Carbon Markets, Carbon Credits and Climate Change Policy

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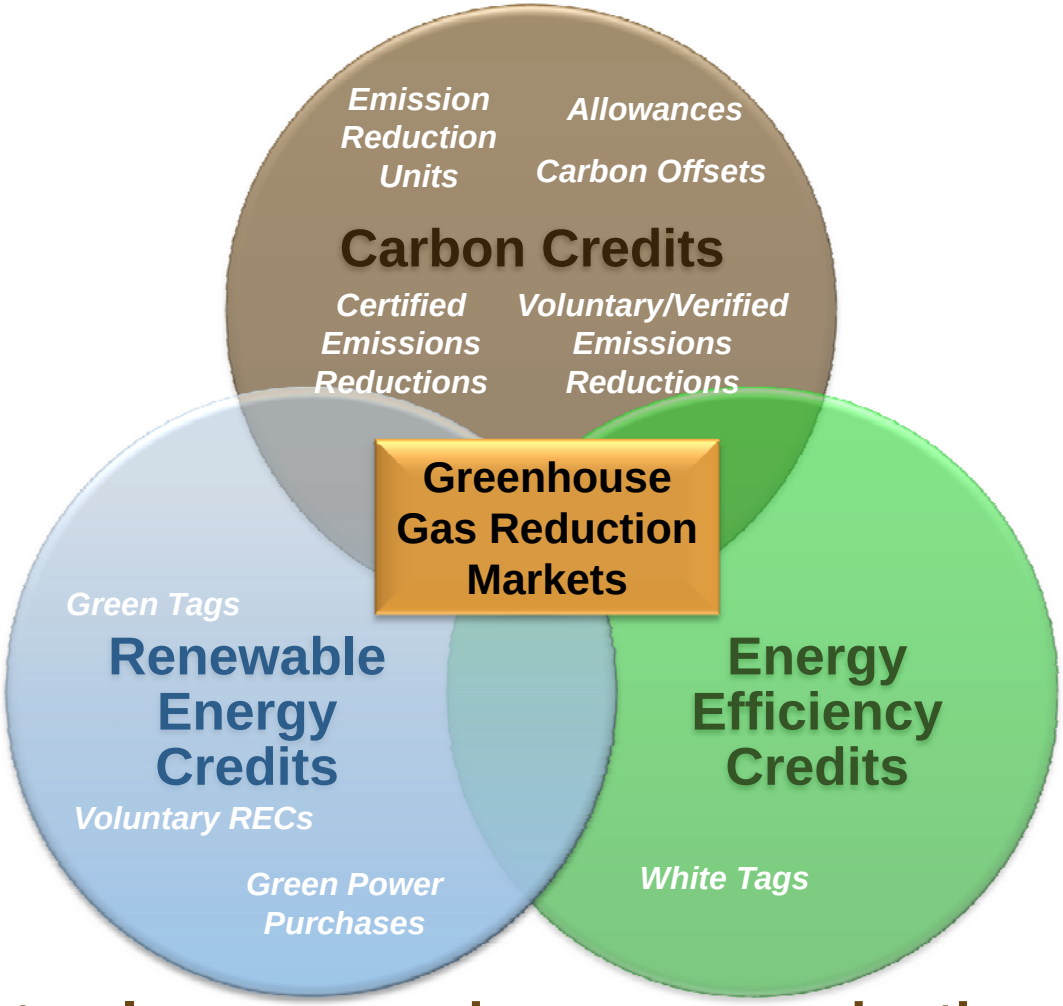
There are several types of markets and associated credits that are created to encourage economically efficient emissions reductions...



... but only one greenhouse gas reduction unit created for every action so there is no double-counting

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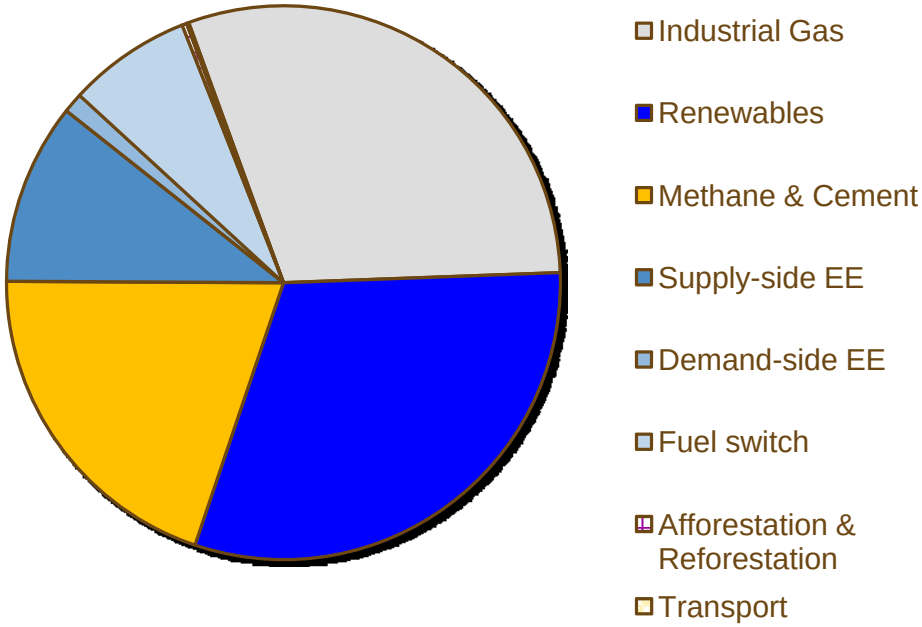
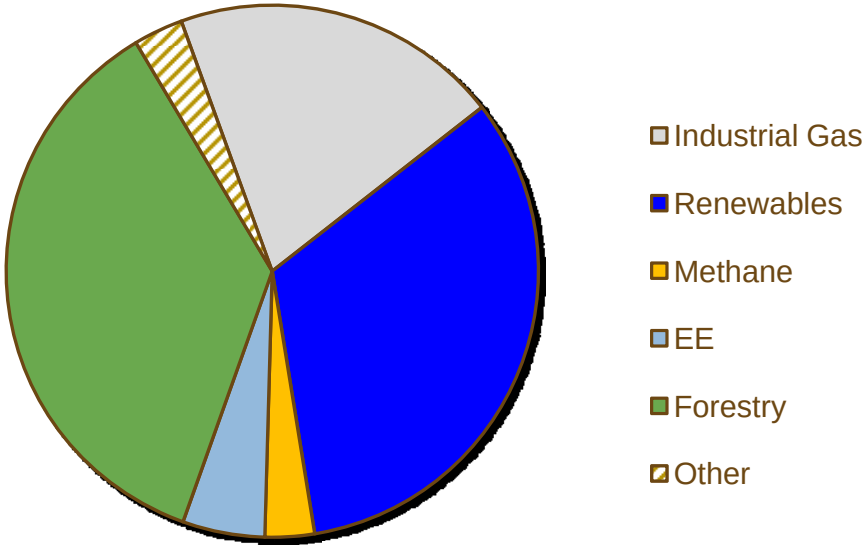
Types of projects that generate carbon credits in Kyoto and voluntary markets

