

Climate Action Begins at Home

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While it's clear that solving the urgent climate crisis requires substantial collective governmental effort at all levels, from the local to the federal, it is also very much the case that climate action starts with what we as individuals and families do. This is a critical first step because

- a) although solving the climate crisis is a daunting task, it starts at home where the cumulative impact of millions of painless choices can be immense, and
- b) while collective governmental action undoubtedly can have a greater effect than individual action, those of us aware of the problem, its causes and remedies, will have no authority or credibility in urging friends, co-workers, family members, and candidates or elected representatives to take action unless we are doing all that we can to address the crisis ourselves.

What's the Climate Crisis?

In a nutshell, Figure 1 depicts the problem:

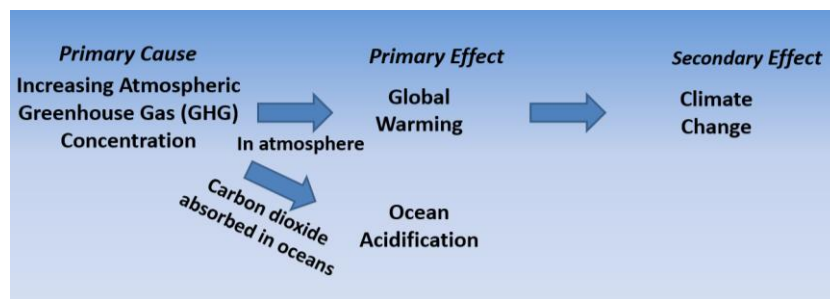


Figure 1. The climate crisis in brief.

As illustrated, the primary cause of the current climate crisis is the increasing concentration of greenhouse gases in our atmosphere. These gases absorb and retain heat as a function of their concentration in the atmosphere. They are increasing largely as a consequence of two human behaviors: (1) the extraction, processing, and burning of fossil fuels (coal, oil, natural gas) which release into the atmosphere the warming gases carbon dioxide, methane and nitrous oxide; (2) land management, especially conversion of forests to agriculture and the harvesting of timber from native forests again releasing carbon dioxide, methane and nitrous oxide.

The primary immediate effect of the increasing concentration of these gases is warming of our atmosphere. These gases are measured in terms of their equivalence to carbon dioxide (designated as 1) as warming agents reported in carbon dioxide equivalent (CO₂e) values. They have risen from about 280 parts per million (ppm) before the industrial revolution (mid to late 1700s) to over 500 ppm today. Additional consequences of these atmospheric greenhouse gas

increases are warming of oceans and melting of polar and non-polar ice causing ocean level rise.

This atmospheric warming is, in turn, imparting additional moisture and energy into the atmosphere and disrupting historical climate and weather patterns, hence climate change.

A correlated problem is that much of the released carbon dioxide is absorbed by oceans where it turns to carbonic acid. Thus, a parallel but non global warming problem caused by fossil fuel combustion and land conversion, is the acidification of our oceans threatening marine species and ecosystems.

Although the warming is not the same across the globe, we have assessed a global average warming since the industrial revolution of about 1°C (1.8°F) with greater warming in the Arctic than elsewhere.

We are grateful to these greenhouse gases because, without them, the global temperature would be between 35°F and 55°F cooler than currently, thus slowing or negating the evolution of life that brought us into existence. For a more complete discussion of the scientific consensus on global warming, visit [Global Warming - Climate Chaos: The Twelve-Step Science Consensus](#).

The problem is less the warming and climate chaos we have experienced to date, than what climate projections suggest we will experience if we continue the current trajectory of accelerating fossil fuel use, land conversion, and consequent accelerating greenhouse gas emissions. If we continue this trajectory, by the end of this century (2100) the global average temperature could be well over 5°C (9.0°F) warmer than before the industrial revolution. To put this into context, this is within the range for warming that has occurred since the depths of the last Ice Age 18 to 20 thousand years ago when ice sheets in North America were up to 12,000 ft (over 2 miles) thick. The problem is that warming of this severity would likely destroy current natural ecosystems (grasslands, forests, deserts, tundra, etc.) across the planet along with the species these ecosystems support. This would also destroy our agriculture, forestry, and fisheries. It is consideration of the impact of global warming on our natural life support system that has led the Intergovernmental Panel on Climate Change, among others, to conclude that to avoid a climate catastrophe we must limit warming to under 2°C (3.6°F) above the preindustrial revolution temperature and – better – to no more than 1.5°C (2.5°F). This represents a substantial challenge and requires that each of us individually, and all of us collectively, do everything we can to minimize emissions of greenhouse gases.

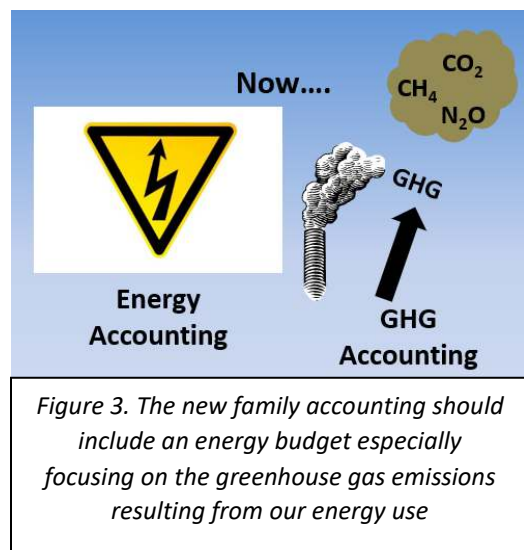
After reviewing the climate literature, the Intergovernmental Panel on Climate Change has concluded that to achieve the goal of a temperature rise below 2°C, we need to achieve net zero emissions by 2050. This means that human activities emit only as much greenhouse gas annually as natural systems can sequester (capture and store). The Biden Administration has established such a commitment for the U.S. A reasonable personal goal that U.S. residents might adopt, could be achieving as close to net zero individually or as a family as soon as we can.

