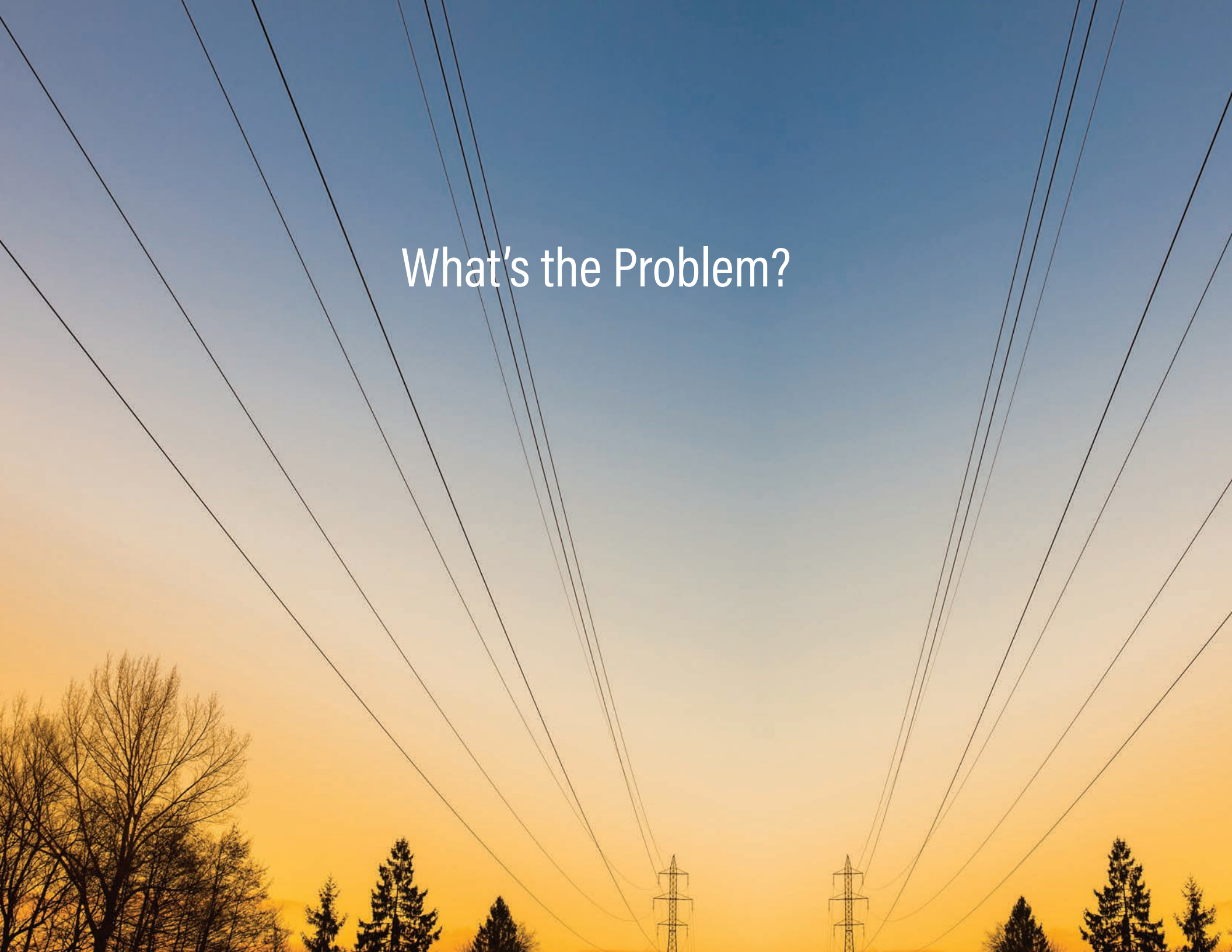
What's the Problem?

