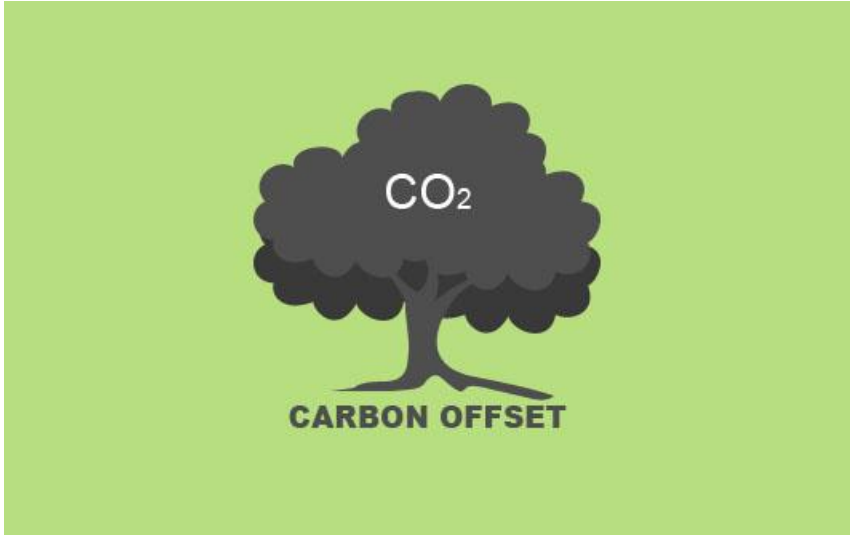
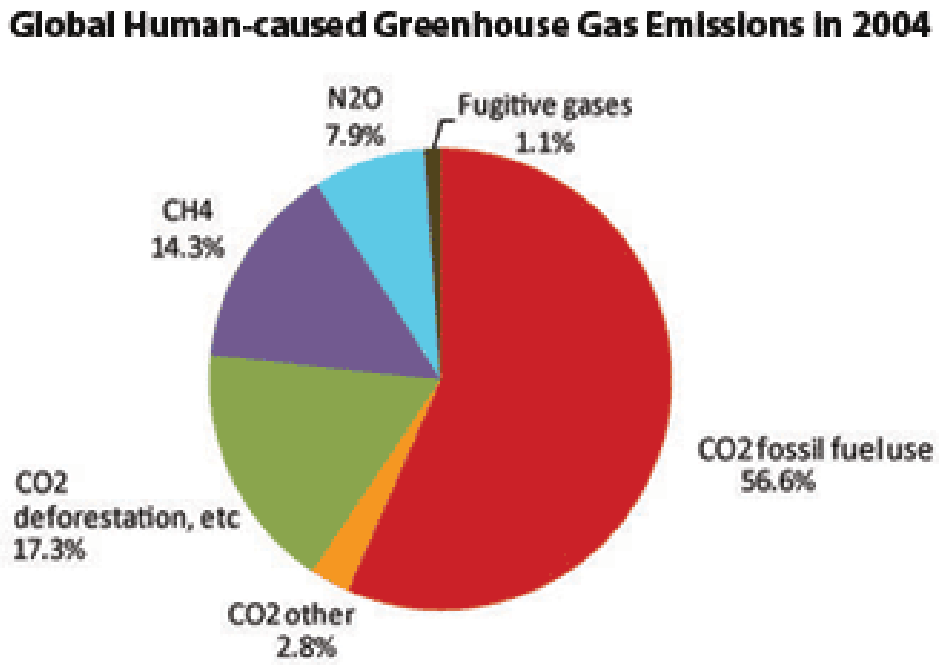
Carbon Offsets



BY: JOE ARCANGELO

What is a Carbon Offset?

- A **carbon offset** is a reduction of carbon in the atmosphere (or other greenhouse gases) in an attempt to offset emissions occurring somewhere else.
- **Carbon offsets** can be in one of six major categories, but they are all measured in metric tons of (CO2e).
  - carbon dioxide (CO2)
  - methane (CH4)
  - nitrous oxide (N2O)
  - perfluorocarbons (PFCs)
  - hydrofluorocarbons (HFCs)
  - hexafluoride (SF6)
- (1) **carbon offset** represents the reversal of (1) metric ton of carbon dioxide or another greenhouse gas.