Back before we became aware of the climate crisis, we lived a happy life where money flow was the main family budgetary concern (Figure 2). If money in exceeded money out, the family was happy. Unfortunately, with our growing understanding of the climate crisis, its causes and trends, we now must add to our thinking new considerations, as identified in Figure 3. These socially responsible considerations include an assessment both of our energy use and of the greenhouse gas emissions that result from this energy use. Specifically, we now should try to reduce as much as possible energy use resulting from our actions – including energy used in producing and transporting to us items we purchase.



Figure 2. The happy family consequences of a budget where money in exceeds money out.

Although any steps we take individually or as a family to reduce energy use and resulting emissions are helpful, before embarking on an effort to reduce emissions, it is probably helpful for us to assess the emissions consequence of our current lifestyle. We can then assess the impact of any changes we consider or undertake. This can be done through any one of a number of online and readily accessible ‘Footprint Calculators.’ One relatively simple such calculator is the [Berkeley Cool Climate calculator](#) for which we (SOCAN) offer [written instructions](#) and a [video tutorial](#). We will use the categories in this calculator (Travel, Home, Food, Goods, Services) to identify some steps that might be considered by individuals and families wishing to reduce their climate impact.



Travel:

Each gallon of gas combusted results in the emissions of about 20 lbs of carbon dioxide, while the extraction, production and transport of these fuels results in the release of other greenhouse gases. Globally, the percentage of greenhouse gas emissions resulting from transportation is reported in the range of [14%](#) to [17%](#). Meanwhile, in the United States, the [EPA](#) assessed that, in 2020, transportation accounted for some 27% of emissions. These values are largely attributable to our use of the inefficient Internal Combustion Engine (ICE) using petroleum

combustion as the energy base. Reflections on how to reduce our individual and family transportation GHG emissions therefore involve actions that reduce ICE fuel use.

A number of approaches to addressing this emissions source are available:

If we can afford it, trading our ICE vehicle for an all-electric Battery-powered Electric Vehicle (BEV) or a Plug-in Hybrid Electric/ICE Vehicle (PHEV) is a great option. A critical question often asked is whether – given the materials requirements of electric vehicles and their batteries – these are really climatically better than the ICE. The Fuels Institute recently published ([Eichberger 2021](#)) a cradle to grave (full Life Cycle) assessment of the choices and revealed that the average ICE produces 66 tons of carbon dioxide over its lifespan (average 200,000 miles), the Hybrid 47 tons, and the BEV 39 tons. Not surprisingly, because the life cycle benefit from the electric option arises from the day-to-day operation of the vehicle, if we just look at the vehicle production emissions costs, the comparison is reversed, with the ICE production accounting for 17 tons, the HEV 29 tons, and the BEV 39 tons. The critical comparison, however, is the former, which demonstrates the huge benefits of both electric options with the Hybrid clocking in at nearly 30% lower emissions than the ICE, and the BEV at over 40% lower. However, even with the federal and state incentives available across the country (check with BEV / PHEV dealers since they will know what these are), not everyone can afford this option.

For those for whom the electric option is out of reach, there are steps users of ICE vehicles can take to reduce emissions:

- i) Buy, rent, or lease the smallest vehicle that your personal needs demand since heavier vehicles demand more gasoline (i.e., have a lower m.p.g.).
- ii) Since well-maintained and well-tuned vehicles produce fewer emissions, it is beneficial to keep the vehicle up to snuff in this arena.
- iii) High speed driving results in profoundly greater emissions. It is advisable to find out what road speed results in the lowest emissions for the vehicle we own, and adjust our cruising road speed accordingly. We can then adjust our road speed by keeping the cruising speed as close to that recommended optimum as possible and reasonable, even if this means planning to leave for trips a little earlier.
- iv) Acceleration, especially aggressive acceleration, heightens emissions, so a good tactic is to coast to traffic lights that are red so as to avoid having to stop and then accelerate. Though this doesn't work for STOP signs, we can avoid screeching from the stop with rapid acceleration.
- v) Whenever possible, we can reduce Vehicle Miles Traveled (VMT) by carpooling so we can take advantage of High Occupancy Vehicle lanes that reduce congestion.
- vi) We can avoid situations such as drive-through restaurants, school pick-ups, cold morning warm-ups where the vehicle spends time idling. While a warm engine performs better than a cold engine, it will actually warm up faster when being driven.
- vii) Another way to reduce VMT is to plan and consolidate errands to maximize the number of excursions and reduce the number of trips.
- viii) Another option for reducing VMT is to walk, ride a bicycle, or use public transit.

Airline flights are extremely emissions intensive modes of travel. Since a major emissions component of airline travel is the take-off / landing combination, the only time that airline travel is better than ICE travel is when [we artificially compare](#) (Figure 4) long-distance airline travel with single occupancy ICE vehicle travel.

An alternatives to airline travel is tele-conferencing using commercial video-conferencing software.

On those occasions when we absolutely must fly, an option is to compensate for the emissions resulting from the flight by purchasing carbon credits. However, we

have to be aware of [the problems associated](#) with carbon credits/offsets and the requirements that have been established for these to be legitimate. We must confirm that the entity in which we invest is credible and certified.

