CANADA ENERGY

CANADA ENERGY WHITEPAPER:

FINDING THE BEST CARBON OFFSET SOLUTION

TOPIC INDEX:

CANADA ENERGY
11-1155 North Service Road West
Oakville, Ontario, L6M 3E3, Canada
www.canadaenergy.com

CONTACT US:
President – John Cowan – john.cowan@canadaenergy.com
Program Designer – Peter Stabins – peter.stabins@canadaenergy.com

ABOUT CANADA ENERGY

Canada Energy is an electricity supplier that has been licensed by the Ontario Energy Board for the last 20 years. We have provided energy to over 20,000 customers in the industrial, commercial, and residential sectors. From 2015 to 2020 we also operated a North America-wide LED lighting upgrade program where customers paid for these environmentally sound improvements through their energy savings. Currently we supply carbon neutral electricity based on carbon offsets purchased in government regulated markets.

ABOUT THE AUTHOR

Peter Stabins is the program designer and a senior vice-president at Canada Energy. He possesses engineering, M.B.A., and law degrees, is a lawyer at Stabins Energy Law, and owns and manages businesses that do research in hydroelectric turbines, compressed air energy storage, and low-impact nuclear energy. Peter has also authored the book "Ontario Electricity Trading: Regulation and Economics" and is the holder of several international hydro turbine and energy storage patents.

FINDING THE BEST CARBON OFFSET SOLUTION

The best step an organization can take to fight climate change is to eliminate its greenhouse gas emissions. However, this is not possible with existing technology. The next best step is to reduce emissions as much as possible through conservation and to cancel out the remaining carbon (CO_2) emissions with the purchase of carbon offsets.

There are two keys to offsets. First, they should be as economical as possible so a large enough quantity can be purchased to truly influence climate change. Second, they should be proven to truly stop CO_2 emissions. This is important as many offset options seem to be useful but in reality have limited to no effect on the fight against climate change.

To help form your offset strategy we have summarized the strengths and weaknesses of the various offset options:

1) RENEWABLES

For most organizations their carbon emissions mainly stem from electricity usage (called "scope 2" emissions). Because of this, one solution would be to use 100% renewable power, such as solar, wind, and hydro.

This is a simple concept but **very difficult in practice**. Most organizations are not experts in power generation and do not have the ability to construct wind and solar plants without outside help, which is expensive. A second challenge is that wind and solar are only economic in certain geographical areas, outside of which their cost is very high.

A more significant challenge is that without energy storage it is impossible to use wind and solar 100% of the time. A very effective wind turbine might generate power 40% of the year while an excellent solar panel will produce energy only 25% of the time. Batteries can be used to fill in some of these gaps, but they are only economic for short spurts of up to 4 hours. There will be significant periods where renewables cannot meet electricity demand.

As a result, renewables are not a real solution. They might reduce scope 2 emissions, which is a good thing, but an organization will still be left with a significant amount of carbon to offset. Another limitation is that renewables do nothing to offset an organization's emissions from sources other than electricity ("scope 1" emissions).

2) RENEWABLE ENERGY CERTIFICATES ("RECs")

Green power producers such as wind farms, solar farms, and hydro plants, sell their energy into their local grids at the market price. To increase revenues they may also sell renewable energy certificates ("RECs"), each representing ownership of 1 megawatt-hour ("MWh") of the environmental attributes of the clean energy.

On its face this seems like a win-win where green power producers increase revenues and consumers support green power. However, in most cases there is no positive environmental benefit. This is because wind and solar sites have very low operating costs and generate power all the time when conditions permit (i.e., when it is sunny or windy). This is regardless of how many RECs are sold. There is therefore a **lack of additionality**, in that the purchase of an REC does not add any new green power to the grid.

For an REC to have additionality it must create new clean energy supply that would not otherwise have been developed. Generally, this only occurs when a commitment to purchase RECs is made prior to the construction of the renewable energy facility and the RECs are the main driver for the construction of the facility. This is normally accomplished through expensive and complex virtual power purchase agreements ("VPPA") of 12 to 20 years of length.