Types of CDM (Regulated) Projects
(as % share of CER volume through 2012)



Type of Voluntary Projects
(as % share in Voluntary OTC market)



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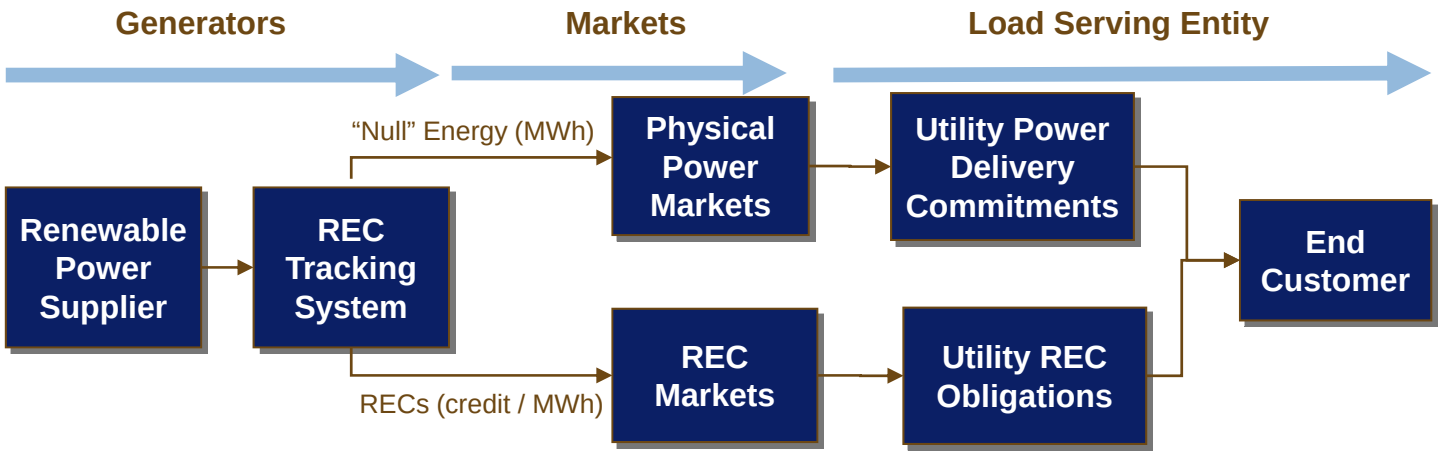
RECs are not Carbon Credits, although renewable energy projects can be produce carbon credits in certain carbon markets

- There are various types of Renewable Energy Credits (RECs) but the RECs that are driving renewable energy projects are those created by State Renewable Portfolio Standards
  - Complex regulations, point of regulation, banking, set asides for particular technologies, etc.
  - In the U.S., these RECs will be much more valuable than Carbon Credits for the foreseeable future
- Confusion sometimes happens when entities wish to voluntarily reduce their carbon footprint
  - They can do this via purchasing carbon offsets - based on their overall direct and indirect emissions
  - Or a combination of carbon offsets for their direct emissions *and* voluntary renewable energy credits (VRECs or green power) - based on their calculated total indirect emissions from their power consumption