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Our lives depend on energy. We use electricity to heat and cool our homes, generate light so we can read bedtime stories to our children, and cook a special meal for our friends. Enjoying a hot shower or a cold beer at the end of the day depends on electricity or natural gas. We rely on gasoline and other liquid fuels to run vehicles, planes, trains and buses so we can get to work or school, go on holidays or to conferences, and visit the grandchildren. Industry employers need electricity, oil and natural gas to make and ship products to stores for consumers. It's not an overstatement to say that our entire way of life depends on energy.

Unfortunately, there are some unintended consequences from depending on this kind of energy.

Most of our energy comes from fossil fuels: carbon-based coal, gasoline, and natural gas. When we burn fossil fuels to generate energy, we also produce pollution that affects air quality and changes the climate.

Air quality is affected because burning fossil fuels generates small particles and volatile organic compounds that react in sunlight to create smog and that make rain more acidic. Special pollution control equipment placed on smoke stacks and in cars can reduce this kind of pollution and once this pollution is reduced air quality can improve quickly. But producing and burning fossil fuels also releases greenhouse gases, like carbon dioxide, methane and nitrous oxide, affecting the climate. These emissions are not easily captured by end-of-pipe technologies.

Figure 2: The oil we dig out of the ground and ship by rail or pipeline is processed in refineries like this one in Saint John and then pumped into our cars at gas stations. The entire process of producing oil and making gasoline and then burning it to make our vehicles run generates greenhouse gas emissions that are destabilizing the climate.

With the global population rapidly increasing over the last 100 years and with a growing and globalized economy so much fossil fuel is being burned that a lot of pollution is going into the air that we breathe. Globally, over 40 billion tonnes of carbon dioxide were emitted in 2014.[11] In Canada, over 80% of the 732 million tonnes of greenhouse gas emissions that we generated in 2014 came from the energy we produce and use, about the same proportion as globally.[12] In New Brunswick, the proportion of our almost 15 million tonnes of emissions in 2014 from energy use was somewhat higher at about 90%[13]

We add the remaining 10 to 20% by cutting trees to make products or to grow food. This happens because through photosynthesis trees and plants absorb carbon dioxide

Figure 3: When we burn coal to generate electricity to heat and cool our buildings and run our equipment and appliances, we also add greenhouse gases to the air. A solution would be to make our electricity from cleaner sources like hydro, wind, solar, tidal power and bioenergy and to use electricity to run our vehicles so we can phase out using oil, except for products like plastics and other important things.[14]

Figure 4: When we bury garbage, especially food waste in landfills, a gas called methane is produced as the waste decomposes. When we cut forests to make pulp we remove living plants and trees that absorb carbon dioxide as they grow and release it when they die. When we cut forests faster than they can grow back we add more greenhouse gases to the air because there are fewer trees to absorb carbon dioxide. When we use too much fertilizer another greenhouse gas called nitrous oxide is created as nature breaks it down. A solution would be to put less food waste in landfills, use fertilizer more efficiently, as well as use more organic methods, and to reduce clear cutting and increase forest conservation and regeneration.[15]

when they grow and release it when they die or are disturbed. Rotting food in landfills and using too much fertilizer also add to the problem by releasing greenhouse gases called methane and nitrous oxide.

We all contribute to the greenhouse gas emissions that scientists know with certainty are changing our climate through our industrial, forestry and agriculture practices, and the way we build our communities and consume and throw away products. This is because greenhouse gases like carbon dioxide, methane and nitrous oxide have a special talent: they hold heat and that is mostly a good thing. Naturally occurring greenhouse gases keep the planet's average temperature just right for life to thrive. More heat energy trapped in the atmosphere because of too many human-generated greenhouse gases, however, is unbalancing the climate system making us less safe from high-energy extreme weather and changes to sea level.