Besides the issue of additionality, there is the challenge of balancing an organization's CO_2 emissions with the CO_2 saved by the VPPA / RECs. This is because each regional grid has a different CO_2 intensity (CO_2 emitted per megawatt-hour of electricity) so unless the RECs are purchased from the same grid one cannot merely offset 1 megawatt-hour of electricity with one REC.

For example, 1 MWh of green power in the REC grid might keep 0.2 tons of CO_2 from entering the atmosphere but 1 MWh from the REC purchaser's grid might spew 0.45 tons of CO_2. Purchasing 1 REC, which represents 1MWh, will result in an offset that is 0.25 tons of CO_2 short. The REC purchaser's CO_2 emissions are therefore not offset by merely matching the MWh of the RECs with the MWh of usage, yet this is an erroneously common practice. If the goal is to stop climate change the focus must be on CO_2 emissions, which requires using a more complicated equation to determine the correct REC purchase volume.

This problem is further exasperated by the fact that RECs most often come from grids with a surplus of green power as clean power projects clump together in areas where they are cheap to construct. Their power output therefore displaces much less CO_2 than if the projects were built in "dirtier" grids or spread around the continent more evenly. As a result, to truly offset CO_2 emissions, most REC buyers need to purchase many more RECs than they currently are.

Another problem with RECs is that they are mostly unregulated and can have expansive definitions. They can include power from large-scale hydro, nuclear power, bioenergy with CO_2

emissions, or other technologies with potentially questionable environmental attributes. REC purchasers must be very careful to understand what they are purchasing.

Given the many challenges of RECs, in most cases they are not an effective tool in the fight against climate change. This makes them a ticking PR time bomb that could damage their users' reputations when the public becomes more aware of the drawbacks. If an organization uses RECs they should stem from virtual power purchase agreements that have additionality.

3) REFORESTATION CREDITS

Trees and plants absorb carbon dioxide through photosynthesis. Reforestation (the restocking of depleted forest lands) can therefore pull CO_2 from the atmosphere and help fight climate change. Organizations that complete reforestation projects can estimate the CO_2 reductions and sell credits to buyers who wish to offset their emissions.

There is little debate that more forest cover is good for the environment. The problem with reforestation credits is that it is very difficult to accurately quantify how much it helps. New plantings draw very little CO_2 and only have a significant effect after 10 to 15 years. The claimed CO_2 savings are based on estimates of what will happen over many decades. Should the trees not grow as well as estimated, burn in a fire, or die from disease, they will not meet their CO_2 removal potential. Estimating their effect on atmospheric CO_2 is therefore difficult and not particularly accurate.

A second problem is that new plantings remove very little CO_2 during their first 10 to 15 years of life while the fight against climate change needs action now. We are emitting too many greenhouse gases today and cancelling out a ton of CO_2 now has a much larger impact than cancelling a ton of CO_2 decades into the future when our electricity grid will be almost or fully clean. It is possible that many of the tons of CO_2 saved by reforestation in the future will have very little effect on climate change if the world meets its long-term net-zero targets. Reforestation credits may therefore be overclaiming their positive effect.

Purchasing reforestation credits is generally positive and a nice story but the **lack of exact quantifiability** and their limited effect on a net-zero future greatly limit their effectiveness as an offset tool today. They may be useful as a green marketing tool but are not recommended for use in a real carbon offset program.

4) CARBON CAPTURE

Carbon capture is the extraction of CO_2 from the atmosphere and permanently storing it underground or in a usable material (through a chemical reaction that locks in the carbon). Several technologies are in testing or small-scale operation which have demonstrated the

viability of this process. When one ton of CO_2 is removed from the atmosphere in this way, an offset credit may be sold to a greenhouse gas emitter.

One big strength of this process is that the quantity of CO_2 removed is exactly quantifiable. With proper monitoring very trustworthy offsets can be created. The **biggest drawback is cost**. Currently it is estimated that the most economical technology costs at least $150 per ton of CO_2. Actual prices are likely to be $200 per ton or more, which is a lot more expensive than other legitimate carbon offset alternatives.

A second challenge is determining whether the CO_2 storage is permanent. A small number of underground carbon sequestration sites exist and have not leaked, but the CO_2 must stay captured forever to be effective. The drill holes used to fill these storage sites must be capped shut and the history of drill hole capping in the oil and gas sector is far from perfect. This raises the question of whether this can be a trusted and permanent solution.