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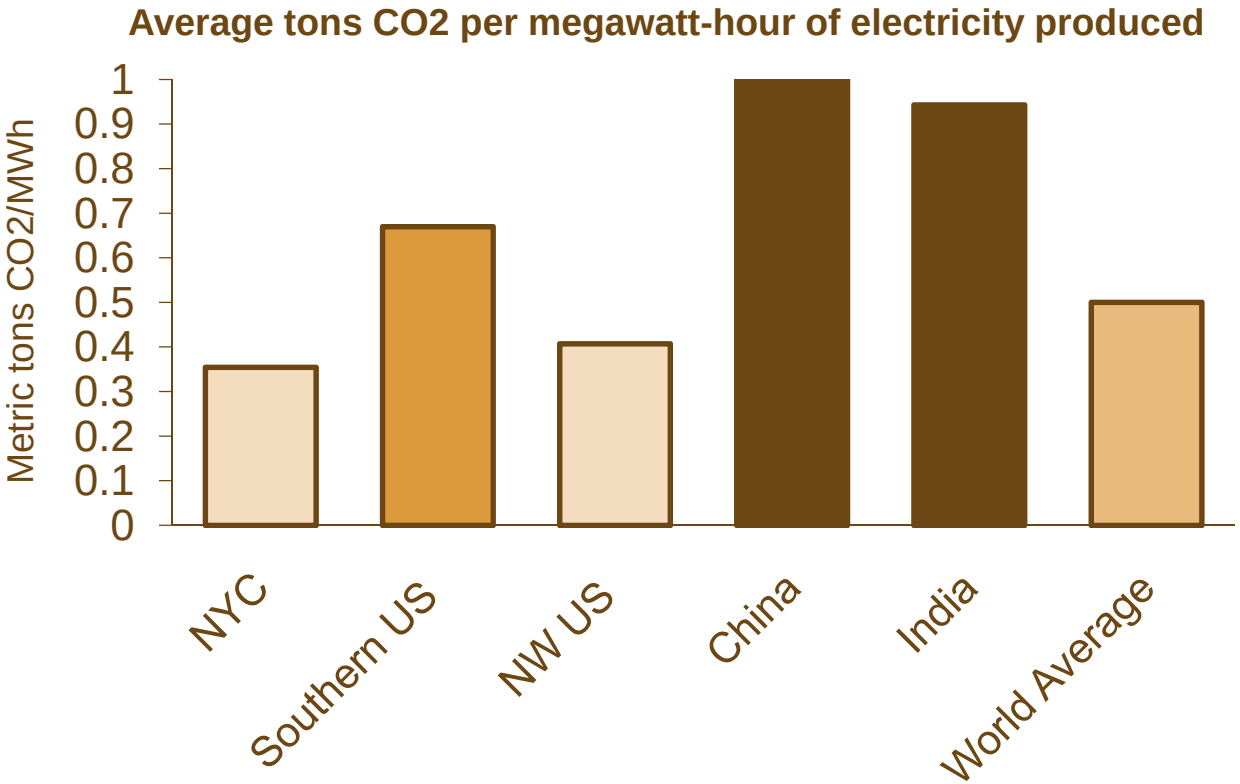
Carbon credits can be generated by renewable energy projects, but the amount of carbon 'credited' for renewable projects depends on the alternatives

- Power sector emissions vary widely and depend on the power sector mix
- Natural gas plants produce about half of the emissions of coal plants per megawatt-hour produced
- Latin America, parts of North America, Africa, have a high reliance on hydropower and therefore low intensities
- India and China's power sectors have some of the highest CO2 emissions intensities in the world



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Some terminology

- Emissions permits/allowances: Allocated permits to emit or 'rights to release GHGs' that can be auctioned or awarded to regulated entities
- Emissions offsets/carbon credits: Credits or 'rights to release GHGs' that are created by projects or entities that are not 'covered' or required to reduce emissions
- Leakage: an increase in greenhouse gas emissions by one facility caused by a reduction in greenhouse gas emissions by another facility; or a decrease in sequestration caused by an increase in sequestration at another location
  - e.g.: industrial production moving from locations with emissions reduction limits to developing countries
- Permanence: greenhouse gases that are credited or sequestered must not later be returned to the atmosphere
  - e.g. a forestry sequestration project that dies or burns loses some permanence
- Additionality: the requirement that a project must produce emissions reductions that exceed (are additional) to reductions that would have occurred in absence of the project (business as usual).
  - To prove additionality for CDM projects the developer must show that there are barriers to the project that carbon credit funding helps overcome, such as investment (project is higher cost than alternatives), access-to-finance (insufficient funding), technological (high risk technology or skills not available), or prevailing practice (project is first of kind)
  - Projecting costs and proving financial additionality is challenging and controversial, therefore some propose government established standards (presumably consistently adjusted upward to be above and beyond BAU) for carbon offset credits rather than additionality requirements
- Emissions price ceilings and floors: Government established bands for carbon prices that may be in US Federal legislation
  - Can impact market prices and the environmental goals, a price ceiling (penalty price) that is set too low makes the system similar to a carbon tax

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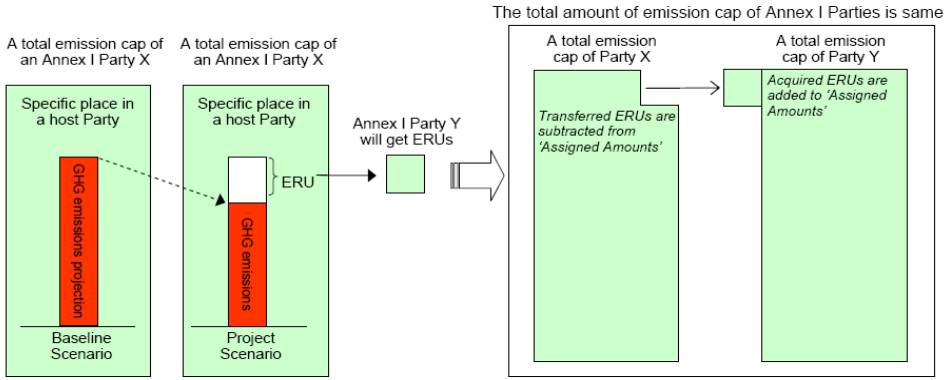
Under the Kyoto protocol three types of carbon credits were created: Issued Allowances, Emission Reduction Units and Certified Emission Reductions