Source: Goodward, Jenna. "Bottom Line on Offsets." *Bottom Line on Offsets | World Resources Institute*, Aug. 2010, www.wri.org/publication/bottom-line-offsets.

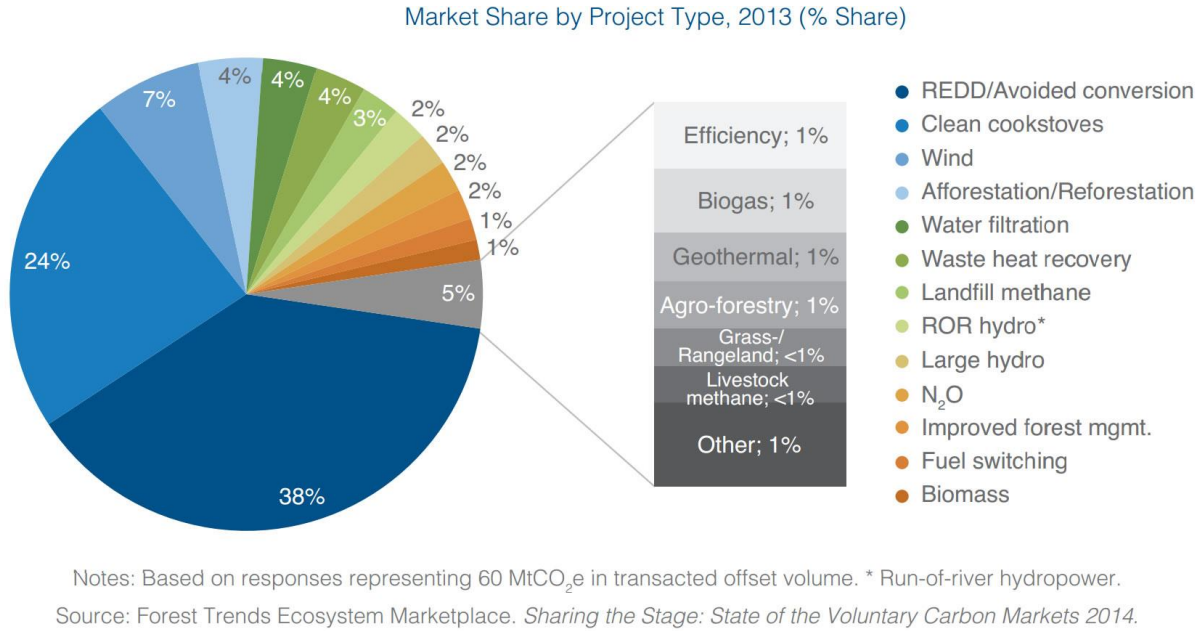
Carbon Offset Markets

- There are two markets for carbon offsets.
  - **Compliance market (Largest buyer of offsets)**
    - Larger market
      - Entities buy carbon offsets in order to comply with caps on the total amount of carbon dioxide they are allowed to emit.
        - This market exists in order to achieve compliance with obligations of Annex 1 Parties under the Kyoto Protocol
  - **Voluntary Market**
    - Smaller market
      - Individuals, or governments purchase carbon offsets to mitigate their own greenhouse gas emissions.
        - Ex. A person might buy carbon offsets to compensate for the greenhouse gas emissions caused by personal air travel.
      - About $700 million of carbon offsets are purchased each year in the voluntary market

Source:
http://www.worldbank.org/en/topic/climatefinance

Market Size

- **Global market**
  - In 2009, 8.2 billion metric tons of carbon dioxide equivalent changed hands worldwide
    - Carbon prices around $12 a ton
  - The World Bank's "State and Trends of the Carbon Market 2010" says the overall value of the market is $144 billion