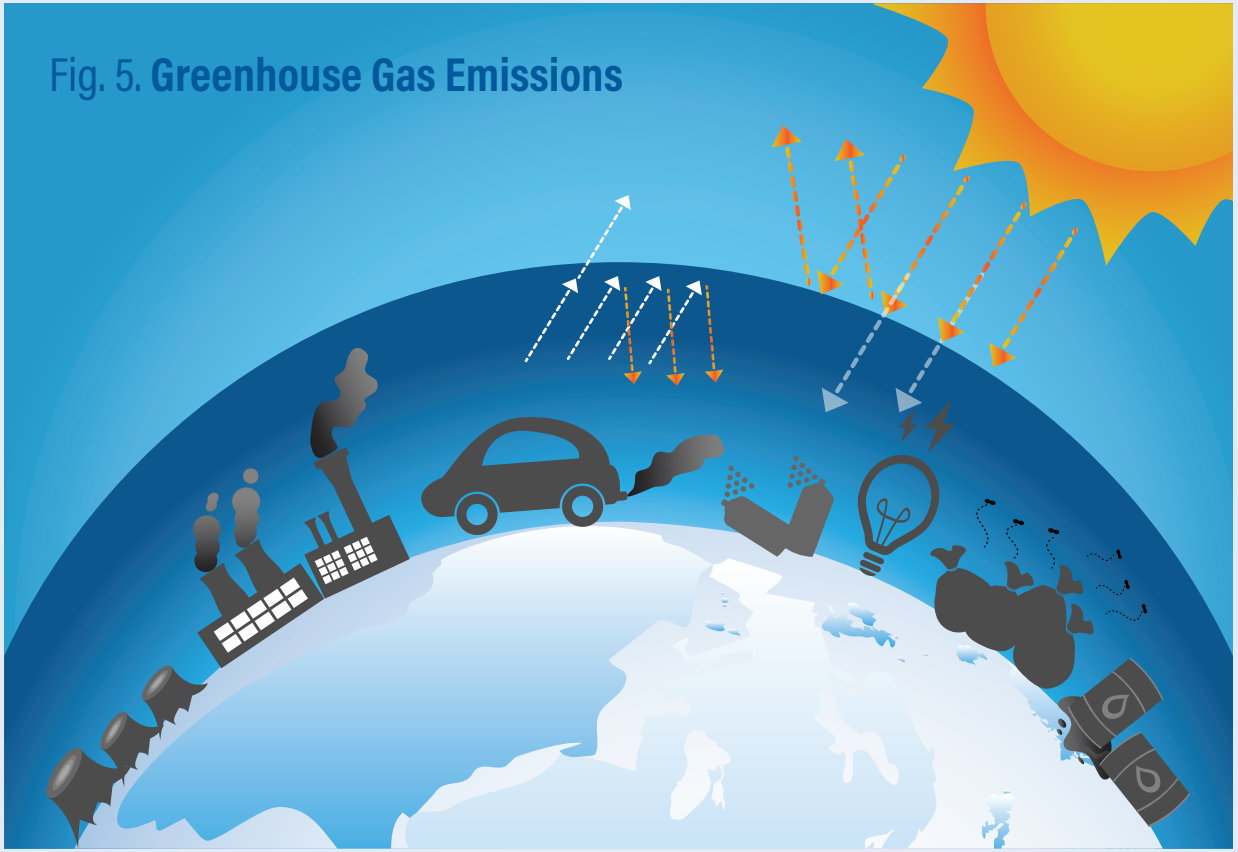
All those greenhouse gases from human activities are adding too much of a good thing to the atmosphere. When these gases get into the air it takes the Earth a long time to process them: up to 100 years or more for carbon dioxide, and for some greenhouse gases, it can take thousands of years.

The world's leading climate scientists are absolutely certain – as certain as 95 to 100% – that humans are the primary cause of the pollution increasing global temperatures:

> *"Anthropogenic greenhouse gas emissions have increased since the pre-industrial era, driven largely by economic and population growth, and are now higher than ever. This has led to atmospheric concentrations of carbon dioxide, methane and nitrous oxide that are unprecedented in at least the last 800,000 years. Their effects, together with those of other anthropogenic drivers, have been detected throughout the climate system and are extremely likely (95 to 100%) to have been the dominant cause of the observed warming since the mid-20th century"* *(Intergovernmental Panel on Climate Change, Core Writing Team, Pachaur, & Meyer, 2014, p. 3)*

While it might sound complicated, think of what we're doing as putting an extra blanket around the Earth. Greenhouse gases from burning fossil fuels act like a blanket keeping heat at the surface so the Earth gets hotter and we go from being cozy to sweating. Unfortunately, when the thicker greenhouse gas blanket makes the Earth too hot, we can't take it off. We're better off in this case to not add any more blankets.