UNFCCC Kyoto Country Categories

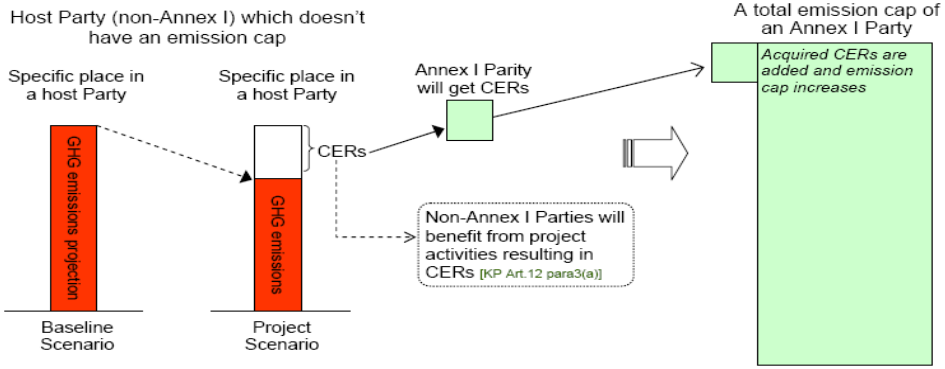
- The European Union (Annex II countries)
- Annex I countries with economies in transition (potential JI host countries)
- Annex II countries that have not ratified the Kyoto Protocol
- Annex II countries outside of the European Union that have ratified
- Non-Annex I countries (potential CDM host countries)

Trading of fixed emission allowances between Annex II countries (Red and blue). Facilitated within the EU by the regional Emissions Trading System (ETS)

Mechanism	Unit	Type
IET - International Emissions Trading	AAUs - Assigned Amount Units	QUOTA
JI - Joint Implementation	ERUs - Emission Reduction Units	CREDIT



CDM - Clean Development Mechanism	CERs - Certified Emissions Reductions	CREDIT



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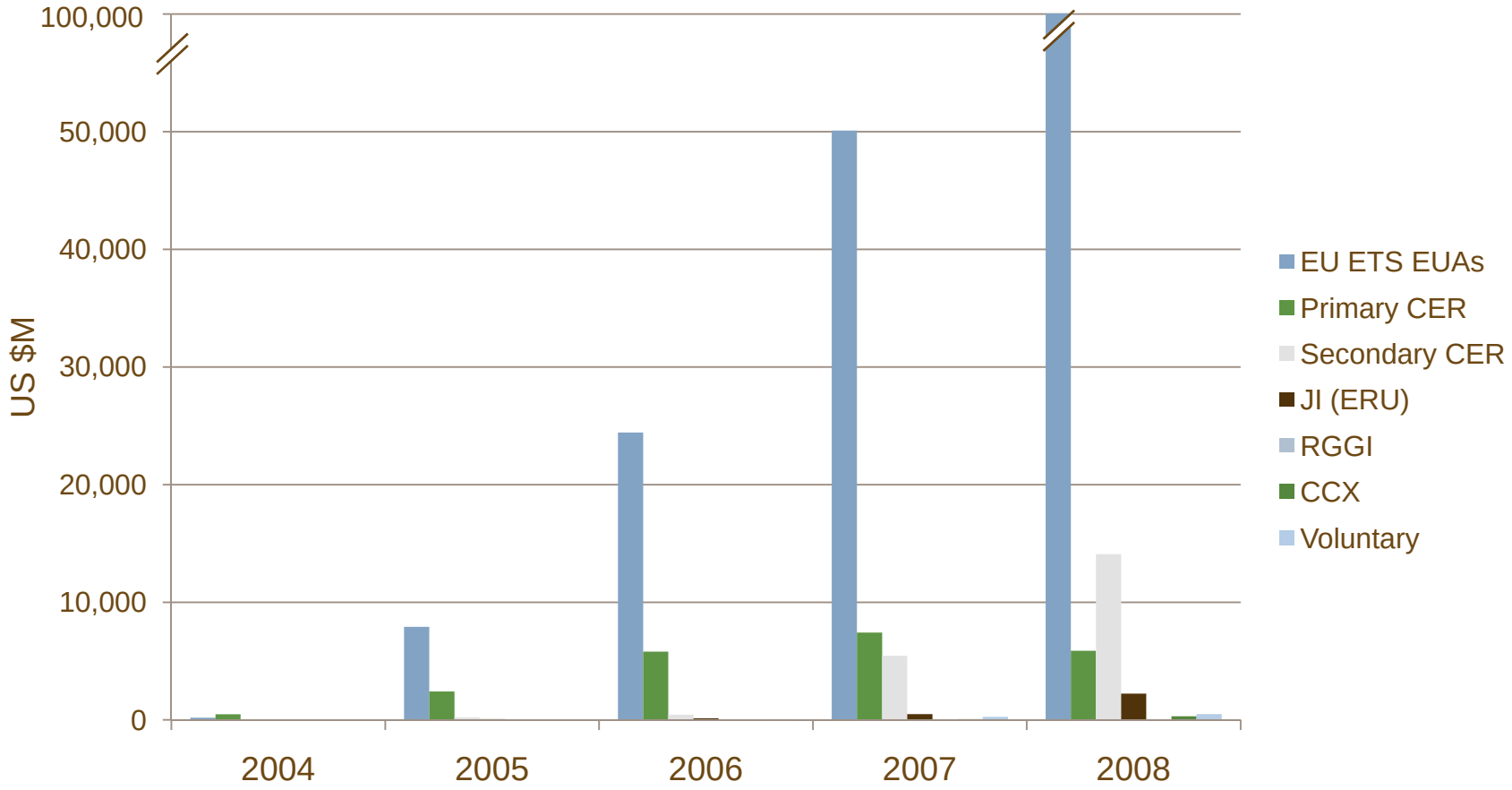
Source: CDM in Charts

