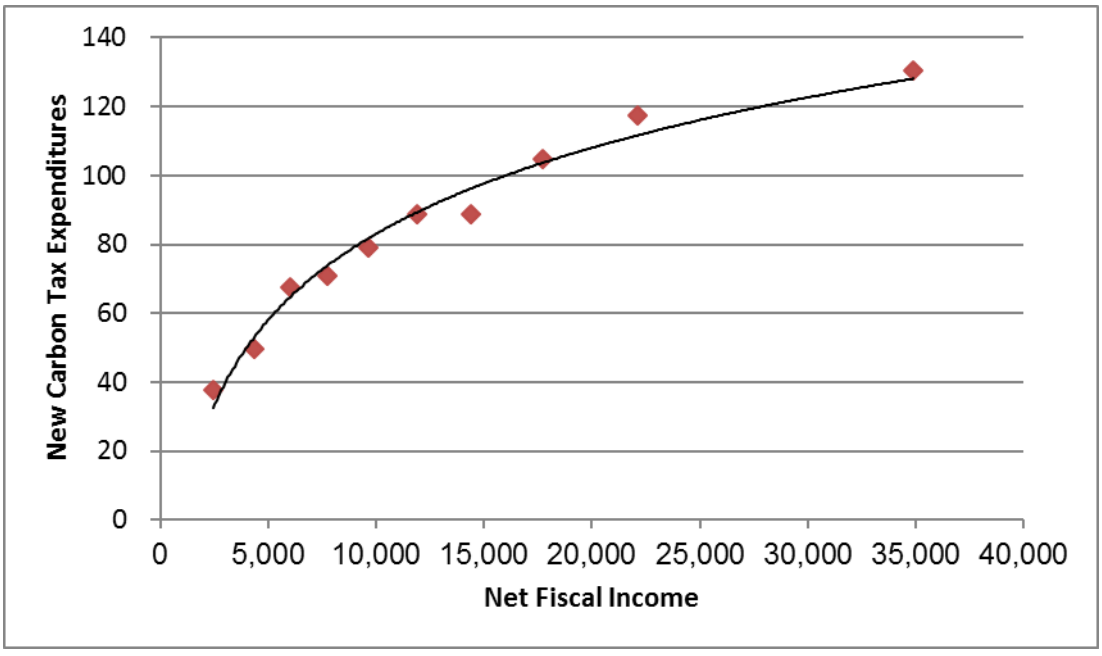

Table 5 and diagram 1 provide a clear demonstration of the carbon tax impacts on households in different deciles. On the one hand it is evident that as income climbs, so do the expected new monthly expenditures following a carbon tax. On the other hand, the rate of increased new

expenses is lower than the rate of increased fiscal income (in other words, the marginal rise of expenses diminishes), therefore the share of new expenses out of the total income will continuously decrease (from 1.52% in the first decile to 0.37% in the tenth decile). Hence, the impact of the carbon tax will be **regressive**, considering households in the lower deciles would need to spend a higher rate of their income to fund the new tax.

It is important to emphasize that in this section we only examine the immediate impacts of the tax, and do not address flexibility of demand for energy. It is likely that following the carbon tax households would minimize their consumption, therefore the influence of the tax will be lesser than the above data; but in that case it is also possible that the welfare of households would be compromised. We can also think of the value in the table above as the maximum loss from a carbon tax, caused mostly by increased cost and partially by decreased welfare.

The regressive nature of the tax might be addressed by means of an educated use of revenues. Table 6 demonstrates how different uses of the revenue would affect households. Scenario A assumes that tax revenues will be kept as part of the general state budget, and thus in fact household impacts would be identical to the result demonstrated above. The other two scenarios describe the use of revenues for apportioning a carbon dividend or the reduction of VAT.

Table 6: **The Impact of Different Scenarios on the Level of Progressivity of a Carbon Tax**

Decile	Scenario A: Using Revenues for National Budget		Scenario B: Identical 'Carbon Dividend' for All Households		Scenario C: Using Revenues to Reduce VAT	
	Household Income	Rate of Change from Income	Household Income	Rate of Change from Income	Household Income	Rate of Change from Income
1	-37.9	-1.54%	45.6	1.85%	-5.8	-0.24%
2	-49.8	-1.14%	33.8	0.77%	-5.6	-0.13%
3	-67.6	-1.12%	16.0	0.26%	-10.5	-0.17%
4	-70.7	-0.91%	12.8	0.16%	-6.5	-0.08%
5	-79.2	-0.82%	4.3	0.04%	-7.3	-0.08%
6	-88.7	-0.75%	-5.2	-0.04%	-3.5	-0.03%
7	-88.7	-0.62%	-5.2	-0.04%	2.3	0.02%
8	-104.7	-0.59%	-21.2	-0.12%	2.4	0.01%
9	-117.4	-0.53%	-33.9	-0.15%	8.5	0.04%
10	-130.4	-0.37%	-46.9	-0.13%	26.1	0.07%
Average	-83.5	-0.64%	0.0	0.00%	0.0	0.00%