Scientists specializing in understanding how the climate system works understand well the physics of how greenhouse gases affect temperature. And because each molecule of greenhouse gas has a specific capacity to hold heat, scientists can calculate within a range, and with confidence, how much warming is likely to result from different projections of greenhouse gas emissions. Scientists can also calculate the potential influence of higher temperatures on how much moisture the atmosphere can hold. With 71% of the Earth covered by oceans, scientists calculate that for every 1 degree Celsius increase in temperature, the atmosphere can hold 7% more water and that extra water is expected to increase the volume of precipitation by 1 to 2% per degree of warming.[16]



Adding greenhouse gases to the air is like adding a human-made blanket over the Earth.

We can see how these basic facts about climate change are affecting the province that we all care about. The Government of New Brunswick reports that temperatures have "increased by 1.5°C relative to historical norms and seasonal temperatures have increased in all parts of the province".

Most of this warming (1.1 degrees Celsius) has occurred in the last 30 years. When scientists peer into the looking glass using highly sophisticated

"The annual cost of damage to homes due to coastal flooding is expected to reach **$730 to $1,803 per New Brunswicker by 2050**, higher than any of the other Atlantic Provinces and **five times higher** than the Canadian average."

– New Brunswick 2014 Climate Action Plan[20]

Figure 6: New Brunswick is already affected by climate change. Coastal erosion is just one problem that is going to get worse as sea level rises because the oceans receive more water from melting glaciers and expand as they get warmer. These changes mean, for example, that there is more energy in the ocean making waves more powerful. Coastal erosion is already affecting northern communities like Cap-de-Cocagne and our shores are at moderate to high risk in the future.[21]

climate models, the results suggest there is a strong chance that by 2100, New Brunswick's mean annual temperature will increase by as much as 5°C. The number of very hot days (+35°C) is also expected to increase dramatically in some parts of the province. From 2000 to 2010, there were more extreme rainfall events (50 millimetres or more of rain over a 24-hour period) in Fredericton and Moncton than any other decade on record. Climate models project that New Brunswick will experience less frequent but more intense precipitation events, increasing the annual total precipitation throughout the province,".[17]

The climate is changing now and New Brunswickers are vulnerable to higher temperatures threatening the health of very young children and older people, as well as those with health problems[18]. More intense rainfall is causing flooding and damaging our homes; ice and wind storms are knocking out our power, risking our safety in winter and our food supply in summer, interrupting our lives and economy. Sea level rise and coastal erosion are changing where communities can be located. Experiencing extreme events that disrupt our lives also can harm our mental health, as well as our pocket books.

The cost of post-tropical storm Arthur exceeded **$12.5 million**, according to the province's flood history database. Combined with damage costs from other flooding events since 2010, total damage costs exceed $80 million.[19] And these kinds of costs are going to increase over time.

From St. Stephen to Lamèque, disruption from flooding and loss of shoreline is an increasing fact of life. We need to work together to keep our communities safe. We can do that by being more prepared for extreme events and supporting governments in setting new rules for land-use that severely limit development on flood plains and on at-risk shorelines. We need to ensure all infrastructure investments account for projected climate change impacts, as well as the greenhouse gas emissions they might generate over the course of their operation compared to less polluting options.