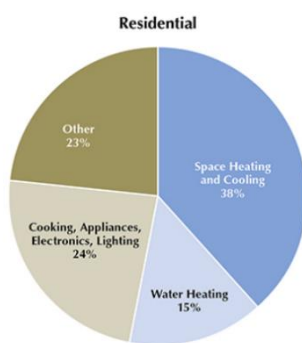


Figure 5. Components of U.S. residential building emissions

Home

The operation of commercial and residential buildings accounts for some [27% of global](#) or [29% of U.S.](#) greenhouse gas emissions (including offsite electricity production). Indeed, in the U.S., residential energy consumption is the [third largest energy use category](#) so it's worth asking ourselves how we and our family can

reduce this personally. Figure 5 identifies where emissions originate in residential buildings;

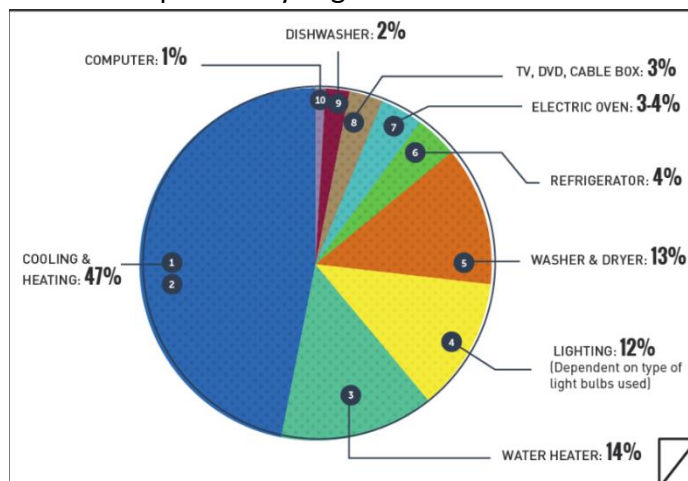
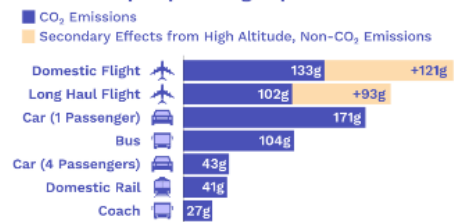


Figure 6. Energy use by domestic appliances in the average home

domestic appliances fit. Clearly water heating, for direct personal use or washing (along with drying) clothes are also substantial uses. Also, lighting, depending on the kind of bulbs used (where Light Emitting Diodes – LEDs are by far the most energy efficient), food preservation

Emissions from Different Modes of Transport

Emissions per passenger per km travelled



Note: Car refers to average diesel car

Source: BEIS/Defra Greenhouse Gas Conversion Factors 2019

Figure 4. Emissions per km traveled from different modes of transportation.

(refrigeration) and cooking are consequential. Additionally, dishwashers contribute a little, as do televisions (with large-screen TVs using more and [Plasma screens scoring worse than Liquid Display Crystal screens when Light Emitting Diodes are incorporated](#)). In the hierarchy of appliances, radios score well below televisions with the older Cathode Ray Tube screen intermediate between the LCD and Plasma technologies in terms of energy use. Those seeking a source of noise should probably consider the greater energy efficiency of the radio as opposed to the TV. The basic principle is that any reduction in energy use reduces GHG emissions and saves money.

Heating, Ventilation, and Air Conditioning (HVAC)

As discussed above, domestic space heating, cooling and conditioning results in the greatest energy use and greenhouse gas emissions in residences. Thus, anything we can do to reduce HVAC equipment use will reduce our footprint.

The first step, if not already in place, is to install a programmable thermostat to heat and cool only when we are present and need it. This can also be set such that our living area thermostat is a little lower in winter and a little higher in summer than we have historically established.

One of the most efficient means of space conditioning for temperature is the electric Heat Pump. Unfortunately misnamed because it both heats and cools, this technology uses far less energy than conventional heating and cooling systems and can adjust residential temperatures much more quickly. While natural gas companies promote gas heat pumps, these are far less efficient in terms of emissions than electric heat pumps.

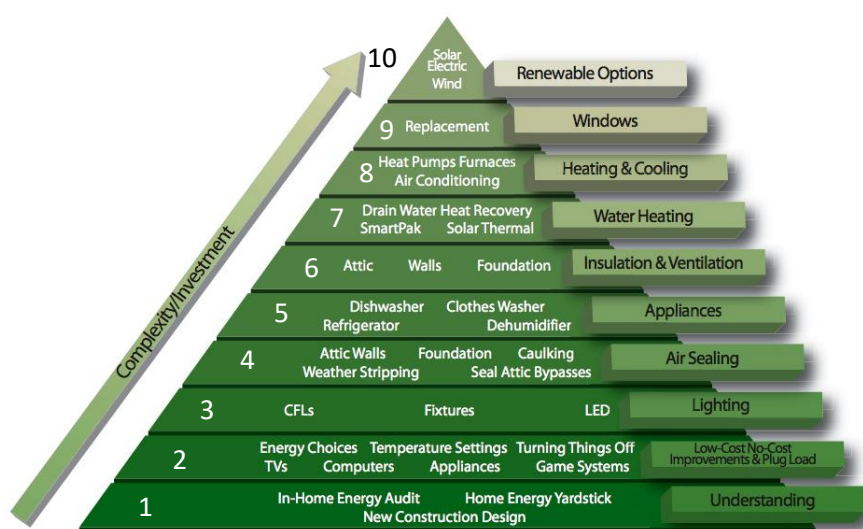


Figure 7. The Energy Efficiency Pyramid depicting from the base up the sequence from the cost-effectiveness of residential modifications

Figure 7 provides a guide to the [cost-effectiveness of various actions](#) we can undertake to reduce our energy use, expenditures, and greenhouse gas emissions from most cost-effective at the base to least at the apex.