Table 6 demonstrates that while a carbon tax is originally regressive, the tax can be made very equitable by dispensing all revenues back to households or reducing VAT, parallel to raising the

carbon tax. The carbon dividend would be approximately NIS 83.5 per month, and following the dividend the general outcome of the carbon tax will be progressive. The income of households in deciles 1-4 (which can be associated with low to mid-low classes) will increase, the income of households in deciles 5-7 (middle or mid-high classes) would hardly be altered, and the income of households in deciles 8-10 (mid-high to high classes) will decrease slightly. On the other hand, scenario C, exploring VAT reduction, does not lead to a more progressive taxation system, but in fact cancels most of the regressivity of the price raises due to the carbon tax, and thus makes the carbon tax relatively equitable and neutral in terms of its distributional impacts. The higher deciles might benefit a little more from the lower deciles in such a scenario, but the differences are very small.

Finally it should be mentioned that although the results depicted in the graph are not very high in absolute terms, they are still of significance. First, since even a sum of NIS 540 per annum is not negligible for families in the first decile, and a sum of NIS 1,000 per annum is not negligible for an average family. Secondly, we can learn from the results about distributional impacts of the taxation, which would be relevant even if the carbon tax would be higher and will have more dramatic impacts on households, a very possible scenario (primarily if the tax will cover additional GHGs and impact other sectors).

Impact on Total GHGs Following an Evaluation of Changes in Demand

In this last section we examine how the decline in carbon consumption among households would impact the entirety of carbon consumption.

Table 7: **Decline in GHG Emissions by Fuels**

Fuel	Unit	Rate of Decline in Household Consumption	Reduction in total household expenditure, NIS	Reduction in consumed quantities	Reduction of GHG Emissions, Ton
LPG	Ton	0.60%	8,735,756	735	2,023
Heating fuel[1]	Kiloliter	0.97%	1,120,793	155	418
Electricity	1,000 kWh	3.79%	322,555,051	641,707	470,371
Gasoline and Diesel	Kiloliter	1.05%	126,740,604	17,408	40,976
Total					513,787

[1] We assume that all private heating expenditures are dedicated to heating diesel fuel, although a small rate of expenditures might be dedicated to household heating by kerosene based fuels.

This table indicates that following the short term effects of the carbon tax, national GHG consumption will decline by about half a million ton. In order to better understand the magnitude of the numbers, the change in emissions should be examined as a rate of total national CO_2 emissions .

Table 8: **The Decline in CO_2 as a Rate of Total Emissions**

Sector	**CO_2 Emission Reduction**
Electricity – Households	3.58%
Utilities[1] – Households	3.40%
Utilities – Total	1.10%
Transportation – Households	1.01%
Transportation – Total	0.25%
Total	0.76%

[1] Utilities include electricity consumption as well as GHG consumption for household heating.

At first glance, the data featured in the table seems low. Supposedly, following the tax, Israel will mitigate less than 1% of GHG emissions countrywide. However, examination of the data should consider that this work studies the distributional influences of a carbon tax, focusing only on households, therefore a decline resulting from a carbon tax in other sectors of the economy, such as the public sector or industry, is not included in the research. In order to better understand the impacts of the tax, the focus should be on the change in emissions relative to total household emissions. It is discernible that the influence on GHG emissions as a result of electricity consumption and energy in general among households is non-negligible at close to 3.5%, whereas the change in emissions from transportation is smaller.

Furthermore, it is important to remember that in this paper, the indirect impact of the tax on sectors other than transportation and energy was not examined, which is anticipated to lead to an additional decline in emissions. Additionally, the table only includes a decline in CO_2 emissions resulting from a short term price increase, and is based on short term demand flexibility, which is smaller in magnitude than the long term flexibility. However, in the long term a carbon tax should change the entire conduct of the economy, incentivize businesses to adopt low carbon solutions and develop new technologies, and encourage households to adopt solutions leading to GHG mitigation. It might therefore be expected that the flexibility of demand for polluting products be higher, as well as the mitigation of emissions.