The EU's European Trading System dominates the market but US voluntary markets are experiencing significant growth



EU Emissions Trading Scheme

EUA = EU Emission Allowance (EU ETS trading unit)

CDM = Clean Development Mechanism

CCX = Chicago Climate Exchange

RGGI = Regional Greenhouse Gas Initiative

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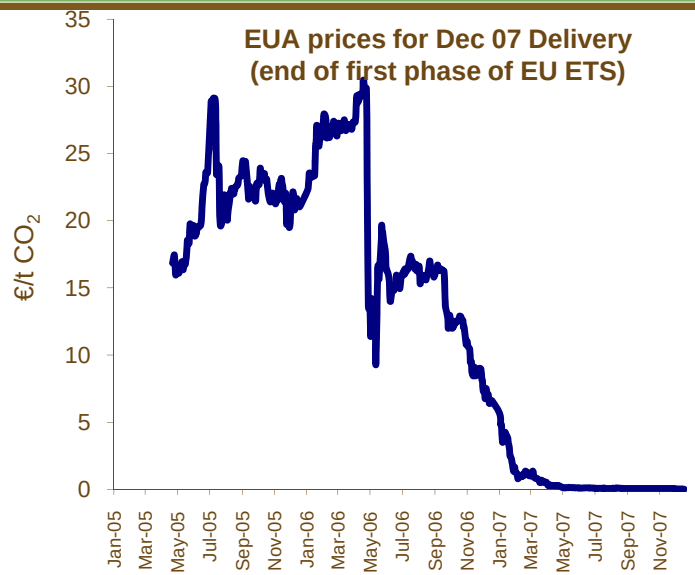
Carbon markets work, although policy constraints and other natural and economic forces can cause large fluctuations in prices

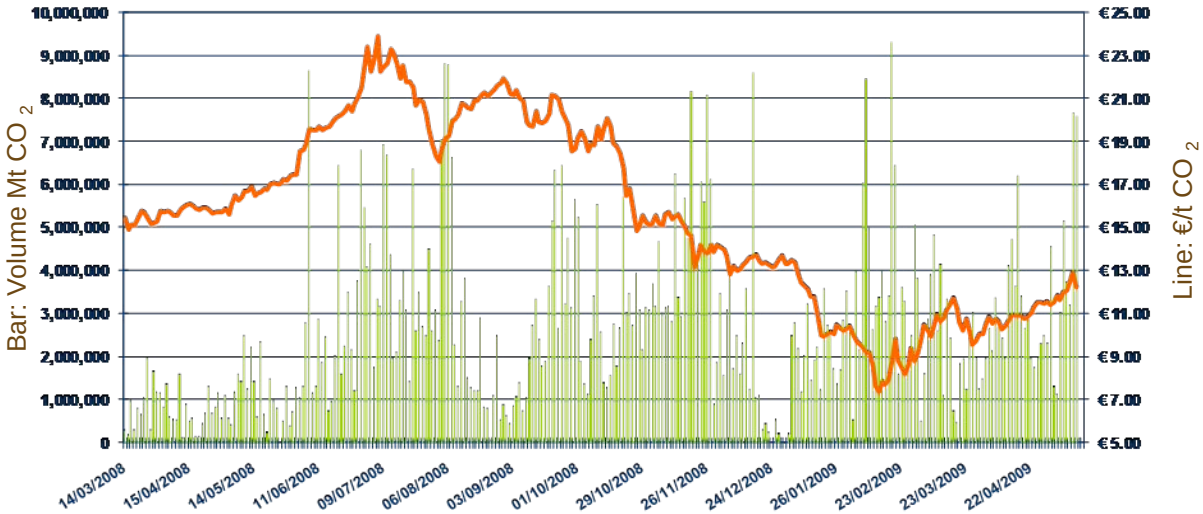
- Demand for carbon credits is driven by lower cost of CO2 abatement
  - e.g., CDM projects are €8-12 vs. cost of fuel switching in Europe: €40/tCO2
- Carbon prices are dependent on many factors including:
  - Natural gas and coal prices
  - Weather
  - Global economic growth
  - Foreign exchange fluctuations
  - Emissions reduction project technical delivery and policy approval uncertainties
  - Speculation on any of the above
- Project-based CDM transactions are declining
  - Decline in demand due to recession
  - Regulatory and price uncertainty post 2012 continues to prevent most buyers from committing to long-term purchase agreements
  - Uncertainty in CDM credits post 2012 is expected to produce a lull in CDM project development
- Post Kyoto 2012 agreement is hoped for in Copenhagen Dec 2009 meetings