Row 1 – recommends a [home energy audit](#) as a first step since this will provide

information on which of the rows in the pyramid constitute the most cost-effective steps to take. If you are lucky enough to be building a new home, it's worth contacting one of the

organizations that certifies building construction in terms of energy efficiency. In Oregon, [Earth Advantage](#) offers such a service. If living elsewhere, a search for 'Home energy efficiency certification systems' would probably reveal a local entity able to do this.

Row 2 – offers what are often termed 'soft' solutions that require only a behavioral change rather than requiring the purchase of new equipment / appliances.

Row 3 – addresses lighting and suggests replacing traditional incandescent (thankfully, difficult to find these days) or Compact Fluorescent Lightbulbs (CFLs) with Light Emitting Diodes (LEDs). This is very cost-effective because LEDs use much less energy and last much longer.

Row 4 – introduces air sealing to keep cold drafts out of the home in winter and avoid heat leaks during the summer. A way to find such leaks is to conduct a '[Blower Door Test](#)' during which air is sucked out of the building through a vacuum pump in the doorway surrounded by an airtight door seal. This reveals where air can enter or leave the building and allows sealing the leaks.

Row 5 – addresses large appliances and urges energy efficiency. When purchasing appliances, particularly large appliances, a visit to [energystar.gov](#) for efficiency comparisons with a focus on items that are the most energetically efficient will help reduce emissions.

Row 6 – revisits the building shell and assesses the insulation that keeps warm air in during winter and out during summer.

Row 7 –assesses the efficiency of our water heating system

Row 8 – explores the efficiency of our space heating/cooling and air conditioning

Row 9 – involves window and frame assessment and the potential replacement with multi-paned glass windows and/or better seals.

Row 10 – finally consider the installation of renewable energy generation. Installation of domestic solar and /or wind turbine options is at the apex in terms of its cost-effectiveness. However, it is also probably the case that even If we have the leakiest and most energy inefficient home on the block, installing renewable energy generation technology would mean that our wasted energy is either resulting in no or fewer greenhouse gas emissions than if we were wasting energy from the grid. Thus, from the perspective of addressing climate change, this is a positive step to take even if it's not the most cost effective step.

Domestic Appliances:

Turn 'em off whenever possible is the most obvious remedy to the power consumption and emissions from the energy we use with domestic appliances. While lights, televisions and radios are not huge energy consumers, they certainly consume energy, so it's probably worth considering turning them off when not in the same room and thus they are not in use. Again,

the question is: are we doing everything we can to reduce emissions by incorporating energy conservation behavior into daily thinking?

Vampire energy consumption occurs because many electronic appliances are [not really shut down when they are turned off](#). The ubiquitous colored LED light on the appliance when it's turned off is a giveaway of this condition. Thus, the appliance continues to consume a small amount of electricity even when not in use – unless power to the appliance is completely cut off. [Duke Energy](#), for example, reports that vampire load is responsible for 5% of U.S. energy consumption, and costs consumers \$3 billion annually. The solution is to attach such appliances to a power strip and turn that off. But, beware, satellite and cable television providers require constant access through which they keep our systems updated.

Given the energy cost of heating water, it is worth considering washing in cold water, providing an appropriate detergent is available, and then drying clothes on a line or rack/clothes horse rather than using the dryer. This is clearly easier during summer than winter, but indoor clothes racks work effectively in winter to allow drying.

Another remedy for the energy cost of heating water is to adjust to heating water only when hot water is needed, rather than wastefully keeping the water hot all day and night.

Electrification An essential principle with electricity as an energy source is to recognize that the use of electricity does not itself result in emissions; rather it is the generation of the electricity when the power plant is fueled by fossil fuels (i.e., coal, oil, methane) that results in GHG emissions. In 2020, the Oregon Legislature passed, and Governor Brown signed, House Bill 2021. This bill demands that by 2040, all electricity retailed in Oregon, whether generated within or outside the state, shall be 100% clean - meaning generated with no fossil fuels. As a result, Oregon electric utilities will be required to switch all their Oregon retail capacity away from fossil fuels. In addition, the 'natural gas' (methane) utilities are also charged to reduce their greenhouse gas emissions. Unfortunately, their effort, typical of an industry that has spread disinformation about its product for decades, is largely a smoke and mirrors campaign focusing more on marketing than real emissions reductions. As a result of HB2021, and agency programs developed in response to Governor Brown's Executive Order 20-04, electricity in Oregon will become much less of a climate threat than previously.

Given the methane and carbon dioxide emissions that result from methane usage, and the negative health effects of that gas in the home, Oregonians have considerable reason to engage in the 'electrify now' effort which urges residents to convert both their vehicles and homes to electricity and away from gas. A more complete discussion of the problems with methane (natural gas) and the benefits of electrification is available in: [Methane Gas: Health, Safety, Economic, and Climate Impacts: A Case for Equitable Electrification](#).

The main benefit of electrifying results from the fact that electric motors are far more efficient than their non-electric counterparts. As a consequence, even when the electricity is generated from a coal-fired power plant, the emissions resulting from the use of that electricity are lower.

Banking An element of our individual behavior that we often fail to appreciate is the impact of our banking decisions. The problem is that some banks have a history and commitment to using our investments to promote fossil fuel extraction or fossil fuel combustion projects. The problem is that many major U.S. and international banks invest in such activities, so the funds that we deposit in these banks support exactly the activities we understand promote the climate crisis. Morgan Chase, Citi, and Wells Fargo (with Bank of America close on their heels) are among the greatest offenders in this regard, a conclusion supported here (Figure 8).