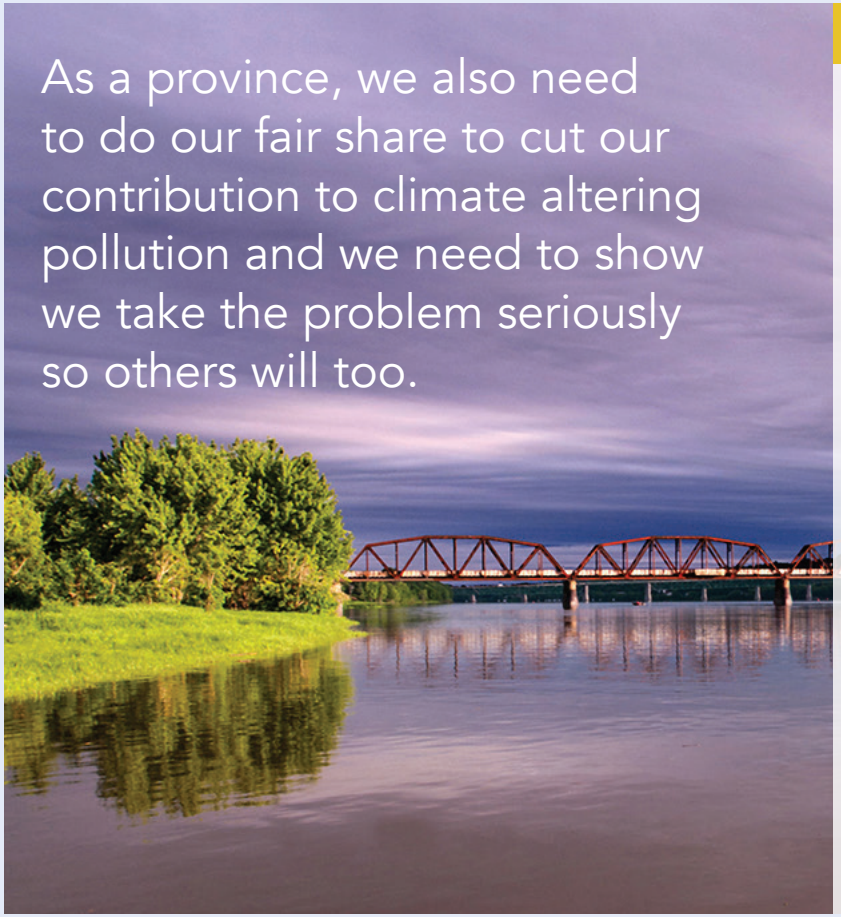
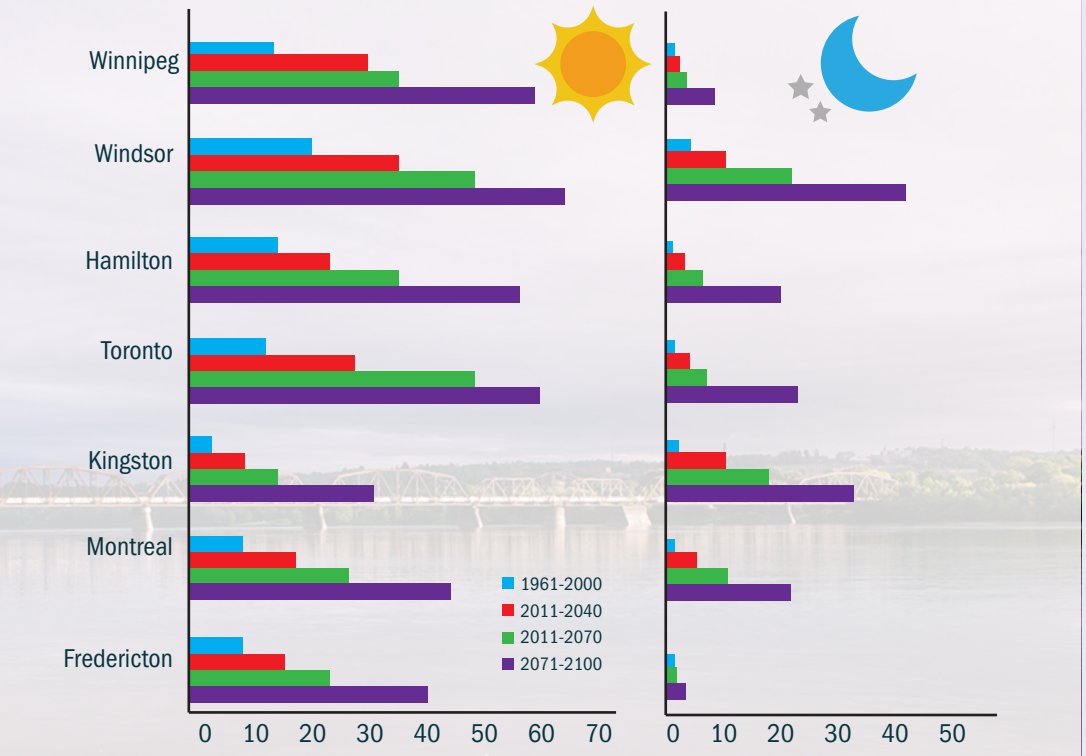