Supply-demand mismatches such as the over-issuance of credits in 1st phase EU ETS can cause drops in prices and high volatility

But the longer term (Phase II) prices never dropped



ECX EUA Futures Dec 09 delivery



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The carbon credit industry is young with no single dominant business model and relatively low barriers to entry for new firms

Flow of project-based carbon credits

Significant vertical integration → Project origination[2] → Project validation and approval → Project finance → Credit marketing, brokerage and trading[1] → Exchanges → Credit purchase and compliance submission

Core competencies required

- PIN/PDD expertise
- Engineering expertise
- Access to capital
- Knowledge of CDM/JI procedures and voluntary market options

- MMV skills
- Methodology development
- PDD expertise
- Legal expertise
- Knowledge of CDM/JI procedures

- Carbon market knowledge
- Project finance skills
- Able to evaluate and hedge project risks
- Capital markets expertise and access
- Regulatory/legal expertise

- Trading skills
- Carbon market knowledge
- Buy-side and sell-side capital markets expertise
- Credit quality expertise
- Network of buyers and sellers for OTC trades

- Energy expertise and trading experience
- Commodities trading skills
- Carbon market knowledge
- Regulatory expertise

- Regulatory and legal expertise
- Compliance expertise
- Risk management and hedging skills

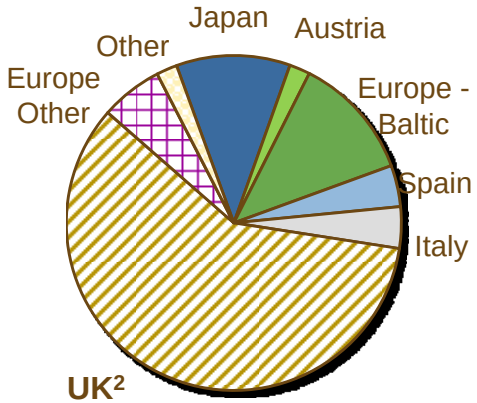
Top 15 By Projects[3]

Company/Fund	# of Projects
EcoSecurities	237
Carbon Asset Mgmt Sweden	108
EDF Trading	82
IBRD	77
RWE	59
ENEL	58
Trading Emissions	55
Mitsubishi	53
Agrinergy	52
AgCert	51
Cargill International	46
Noble Carbon	45
MGM Carbon Portfolio	38
CAMCO	38
Climate Change Capital	35

Top 5 By CERs[4]

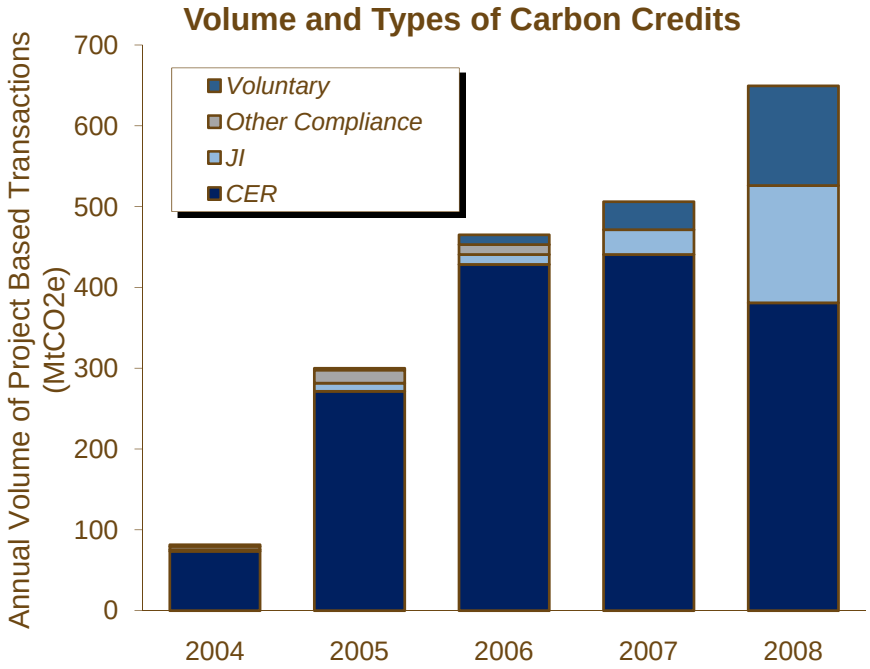
Company/ Fund	Millions of contracted CER/ERU
Natsource	101
EDF Trading	65
Trading Emissions	62
CAMCO	50
Natixis (European Carbon Fund Mgrs)	32

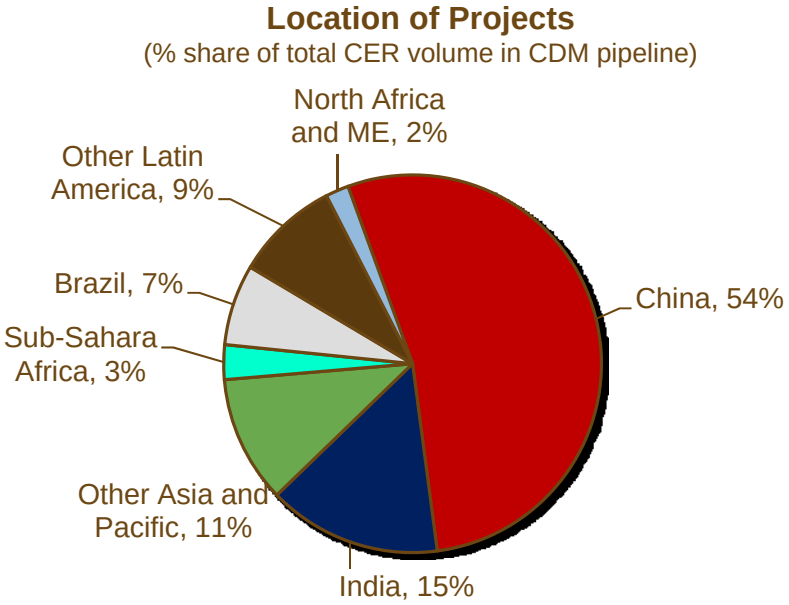
Location of CDM and JI Market Buyers
2007 Overall volume:
592 MtCO2e