Source: http://www.worldbank.org/en/topic/environment

Carbon Offset Project Types

- The Clean Development Mechanism (CDM) says there are 200 types of projects suitable for generating carbon offsets. These project types belong to one of six groups:
  - **Energy efficiency**
    - Use less energy than conventional technology to perform the same task
      - Ex. efficiency offset project at a large industrial facility (larger scale)
      - Ex. distributing compact fluorescent bulbs, or installing more efficient cooking stoves in a village (smaller scale)
  - **Industrial gases**
    - Some industrial gases hold immense Global Warming Potentials (GWP). The destruction of these gases is therefore a very effective way to reduce Greenhouse gases.
      - Controversial because although they are the cheap and offset a lot, they do not create environmental benefits
        - Contradictory effects may be occurring: the offset market for high GWP gases has created an incentive to create new factories to increase revenue from offsets.
  - **Renewable energy**
    - Ex. hydro, wind, solar power, solar hot water, biomass power and heat production
  - **Methane capture**
    - Methane's GWP is 21x times greater than CO2 but can be used as a source of energy.
  - CH_4 is emitted by landfills, wastewater treatment, agricultural activities, and coal mining.
  - There are two types of methane projects. The first type captures and burns (flares) methane. The gas is turned into less potent carbon dioxide and water. Ex. Flaring of landfill gas and of coal mining gas.
  - The second type of project captures methane and uses it to produce either hot water or electricity. purify methane in wastewater treatment plants or landfills and use it for electricity production
  - Methane projects are known to underperform.
    - CDM landfill methane projects
      - realize just 35% of their projected emissions reductions.

Source: **Centre on Energy, Climate, and Sustainable Development**

http://www.co2offsetresearch.org/consumer/OffsetTypes.html

Carbon Offset Project Types (cont.)

- **Bio sequestration: Forestry & Agriculture**
  - absorbs CO2 emissions through the of vegetation and the continued storage of some of the carbon in plant tissues
    - Avoiding deforestation and degradation of existing forests
    - Converting land to forest (reforestation)
    - Soil management techniques (no-till agriculture).
- Benefits
  - forests provide a wide range of ecosystem services.
  - clean water, habitats for many plant and animal species, and livelihoods for millions of people.
  - sequester and store carbon, protect watersheds, offer economic opportunities for the local population, and conserve or restore biodiversity.
- Leakage
  - "Leakage" is a concern. It is the loss of carbon reductions outside the project
    - Ex. reforestation could make local farmers cut down forests somewhere else for new farmland. (can be prevented by thorough good project design and maintenance)
  - sequestration can be reversed and the carbon re-emitted to the atmosphere.
    - Ex. logging

- **Carbon Capture and Storage (CCS)**
  - capture CO2 emissions from emissions sources and store them by injecting them underground
    - Not currently commercially viable
    - Likely to become an important medium-term option for climate mitigation.
  - The World Wildlife Fund has issued guidelines:
    - "Ensure the permanent safe storage of CO2 so that no leakage or out-gassing is possible."
    - "CO2 is safely stored for a period of 100,000 years, and should be assessed and confirmed through independent scientific review"
    - "Confirming that the storage of CO2 does not interfere with or have negative direct impacts on the environment. This also must be assessed by independent scientific review."
    - "Adoption of internationally agreed-upon procedures for independent verification and monitoring of storage and related activities before CCS technologies are allowed to count towards greenhouse gas reduction targets."