Fig. 7. **Number of hot days above 30º C / Warm nights above 22ºC**



New Brunswick residents will experience more days per year over 30 degrees Celsius with climate change.[22]

We Need to Live Within our Means

New Brunswick has the **third highest per capita emissions** after Alberta and Saskatchewan[23]. We need to cut our greenhouse gas emissions in collaboration with governments in Canada, North America and around the globe because we can't protect the people and communities we care about without national and international collaboration. Slowing growth in greenhouse gas emissions is not enough. We need to work together to get global greenhouse gases to levels the Earth's oceans and land can absorb.

Think of a bathtub with the taps fully turned on and water nearly overflowing. If you only turn the taps slightly to slow the water flow, the tub will still overflow. To stop the bathtub from overflowing, you have to turn the taps off and to get the water level down, you will need to pull the plug. If you think of the atmosphere like a bathtub, we have to lower greenhouse gas pollution enough to slow or stop the flow (turning the taps off) and we have to increase the capacity of the Earth to absorb carbon,

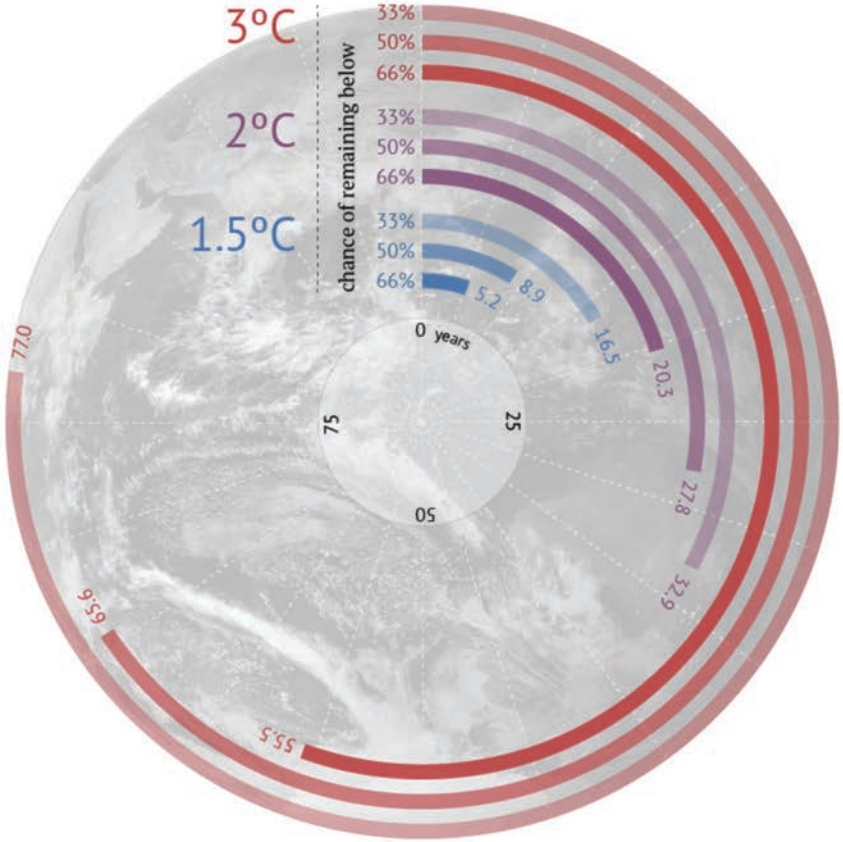
Figure 8: If we want to stop the bathtub from overflowing we have to turn the taps off and pull the plug to lower the water level. We can think of the total amount of water a tub can hold before overflowing as a water budget. The same idea applies to the atmosphere. There is a total amount of greenhouse gas pollution that the atmosphere can hold before temperature increases become dangerous. The global carbon budget is being used rapidly meaning we have to cut the emissions going into the air (turning off the taps) and we have to pull the plug to suck up more carbon (increase sinks).

particularly through increasing green cover with forests and perennial plants (pulling the plug).