A third issue is the type of sequestration site chosen. Sometimes CO_2 is injected and stored in aging hydrocarbon fields and allows the extraction of additional oil. Being associated with oil production might not provide the best look for an offset program. Avoiding offsets from such enhanced oil production is therefore recommended.

Overall, carbon capture is an interesting offset solution. However, it is currently too expensive for widespread adoption and questions still exist regarding permanence. Perhaps these challenges will be overcome in the next 10 years and this will become a very good option.

5) NON-GOVERNMENTAL OFFSET PROGRAMS

Many processes have been proposed by unregulated entities to reduce the emission of greenhouse gases. These include:

- *Methane collection and combustion* – Collecting methane generated by animals, landfills or industrial waste and combusting it instead of letting it escape fully into the atmosphere. The combustion produces CO_2 which has a smaller greenhouse gas effect than pure methane (although methane exits the atmosphere much sooner).
- *Energy efficiency* – Improving heating and cooling systems, installing energy efficient LED lighting, cogeneration (use of the waste heat from power generation), fuel efficiency projects.
- Destruction of industrial pollutants which are greenhouse gases.
- Using agriculture to increase the carbon content of soil.

Some of these schemes are helpful in the fight against climate change while others have minimal impact. Sorting the science and logic of them can be challenging and quantifying their actual impacts can be difficult.

Even though questions about viability and quantifiability exist, various non-government organizations package and market these offsets. **Their effectiveness is not tested to meet a legal standard**. Purchasers are dependent on the offset provider's claims and the standards of any certification organization.

There is practically no penalty for making claims that overstate the effectiveness of these types of offsets. This makes them a risky purchase. Unless the offset claims are tested to a high regulatory standard we do not recommend their use.

6) CAP-AND-TRADE EMISSION ALLOWANCES

To fight climate change some governments have set regional annual greenhouse gas emission limits. Emitters must purchase an emission allowance for each ton of CO_2 they emit. Each year the total number of 1-ton emission allowances ("EA") must equal the region's greenhouse gas emission cap (hence the "cap"). These EAs are normally distributed through an auction process but they may also be purchased post-auction from EA holders who find that they do not need all the EAs that they hold (the "trade"). This system limits CO_2 emissions in the region and can be used to meet long-term greenhouse gas targets by yearly reductions in the cap.

Some of these government regulated cap-and-trade markets are open to any organization that wishes to purchase offsets, even if they are not based in the cap-and-trade region (a "Non-Regional Entity" or "NRE"). NREs can therefore use these cap-and-trade markets to offset their own emissions. An NRE can do this by purchasing a 1-ton emission allowance and then retiring it so it is never used. This creates a fully quantifiable 1-ton offset backed by the highest societal standard, the rule of law.

As an example, if "Company A" wishes to offset 1,000 tons of its CO_2 emissions it could go to a cap-and-trade auction and bid for 1,000 emission allowances. It the bid succeeds the quantity of emission allowances available to polluters in the region would drop by 1,000, for example going from 1,000,000 for the year to 999,000. Regional emissions would become 999,000 tons of CO_2 instead of 1,000,000 tons. This purchase by Company A would therefore keep exactly 1,000 tons of CO_2 from the atmosphere and could offset 1,000 tons of its own emissions. The system is exact, enforced under the rule of law, and is more trustworthy than any other option.

We believe that this is a very effective carbon offset solution. **The challenge is that it is not easy to take part in a cap-and-trade market**. There are financial and registration requirements unique to each one and most of these requirements are generally too onerous for entities that do not trade in these markets on a regular basis. It is also important to be experienced in the markets to ensure that the offsets are purchased at a reasonable price.

7) THE RECOMMENDED OFFSET SOLUTION

Given these various carbon offset alternatives we believe that the best solution is the purchase and cancellation of cap-and-trade emission allowances from government regulated markets. This system provides exactly quantifiable offsets that are backed by the rule of law.

We understand the notional draw of renewable energy certificates but in most cases they cannot offset an organization's carbon emissions. Other alternatives are either not properly quantifiable, not trustworthy enough, or too expensive. As a result, we highly recommend the purchase and cancellation of cap-and-trade emission allowances to offset your organization's CO_2 emissions.