2.6 Summary

This research is the first examination of distributional influences of a carbon tax in Israel. In summation it is appropriate to mention the limitations of the study and the primary conclusions arising from it. The research does cover a number of sectors, but it is still limited in scope. As mentioned, only the direct impacts of the tax on prices of fuel, electricity and public transportation were examined, but not the influences on the entirety of products in the economy; it focuses on short term impacts and only examines CO_2 and not all greenhouse gases. As for distributional impacts, this study is based on examining the change among households in relation to their annual income. Follow-up studies should further examine the changes in relation to permanent income, the anticipated lifetime mean income. Furthermore, methodologically, the examination should be applied to additional surveys of the Central Bureau of Statistics, since the results of expenditure and income surveys tend to fluctuate to a degree.

Despite its limitations, this research presents a number of important conclusions. The first is that should carbon tax revenues be used to increase state revenues, the tax is expected to be regressive and more detrimental to the lower deciles. However, the influence of a carbon tax is not expected to be as dramatic as might have been expected. A tax of NIS 130 per ton of CO_2, which is not low compared to taxes used around the world or mentioned in literature, will increase household expenditure by NIS 37-130 per month, and in any case would not increase expenditure on consumption by more than one and a half percent of income. It seems that households may be able to afford the carbon tax (which is lower than some of the tax increases noted in recent years), yet policy makers should still ensure that the tax is not regressive and exacerbates inequality.

This study suggests two options to promote an equitable carbon tax – the appropriation of all tax revenues to citizens by means of a 'carbon dividend', making the tax progressive rather than regressive. Beyond the fact that such a dividend is just, as it would lead to mitigating inequalities, it would make the tax more acceptable by the public. Another option is to reduce VAT and thus offset regressive impacts of the carbon tax. The peril of this option is that residents would not feel the VAT decrease, as it would expand across many sectors, whereas the increase in energy prices would be more evident. There is also a risk that VAT might be re-elevated whenever the state digresses into a large deficit, whereas a carbon dividend might be harder to cancel.

In any case, it is clear that by means of the two suggested solutions an equitable carbon tax can be promoted, a critical tool for the Israeli effort to mitigate greenhouse gases.

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Appendix: Summary of Carbon Pricing Measures in Select Countries

Country	Economic Tool	Scope	Regressivity Relief Measures	Other Comments
Australia	Carbon pricing system. During initial years a price is set (AUD 23-24.15 per ton of CO_2) and later determined by market	Most polluting companies, excluding transportation and agriculture.	Raising tax threshold and direct payment transfer to eligible households.	These is uncertainty concerning the future of the system following the Labor's loss in the Australian elections.
Canada – British Columbia	A carbon tax of CAD 30 per ton of CO_2	Consumption or use of fuels – gasoline, diesel, natural gas, coal, heating fuels etc.	Lowering the first two income tax brackets, tax relief for low income households, transferring assistance to households in the periphery.	The tax is revenue-neutral, all income from the tax is used to mitigate other taxes or increase subsidies.
European Union and other countries	Emissions trading system	Power stations, factories and flights. Applies to 45% of GHG emissions.		Due to economic deceleration in the EU, emission prices plummeted and the system is less effective. The European Parliament had confirmed a deferral in the allocation of some of the permits (awaiting ratification by the European Council) and deliberations continue regarding a more general reform of the system.
Ireland	A carbon tax of EUR 15-20	Non-commercial fossil fuels – transportation, agriculture, household heating and waste (approx. one third of emissions).	Energy efficiency subsidies and a temporary enlargement of grants to eligible households for heating.	The tax is used mainly to increase state revenues at a time of economic crisis.
New Zealand	Emissions trading system	All sectors (including forestry) except agriculture.		The system was supported by industry and critiqued by environmental organizations for the relief it gives businesses: free permits are provided to companies, additional emission costs are effectively limited to NZD 12.5, and there is no limitation on the number of permits that can be bought in the international market.
USA – California	A cap and trade system. The system was expected to merge with the Quebec system in 2014.	In the first stage – heavy industry and power stations. Starting in 2015 will apply to transportation and should eventually cover some 85% of emissions in the state.	Private utilities are required to sell permits and use revenues to assist polluting industries, small businesses and all households. The government is required to prioritize weakened populations in its use of tax revenues.	In the first stage most permits are allocated. Auctioned permits were sold thus far for slightly higher than the USD 10 minimum price.
USA – North Eastern States	Power stations emission trading system in NE US (Regional Greenhouse Gas Initiative)	Power stations.		The demand for permits is lower than anticipated, as a result many permits are not sold and permit prices are close to the preset minimum (USD 2). The system is unique in that almost all permits are auctioned and not allocated to companies.

The Association of Environmental Justice in Israel (AEJI)
المنظمة للعدل البيئي העמותה לצדק סביבתי (ע"ר)

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:

1. 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.

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

3. 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.