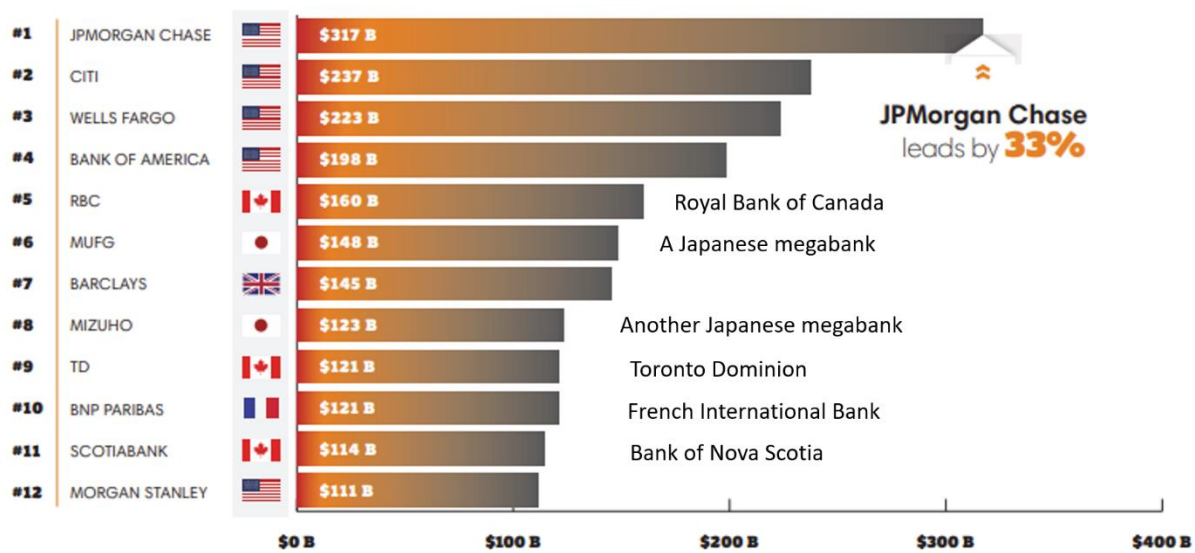


Figure 8 The dirty dozen global banks invest billions in promoting climate chaos.

The climate friendly approach is to remove our accounts (including credit cards and mortgages) from these banks and transfer them to a bank that has adopted Benefit Corporation principles (see discussion under 'Goods' below). The Global Alliance for Banking Values comprises banks that operate on such principles. While most credit unions operate on parallel principles, the following banks are among those that do not invest in fossil fuel extraction or processing: Albina, Beneficial State Bank, Southern Ben Corporation, Sunrise Bank B Corporation. These banks generally do not have local branch offices scattered across the nation, but most banking can be undertaken via internet and telephone communications so this is not a major barrier.

Food & Drink

In 2021 the U.S. EPA estimated that each year, U.S. food loss and waste embodied 170 million metric tons of carbon dioxide equivalent (million MTCO₂e) GHG emissions (excluding landfill emissions) – equal to the annual CO₂ emissions of 42 coal-fired power plants. While it's valuable to prepare more food than needed, we should use 'leftovers' for future meals. The serving motto 'take only what you know you can eat,' provides a valuable guide; we can always serve more, but generally not return half-eaten items from our plate.

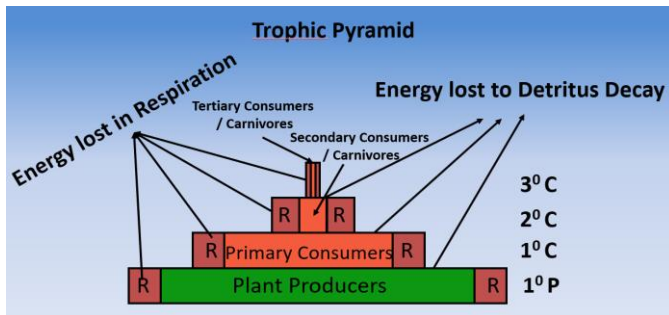


Figure 9. Trophic pyramid depicts trophic energy levels per unit area indicating the loss of energy at each step up

Eat low on the food chain – it's healthier and more energy efficient. Energy is lost at each level up the food chain (Figure 9) while meat production can emit vast amounts of greenhouse gases. As we climb the so-called trophic pyramid from photosynthetic producer plants (in green) through primary consumers (herbivores) to secondary consumers (carnivores) and so on energy (in red) is lost as organisms respire (i.e., burn the biomass to release energy- especially

great for fast-moving predators). The rule of thumb often quoted is that only 10% of the energy present in a [trophic level is available](#) to the next level. Thus, for any given area, there is far more energy available in the vegetation than in the herbivores (cows, pigs, chickens, etc.) that would eat that vegetation. This is the main reason why folks don't often farm carnivores; it's energetically and economically inefficient.

Some additional suggestions:

When cooking – cover boiling pans – they heat more quickly and use less energy.

We should also use appropriately sized cooking containers; since energy is saved by heating less rather than more water, smaller containers are better.

Because of the emissions resulting from shipping, it is always better to buy locally grown, brewed, fermented, or manufactured produce thus saving transportation costs.

We should buy organic produce whenever possible – unless high in shipping costs; energy is consumed and emissions result from both producing and distributing pesticides and fertilizers.

Buy 'fair trade' items whenever possible; by paying the producer a fair price, resource destruction (often tropical forest) is reduced.

It is better NEVER EVER to buy bottled water. Instead, buy a reusable non-plastic (steel?) container and carry your own water supply; it's worth noting that the health regulations for bottled water are no better than those for tap water and maybe worse. A major problem is that the bottle takes energy to produce and transport, and most of them end in the landfill.