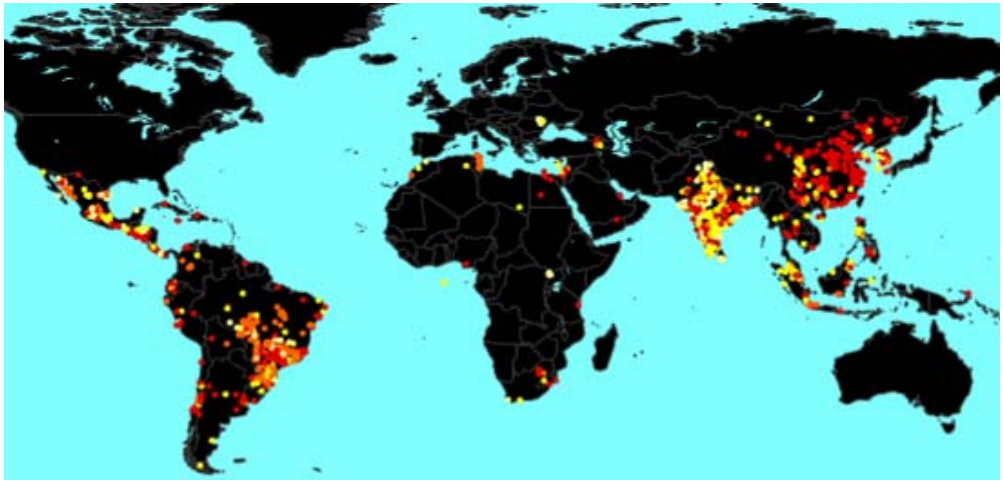
(2) UK is the leader in carbon fund management, with 72% of private carbon funds and 50% of all carbon funds being managed out of London (New Energy Finance)
(3) By # of CDM projects direct investment
(4) Expected volume through 2012 from contracted projects through Dec 2007 (New Carbon Finance 2007 League Table), in 2008, top buyers were Carbon Asset Management, Vitol, Camco, Ecosecurities, and Mitsubishi, each with over 20Mtons contracted

In project-based carbon credit (compliance) market, Clean Development Mechanism Certified Emission Reductions (CER) in India and China are dominant





Data through May, 2009



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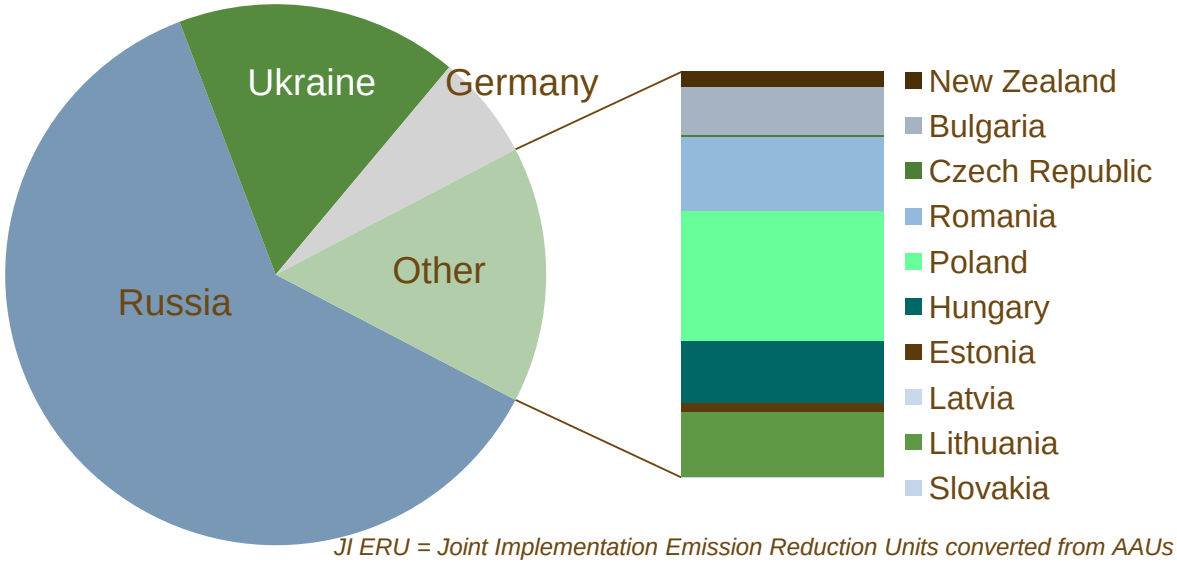
Joint Implementation (JI) Emission Reduction Unit (ERU) projects are dominated by Russia and Ukraine