Source: **Centre on Energy, Climate, and Sustainable Development**

http://www.co2offsetresearch.org/consumer/OffsetTypes.html

Clean Development Mechanism (CDM) projects grouped in types

Number of projects and expected/issued CER	CDM							
Type	number		CERs/yr (000)		2020 CERs (000)		CERs Issued (000)	
Wind	2596	31%	237578	21%	1797371	21%	222148	12%
Hydro	2188	26%	303055	26%	2082800	25%	277041	15%
Biomass energy	734	9%	49965	4.4%	353322	4%	55178	3.0%
Methane avoidance	684	8%	29664	2.6%	196961	2.4%	31416	1.7%
Solar	439	5.2%	14229	1.2%	100270	1.2%	5820	0.31%
Landfill gas	402	5%	57773	5%	413865	5%	97037	5%
EE own generation	368	4%	49503	4%	332227	4%	81641	4.4%
Fossil fuel switch	130	1.5%	70598	6%	480034	6%	66746	3.6%
EE Industry	119	1.4%	4425	0%	27222	0.3%	4991	0.3%
Coal bed/mine methane	108	1.3%	72644	6%	537793	6.4%	57708	3.1%
N2O	105	1.2%	57010	5%	467587	6%	328212	18%
EE Supply side (power plants)	95	1.1%	42627	4%	282054	3.4%	7432	0.4%
EE Households	94	1.1%	3580	0.3%	26867	0.3%	1126	0.06%
Afforestation & Reforestation	71	0.8%	2515	0.2%	22287	0.3%	11334	0.6%
Fugitive	61	0.7%	34973	3.1%	216878	2.6%	41392	2.2%
EE Service	38	0.5%	696	0.06%	4310	0.05%	229	0.012%
Geothermal	35	0.4%	12401	1.1%	282054	3.4%	11835	0.6%
Transport	32	0.4%	3883	0.3%	31911	0.4%	2439	0.1%
Cement	25	0.3%	4109	0.4%	17575	0.2%	12397	0.7%
HFCs	22	0.3%	81319	7%	601230	7%	539942	29%
Energy distrib.	20	0.2%	5742	0.5%	48690	0.6%	2665	0.1%
Mixed renewables	18	0.21%	665	0.1%	4796	0.06%	40	0.002%
PFCs and SF6	17	0.2%	5393	0.5%	40904	0.5%	7531	0.4%
CO2 usage	4	0.05%	91	0.01%	676	0.01%	10	0.001%
Tidal	1	0.01%	315	0.03%	2525	0.03%	1727	0.1%
Agriculture	1	0.01%	8	0.001%	74	0.0009%		
Total	8407	100%	1144762	100%	8372283	100%	1868037	100%
HFCs, PFCs, SF& & N2O reduction	144	1.7%	143721	13%	1109721	13%	875685	47%
Renewables	6011	71%	618210	54%	4623138	55%	573790	31%
CH4 reduction & Cement & Coal mine/bed	1285	15%	199263	17%	1383824	17%	239960	12.8%
Supply-side EE	483	6%	97872	9%	662970	8%	91738	4.9%
Fuel switch	130	1.5%	70598	6.2%	480034	5.7%	66746	3.6%
Demand-side EE	251	3.0%	8701	0.8%	58399	0.7%	6346	0.3%
Afforestation & Reforestation	71	0.8%	2515	0.2%	22287	0.3%	11334	0.6%
Transport	32	0.4%	3883	0.3%	31911	0.4%	2439	0.13%

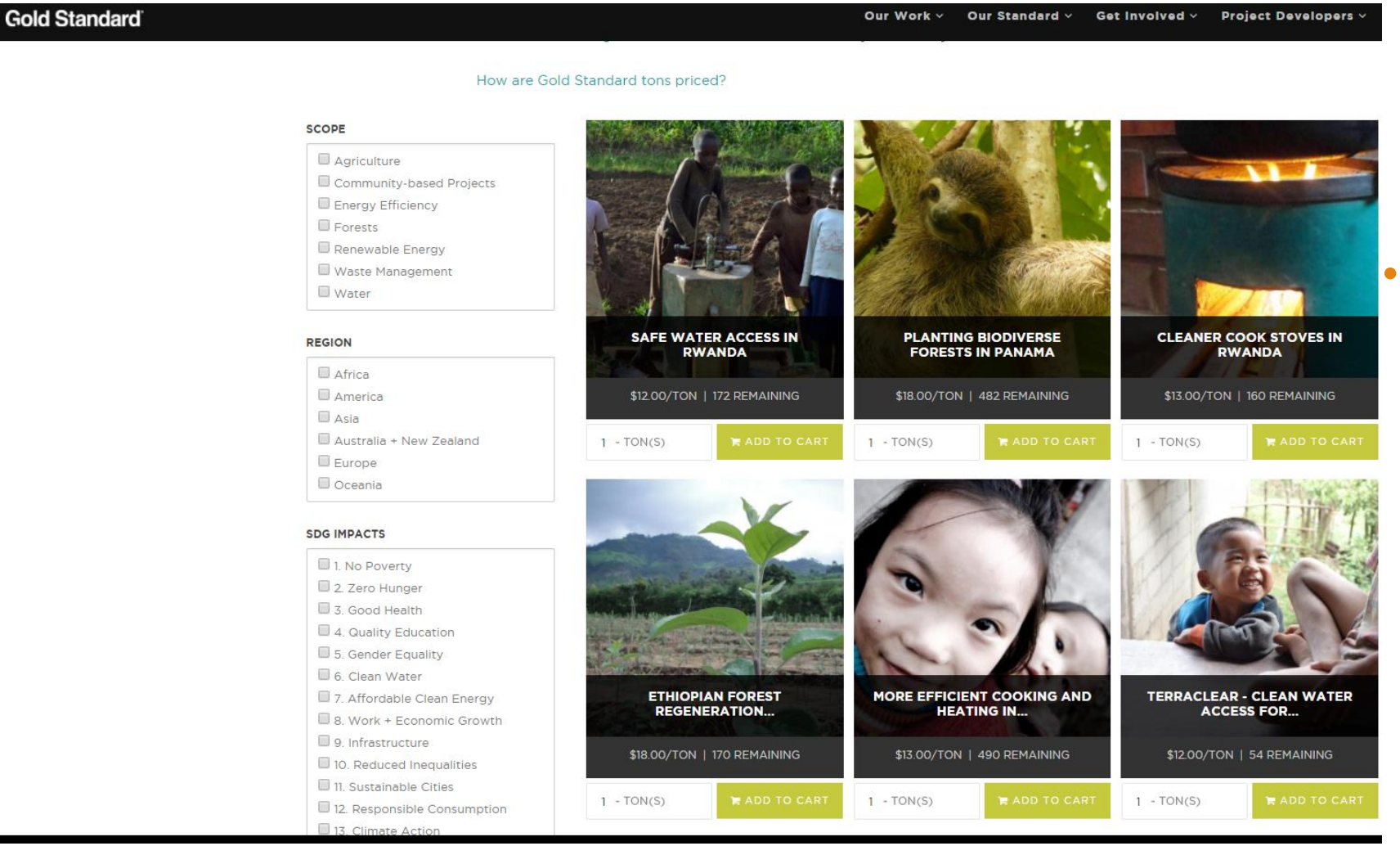
Source: **Centre on Energy, Climate, and Sustainable Development**