Goods

Personal consumption of goods and services certainly drives our economy. Unfortunately, it also drives the climate crisis. This is because the goods and services that we consume require a combination of energy and material resources for their existence. Thus, it takes energy and resources to produce the goods that we buy and are transported to us. When greenhouse gas emissions assessments (called inventories) are undertaken, sometimes they include these emissions, but not always.

Greenhouse Gas (GHG) Inventories assess the GHG emissions for regions. When we assess greenhouse gas emissions on a large scale, such as a state, two kinds of inventories are possible: one is termed a sector (or in-boundary)-based inventory and the other a consumption-based inventory. The former simply assesses the emissions that occur within an area though the sector inventory usually includes emissions from utilities (such as electricity) generated outside the jurisdiction that are transmitted in. The consumption-based inventory, on the other hand, assesses the emissions that result from the production and transportation of items consumed (purchased) within the boundary. Thus, the emissions resulting from items manufactured inside but shipped out are subtracted, while emissions from items manufactured elsewhere and shipped in are added. As an example, [Oregon's, sector-based and consumption-based GHG inventories](#) (Figure 10) show that for this state, the consumption-based inventory charges to the state greater emissions than the sector-based inventory.

This is what would be expected in a state where emissions from industrial manufacturing are

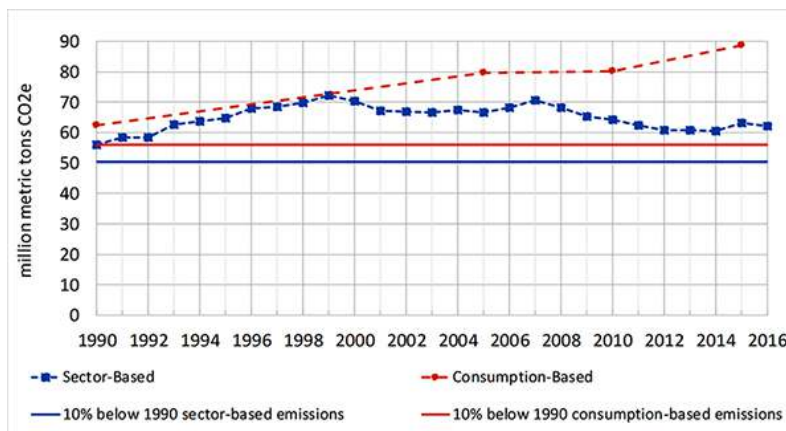


Figure 10 Oregon's Sector-based and Consumption-based greenhouse gas inventories from 1990 through 2015/16

not as substantial as elsewhere. Oregon is a larger importer of manufactured goods than an exporter. States such as Michigan and Ohio, for example, where manufactured exports are a greater proportion of the economy might have an in-boundary inventory that is greater than the consumption inventory since manufactured goods that are exported from the state are deducted from the consumption-based assessment.

A profound message from this discussion concerns the impact on our personal inventory of buying items manufactured or grown at great distance from us. In assessing how effectively our behavior fully accounts for and minimizes emissions for which we are responsible, we must include the cost of our consumption behavior.

Refuse, Reduce, Reuse, Repurpose, and Recycle comprises the updated version of the phrase Reduce, Reuse, Recycle which was born in the 1970s. One of the unfortunate outcome of the phrase has been our tendency to focus on the last concept when the previous 2 or 4 are actually at least as important if not more so. The collapse of recycling over the last few years – largely due to [careless recyclers contaminating the stream](#) – underlines the conceptual error we made. The reality is that we cannot counter our voracious and environmentally destructive consumption habit by recycling; it's time to recognize our need to Refuse and Reduce our consumption as well as Reuse and Repurpose as much as possible when we consume. We can also evaluate the practices of those producers from whom we purchase our goods.

The general principle in business is to achieve and promote profits. Indeed, the articles of incorporation of most businesses identify financial profit as the goal. A result of this is that corporate Executives are charged with the fiduciary responsibility of generating profits for themselves, and their shareholders. A consequence of this priority is that actions that reduce environmental damage, such as greenhouse gas emissions, but may be costly are discouraged. When it is cost-effective to pollute our air and waterways, pollution will be the inevitable choice. Shareholders can file lawsuits against Executives who fail to place profits ahead of any other priority.

Fortunately, there are now alternative incorporation principles that businesses can adopt at their inception: [Benefit corporations are different](#), as follows: “A benefit corporation still has a profit-making goal, but it also has a broader public benefit purpose: to make a material positive impact on society and the environment. Managers must work to achieve this purpose and therefore they have the flexibility to make decisions that balance profits with social causes and environmental responsibility.”

Benefit corporations value the triple bottom line of ‘profit, people, and the planet.’ Adopting policies and programs that reduce greenhouse gas emissions are compatible with their business model and do not defy their corporate mission. When buying goods, look for Benefit corporations. A certified B corporation has undergone 3rd party review to assure its consistency with the principles. Local Oregon B Corporations include: Rogue Creamery in Central Point; Inesscents Aromatic Botanicals and Banyan Botanicals in Ashland; Herb Pharm in Williams; and AllCare Health in Grants Pass. Ashland and Medford Food Co-ops may not be B corporations, but they operate under parallel principles. A little further way is Stumptown Coffee in Portland is a B Corporation.