You can think of the total amount of water that a bathtub can hold as a water budget. Scientists think of the atmosphere in a similar way when they think about how much greenhouse gas can be released into the atmosphere before exceeding dangerous increases in global temperature which, in turn, would have serious impacts on the climate. There is now a general scientific and political consensus that the world should act to keep global temperature increases to "well below 2°C above pre-industrial levels" and to pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels.[24] This is what countries around the world, including Canada, agreed to at the United Nations climate change negotiations held in Paris, France in 2015. The world has already seen global average

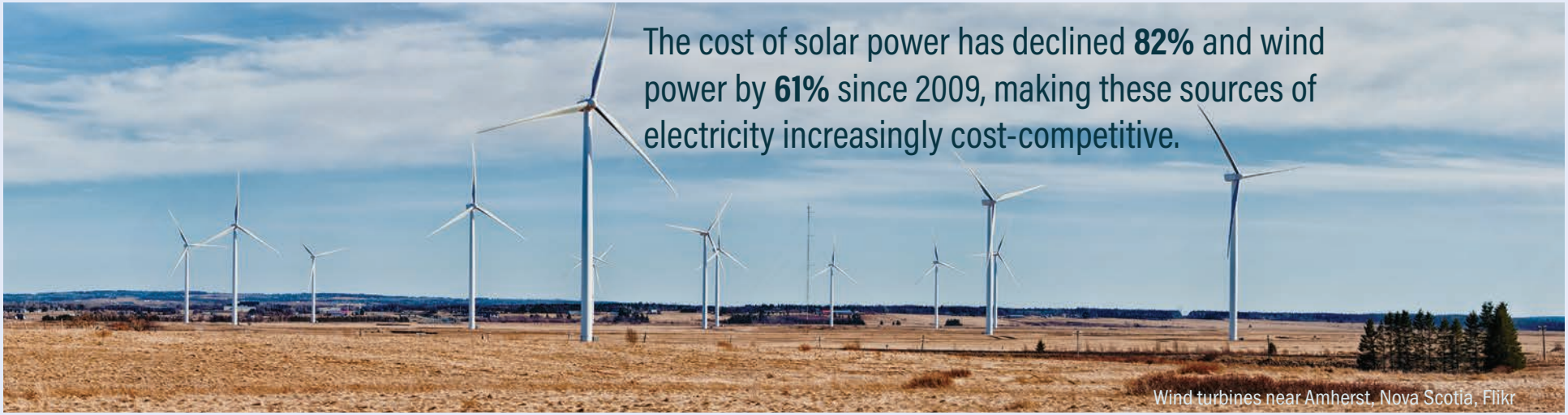
Fig. 9. **Carbon Countdown**

If we want a 66% chance of keeping global temperatures well below 2 degrees Celsius above pre-industrial levels, then at current global emission levels there is just 21 years remaining. The *Paris Climate Agreement* only slows emissions a little: after full implementation 75% of the global carbon budget will have been used up.



temperature increase of 1 degree Celsius above pre-industrial levels (and in Canada and New Brunswick we have warmed more than that amount), and global emissions are still increasing.

Climate experts have calculated how much carbon dioxide, or carbon budget, is available to have a 66% chance of staying below 2 degrees Celsius: 21 years is all that remains and it declines every year. If we account for other greenhouse gases; or want to have a greater probability of success (would you get on a plane that had a 33% chance of crashing?); or aim to keep global temperature increases closer to 1.5 degrees Celsius then the budget is even smaller and the timeline shorter (less than 7 years; Figure 9). The implications are clear: by 2030 the world (and that means Canada and New Brunswick), needs to be well on the way to phasing out fossil fuels and transitioning to a cleaner, more efficient and renewable energy system.