http://cdmpipeline.org/cdm-projects-type.htm

Largest Suppliers

- **E.U. market**
- The global carbon market is dominated by the European Union
  - companies that emit greenhouse gases are required to cut their emissions or buy pollution allowances or carbon credits from the market, under the European Union Emission Trading Scheme (EU ETS).
- **U.S. market**
  - The U.S. market has remained primarily a voluntary market, but there are some cap and trade programs being set up at the regional level.
    - Regional Greenhouse Gas Initiative (RGGI)
    - Western Climate Initiative (WCI)

Carbon Offset Pricing



- Offset schemes vary greatly in cost
  - A typical fee would be around \$12 for each ton of CO_2 offset.
    - At this price, a typical family would pay around \$50 to offset a year's worth of gas and electricity use.

Source: https://www.theguardian.com/environment/2011/sep/16/carbon-offset-projects-carbon-emissions

Fraud Prevention/ Standards

- **Offset Standards**
  - many offset standards have been created for the voluntary offset market.
  - Standards set criteria for projects to be chosen and evaluated.

- **Clean Development Mechanism (CDM)**
  - Largest regulatory project-based mechanism,
    - Offers opportunity to purchase carbon credits from offset projects in developing nations.
  - Standards are stringent and extensive
    - High cost so usually only large projects are registered.

- **<u>Voluntary Standards</u>**
  - Unlike under CDM, there are no unified rules and regulations for the voluntary carbon market.
    - *Positives:*
      - can serve as a testing field for new procedures
      - can also serve as a niche for micro projects that are too small to warrant the administrative burden of CDM
    - *Negatives:*
      - lack of quality control leads to low quality projects

- **ISO 14064**
  - voluntary GHG project standard.
    - provides general guidance and does not prescribe specific requirements.

Fraud Prevention/ Standards (cont.)

- **Gold Standard**
  - The Gold Standard (GS) is a voluntary carbon offset standard for renewable energy and energy efficiency projects.
    - Can be applied to voluntary offset projects and to CDM projects.
    - Developed under the leadership of the WWF
    - Presently endorsed by over 60 environmental and development NGOs.
- **Voluntary Carbon Standard 2007**
  - The Verified Carbon Standard (VCS 2007) is a full carbon offset standard.
    - Focuses on GHG reduction attributes only and does not require projects to have additional environmental or social benefits.
      - broadly supported by the carbon offset industry
- **VER+ (VERplus)**
  - The VER+ is a full-fledged carbon offset standard and closely follows the Kyoto Protocol's project-based mechanisms
    - Designed for project developers who have projects that cannot be implemented under CDM yet who want to use very similar procedures as the CDM.