Some additional specific suggestions to reduce our consumption impacts are:

- Before buying new items let’s pause and ask ourselves if we really need that item
- Recycle everything we can – before throwing anything away we should stop and think; recycling reduces landfill needs and industry/ corporate energy consumption in processing raw materials.
- Close the circle by buying recycled items whenever you can - reducing consumption.
- Buy and reuse canvas shopping bags when shopping and retain and reuse plastic veggie bags; in response to the question: “paper or plastic?” just say “Neither!”
- Reuse, Reduce, Recycle paper – print front and back and reuse paper printed on one side. We can buy printing paper that contains as high a percentage of post-consumer recycled materials as is available. 100% recycled copy paper is readily available and serves effectively.
- Replace home paper mop-up products with washable cloth items; disposable paper consumes energy and clogs landfills.

- Use recycled trash bags or better biodegradable trash bags; this reduces the production energy, resource consumption and landfill space occupied.
- Avoid disposable items whenever possible, saving both energy and resources.
- Avoid all plastic products since they are made from oil resources. Besides not being degradable and ending up in the landfill or worse in the oceans contaminating marine animals, plastics result in substantial greenhouse gas emissions.
- Conserve water – when washing dishes or the car, cooking, or cleaning teeth; it takes energy to purify and pump the water.

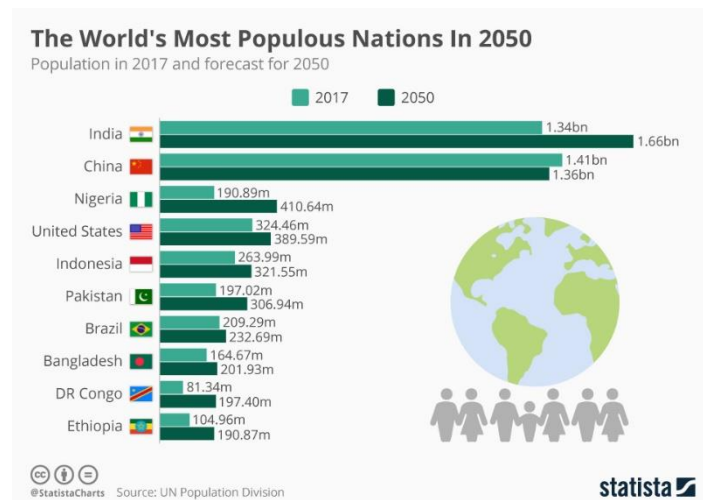


Figure 11. Population of leading nations in 2017 and projected to 2050

We often hear the claim that our environmental crisis, or the climate crisis in particular, cannot be solved unless we address population growth rate. Such claims are often accompanied by reference to charts such as Figure 11, [depicting 2017 and projected 2050 national populations](#). While the number of us certainly contributes to the problem, we should acknowledge that the impact of humans on the environment and climate is a function **both** of how many of us are present, and what each of us

is doing. In this context, 'what each of us is doing' refers to our consumption of resources and our production of waste (in the case of the climate crisis, the waste comprises greenhouse gases). Our consumption is what drives our resource use and GHG emissions. A measure of our climate impact is our individual (per capita) consumption of fossil fuels. This is depicted in Figure 12 in terms of the 2021 [average consumption of energy from coal, oil and gas per person](#) measured in kilowatt hours.

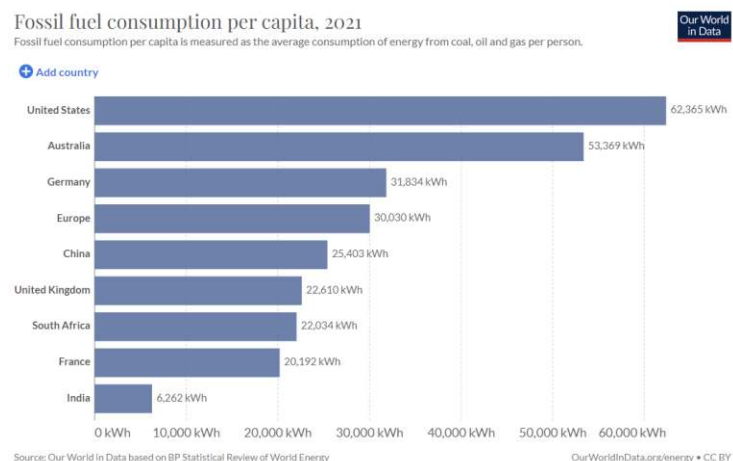


Figure 12. Fossil fuel consumption per capita among leading nations as of 2021

There is no doubt that China and India are the leading contributors to global humanity both now and into the future. However, if our focus is on the relative contribution to the climate crisis, the data in Figure 13 are equally, if not more, relevant since they depict the contribution that each of us makes to the current emissions trajectory as a consequence of our consumptive behavior. No doubt the problem would be dramatically exacerbated if residents of China and India exhibited our per capita emissions behavior, but currently they do not. Certainly, residents of China, India and the developing world nations have legitimate aspiration for economic progress. The message is that while we clean our energy production technology and manage our consumptive behavior, we must do everything we can to help developing nations divert their energy production trajectory away from a fossil fuel-based system.

Services

The service sector includes financial services, retail sales, health, information technology, and education. Since the late 1950s, U.S. expenditures on consumption have risen dramatically. Interestingly, while expenditure on goods has risen sharply, expenditure on services has risen faster. Indeed, over this period, employment in the private sector has risen to [4 out of 5 workers in the service sector](#). Employment in the goods sector has held constant while the service sector has increased five-fold, despite a slight dip during COVID.

While it may not seem as easy to take control of emissions from the service sector, opportunities exist. We can:

- Avoid restaurants that don't offer biodegradable or recyclable take-out / take-home containers; there's no excuse.
- Carry our own take-out containers and insist that they be used rather than plastic / Styrofoam, or whatever.
- Take our own washable, reusable chopsticks If we eat Chinese, Thai or other SE Asian food, and save the trees from which the wooden disposal chopsticks are made.