Wind turbines near Amherst, Nova Scotia, Flikr

If we want to protect our communities, families and businesses from the negative effects of climate change, we need to be part of the global and Canadian effort to find solutions.

Doing our Fair Share

The transition from a fossil-fuel-based lifestyle and economy will be more rapid than people understand, especially if we are serious about limiting temperature increases. That's because government commitments to cut greenhouse gas pollution under the Paris Agreement do not yet put the world on track to staying well below 2 degrees Celsius warming.

Analysis by the United Nations Climate Change Secretariat, the body that manages the climate negotiating process and the *International Energy Agency* both note that global emissions continue to grow, although at a slower pace, **AFTER** implementation of the commitments governments promised in the Paris negotiations. In fact, 75% of the global carbon budget will be used up after accounting for current government commitments.[25] The hard reality of climate change is that much more must be done. Our efforts to cut greenhouse gas pollution **must be accelerated** and that includes in Canada and New Brunswick.

As efforts to slow climate change accelerate by cutting greenhouse gas emissions (a process called decarbonization) demand for oil, for example, will decline, likely keeping the price per barrel at or below the $40 range. At this price point, the National Energy Board expects oil production in Canada to peak after 2020[26] because it is more expensive than $40/barrel to develop the oil sands. Energy analysts expect that the vast majority of the oil sands will never be developed[27].

The good news is that the transition away from fossil fuels toward a modern energy system is already creating more jobs than traditional energy development. **Clean Energy Canada's 2016 Tracking the Energy Revolution** report notes that, in 2015, $325 billion USD was invested in clean energy with $161 billion of that investment in solar energy, $110 billion in wind, $42 billion in large hydro and almost $4 billion in small hydro. The cost of solar has declined 82% and wind by 61% since 2009 making these sources of electricity increasingly cost-competitive. With 96 cites, states, and countries already committed to going 100% renewable, the puck is going into the renewables net.[28]

Energy experts analysing pathways to deep decarbonization in Canada find that it spurs investments that double the size of the national electricity system[29]. That's because the new energy system will rely more on electricity generated from renewable energy like solar, wind, hydroelectricity and biofuels than it does on coal, oil and natural gas. Investment spending could be as high as **$13.5 billion a year** to generate the clean electricity we will need to run our homes, vehicles and factories. Sadly, investment in renewable energy in Canada was only **$4 billion in 2015**; a level far below what researchers say is needed to meet our climate goals. A 2015 report from the *United Nations Industrial Development Organization* and the *Global Green Growth Institute* concludes that:

> *As a general proposition, countries that sustain a 1.5 percent of GDP level of annual investments in energy efficiency and clean renewables will also be able to maintain economic growth at healthy rates while providing a sufficient supply of energy resources to undergird growth. These investments in energy efficiency and renewable energy will also be a net new source of job opportunities. More specifically, new investments in energy efficiency and renewable energy will generate more jobs for a given amount of spending than maintaining or expanding each country's existing fossil fuel sectors[30].*

Canada's economy generated $1.9 trillion of activity in 2014; New Brunswick, $32 billion.[31] At 1.5% of gross domestic product (GDP), Canada should be investing **$28.5 billion** in energy efficiency and clean energy a year, and New Brunswick should be investing **$500 million annually** at least until the energy revolution is well underway.

Blue-Green Canada, an alliance of labour and environmental groups, calculates that for every $1 million invested in the fossil fuel sector two jobs are created; and 15 jobs are created in the clean energy sector[32]. If we use those numbers as a guide, New Brunswick could create up to **7500 jobs a year in clean energy**. Compare this potential to the Energy East pipeline. The Conference Board of Canada, in a report for TransCanada, finds that the **potential job creation is 6,570 direct** (3,248 during construction and 3,322 during operation) in total over 20 years.[33]

Clearly, the real job growth potential for New Brunswick is in clean energy.