Fraud Prevention/ Standards (cont.)

- **Chicago Climate Exchange (CCX)**
  - Voluntary greenhouse gas (GHG) emission cap and trade scheme located in North America.
    - Participation in the CCX cap and trade scheme is voluntary, but once entities elect to participate and commit to emission reduction targets, compliance is legally binding.
- **Plan Vivo System**
  - Offset Project Method for small scale LULUCF projects with a focus on promoting sustainable development and improving rural livelihoods and ecosystems.
- **Green-e Climate Program**
  - Green-e Climate is a certification in the voluntary offset market
    - is the leading US independent certification and verification program for RECs.

Fraud Prevention/Standards (cont.)

5.2.6 TABLE 5: ***Project Types Accepted By Each Standard***

Standard	Accepted Project Types
CDM	Any* except nuclear energy, new HCFC-22 facilities and avoided deforestation (REDD)
GS	Renewable energy (including methane-to-energy projects) and end-use energy efficiency. No large hydro above 15 MW
VCS	Any except projects that can reasonably be assumed to have generated GHG emissions primarily for the purpose of their subsequent reduction, removal or destruction (e.g. new HCFC-22 facilities)
VER+	Any except any HFC projects, nuclear power projects and hydro power projects exceeding 80MW Hydro projects exceeding 20MW with World Commission on Dams compliance only
CCX	Renewable energy, energy efficiency, HFC-23 destruction except from new HCFC-22 facilities, methane capture and destruction, forestry (including REDD) and agricultural practices
VOS	GS VERs: see above or CDM plus large hydro above 20 MW have to comply with WCD guidelines; no new HCFC-22 facilities.
CCBS	LULUCF
Plan Vivo	LULUCF except commercial forestry
GHG Protocol	Any
ISO 14064-2	Any

Controversy

- **Inefficiency**
  - Less than 30 cents in every dollar spent on some carbon offset schemes goes directly to projects designed to reduce emissions (reported by BBC and based on UN data)
    - On average:
      - 28% goes to the set up and maintenance costs
      - 34% goes to the company that takes on the risk
      - 19% to project investors

- **Indulgence controversy**
  - Some activists disagree with the principle of carbon offsets, likening them to Roman Catholic indulgences, a way for the guilty to pay for absolution rather than changing their behavior. George Monbiot: "carbon offsets are an excuse for business as usual with regard to pollution"

- **Effectiveness of tree-planting offsets**
  - Some environmentalists have questioned the effectiveness of tree-planting projects for carbon offset purposes. Critics point to the following issues with tree planting projects:

- **Timing.**
  - Trees reach maturity over a course of many decades. Project developers sell the promised reductions up-front

- **Permanence**
  - It is difficult to guarantee the permanence of the forests, which may be susceptible to clearing, burning, or mismanagement.

- **Monocultures and invasive species.**
  - In an effort to cut costs, some tree-planting projects introduce fast-growing invasive species that end up damaging native forests and reducing biodiversity.

- **The albedo effect**
  - High latitude forests may absorb more sunlight creates a warming effect that balances out their absorption of carbon dioxide

Sources: http://news.bbc.co.uk/2/hi/business/8399740.stm
http://www.monbiot.com/2006/10/19/selling-indulgences/
https://web.archive.org/web/20100212232904/http://www.davidsuzuki.org/Climate_Change/What_You_Can_Do/trees3.asp
https://e-reports-ext.llnl.gov/pdf/324200.pdf

Controversy (Cont.)

- **Additionality and lack of regulation in the voluntary market**
  - No single standard governs the industry
  - Some offset providers have been criticized on the grounds that carbon reduction claims are exaggerated or misleading.
  - Widespread instances of people buying worthless credits that do not yield any reductions in carbon emissions.
  - Industrial companies profiting from doing very little or from gaining carbon credits on efficiency gains from which they have already benefited substantially.
  - Brokers providing services of questionable or no value.
- **Perverse incentives**
  - Offsets provide a revenue stream for the reduction of some types of emissions
    - This can can in some cases provide incentives to emit more