Incentives:

Because federal and state governments are becoming more attuned to the need to respond to the climate crisis, there are now many forms of incentives available for residents to 'do the right thing' in terms of our homes and both the vehicles and domestic appliance we buy. Some of these incentives come in the form of rebates on the price of items, others in the form of tax credits when we get credits that we can cash in at the time we complete our tax forms in April. While rebates are preferable since they do not require that we pay taxes that are substantial enough to allow us to take advantage of the tax credit, in some cases the tax credit can be assigned by purchasers of covered items to the vendor, who can lower the purchase price a commensurate amount. Often such an arrangement must be set up prior to purchase and cannot be undertaken retroactively, so always check for such options.

[Energy Star](#) offers information on energy tax credits and incentives for undertaking home audits. [Energy Star](#) also offers a discussion of Federal Income Tax Credits and Incentives for Energy Efficiency. The White House has also released an [Inflation Reduction Act Guidebook](#) to help us plough through the mass of options and offers available within that program.

General Suggestions

- Avoid using elevators and handicapped door openers unless necessary; energy is used to haul us up and down buildings and open doors.

Yard and Garden

- Those of us living in dry drought-exposed regions should consider landscaping with native drought tolerant species rather than planting species that require moist soils and thus need our constant irrigation attention.
- The old-fashioned yard equipment (chains saws, mowers, etc.) were powered by two-stroke ICE engines and thus driven by gasoline. We can reduce emissions in the yard by converting to electric equipment. Just as is the case with electric vehicles, electric yard equipment is much more efficient and far less noisy.

Social Interactions:

- We can try to serve as a role model, especially for friends and family. This could include asking friends and family to think before acting.
- The climate communication literature indicates that many of us are unaware of the climate crisis because we just don't ever talk about it with friends, family and co-workers. We can overcome this limitation by talking to people about the crisis. This literature indicates also that those who are skeptical about the issue, are more likely to be engaged and persuaded by family members and friends they trust than by science and evidence presented in the media.
- A valuable perspective might be that saving the planet is as important as saving money.
- In the above context, almost everyone loves their children and grandchildren, so reminding family members that averting our climate trajectory is a matter of inter-generational justice.

Collective Action

As stated initially, the cumulative impact of millions of painless actions can be immense. However, we cannot individually level the playing field in the economic system so that corporations are encouraged, incentivized, or required to conduct themselves responsibly in terms of reducing their greenhouse gas emissions or promoting carbon sequestration (capture and storage) from the atmosphere. Achieving this requires political action at the local, state or

federal level. Individual action consists of a first step. In addition to this, we also should be taking every step we can to elect candidates for elective office who acknowledge the climate crisis and commit to acting appropriately once elected. Then, during the sessions of their elective bodies, we can support proposals that are introduced to address the issue locally, statewide, and federally.

While, at a minimum, we can support and vote for candidates at all political levels who acknowledge climate change and its causes, and who commit to considering the climate change impacts of all issues they confront, keeping engaged with councils and legislative bodies will allow us to support favorable proposals and oppose unfavorable proposals.

Is there a free lunch?

One of the realities in the energy arena is that there is no totally benign energy source when we consider all environmental impacts. Solar panels, for example, can take up valuable farmland or wildlife habitat while wind turbines occupy land and certainly present a hazard for birds (though not as serious a threat as domestic cats and buildings). As a result, we encourage everyone always first to address the low hanging fruit – i.e., first take steps to increase energy use efficiency and energy conservation. Some of the steps we can take to do this seem individually trivial, but – again – the cumulative impact of millions of painless choices can be immense.

An example of a simple behavioral change is: unless we'll be right back, when leaving an area of the home, we can turn off the television, radio, and lights. From a climate perspective, adopting the habit of turning things off is far better than retaining or assuming the habit of just leaving them on. No doubt as we develop the habit of looking at our daily lives through the lens of energy and greenhouse gas emissions accounting, other minor and painless adjustments will become evident.

Closing Comments:

There is little doubt that many of the suggested behavioral and material adjustments contained here do not result in huge reductions in greenhouse gas emissions. Neither recycling nor changing light bulbs to Light Emitting Diodes alone will result in substantial savings, but when undertaken in combination with other efforts, the sum can be substantial. The key, as mentioned earlier, is to factor energy and greenhouse gas emissions reduction into our daily thinking, just as we have incorporated money accounting into our daily thinking all our lives. And, as a bonus, for every kilowatt hour less electricity we use, or gallon of gasoline we don't buy, we will save money. Opponents of climate action often argue that addressing climate change is too expensive when, in reality, many adjustments actually save money. To be sure, purchasing efficient appliances and vehicles involves a capital investment, but these are recovered over the life of the item. In most cases, the ultimate savings are substantial. In addition, the naysayers don't factor into their naysaying equation the cost of inaction. [Swiss Re](#), a meta-insurance company that insures insurers, has conducted economic analyses of the cost

of failing to address the climate crisis. They estimate that global warming of 2°C would globally depress Gross Domestic Product 11.0%, while costing North America 6.9%. Meanwhile, a 3.2°C was estimated to impose a global cost of 18.1% on GDP and 9.5% on the North American GDP. What cannot be accurately factored into such equations, however, is the impact of global warming devastating our natural ecosystem, our agriculture, forestry, and fisheries globally. It turns out the cost of action is far less than the cost of inaction. If we wish to pass to our children and grandchildren a sustainable and livable planet that supports the biodiversity we currently enjoy, action is the only option. The route to achieving sufficient action to avert the looming climate crisis is through an adjustment in our day-to-day thinking and behavior and then converting this individual action into collective action.