JI Market Summary

- Traded volumes in JI credits went from 21Mt in 2006 to 38Mt in 2007 to
- Russia and Ukraine are expected to dominate the pipeline, total pipeline credits could amount to 240Mt by 2012
- Supply of JI credits if released and accepted would fill Kyoto compliance shortfall three times over, however, quotas by Russia, uncertain regulation and process hurdles have prevented the market flood

Comments

- Barriers are primarily institutional:
  - Still large uncertainties with regard to issuance procedures
  - Post 2012 uncertainty high for JI credits
  - EU ETS-regulated companies cannot use JI AAUs to meet their EU ETS obligations



JI ERU = Joint Implementation Emission Reduction Units converted from AAUs (Assigned amount units)

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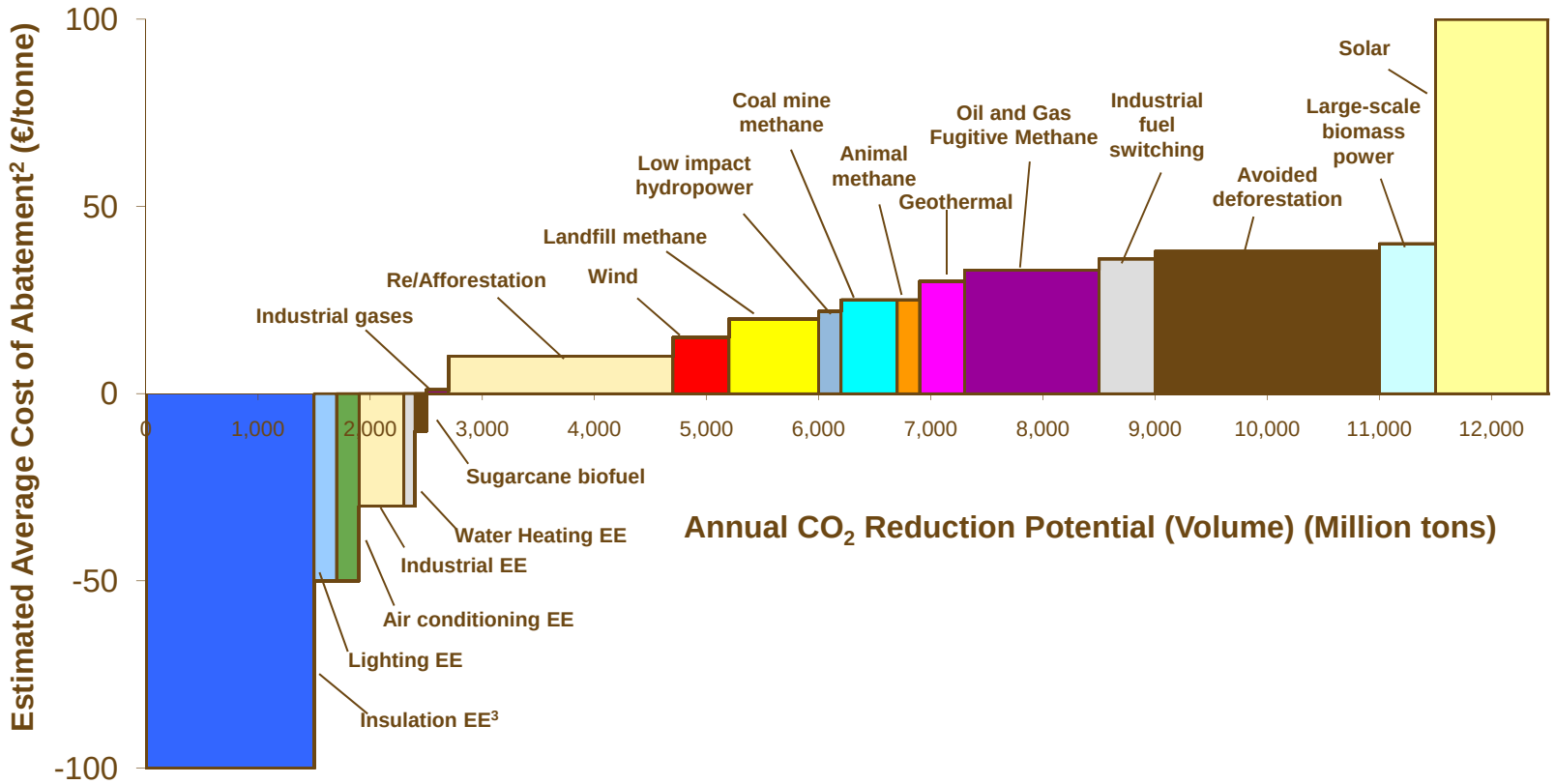
There are many billion tons of potential emissions mitigations available in developing countries

Representative Current Carbon Emission Reduction Supply Curve for "CDM eligible" projects[1]



(1) By type of project and global emissions reduction potential through 2010, excluding non-CDM eligible projects such as increased vehicle efficiency and nuclear power, also excludes currently non-commercial technologies

(2) Cost estimates are approximate averages for different options for relative comparison only. These average costs do not equate to the necessary carbon credit revenues needed to undertake a project as there are other financial impacts on project cost, for each technology option there are individual technology supply curves. Actual costs depend on energy prices and local circumstances such as power costs and technology options-e.g. recovery of methane for pipeline vs. distributed power use

(3) Negative costs indicate a positive return on investment over the lifecycle of the project, however there are other institutional and financial hurdles to energy efficiency projects that prevent action so this does not mean that the projects are non-additional

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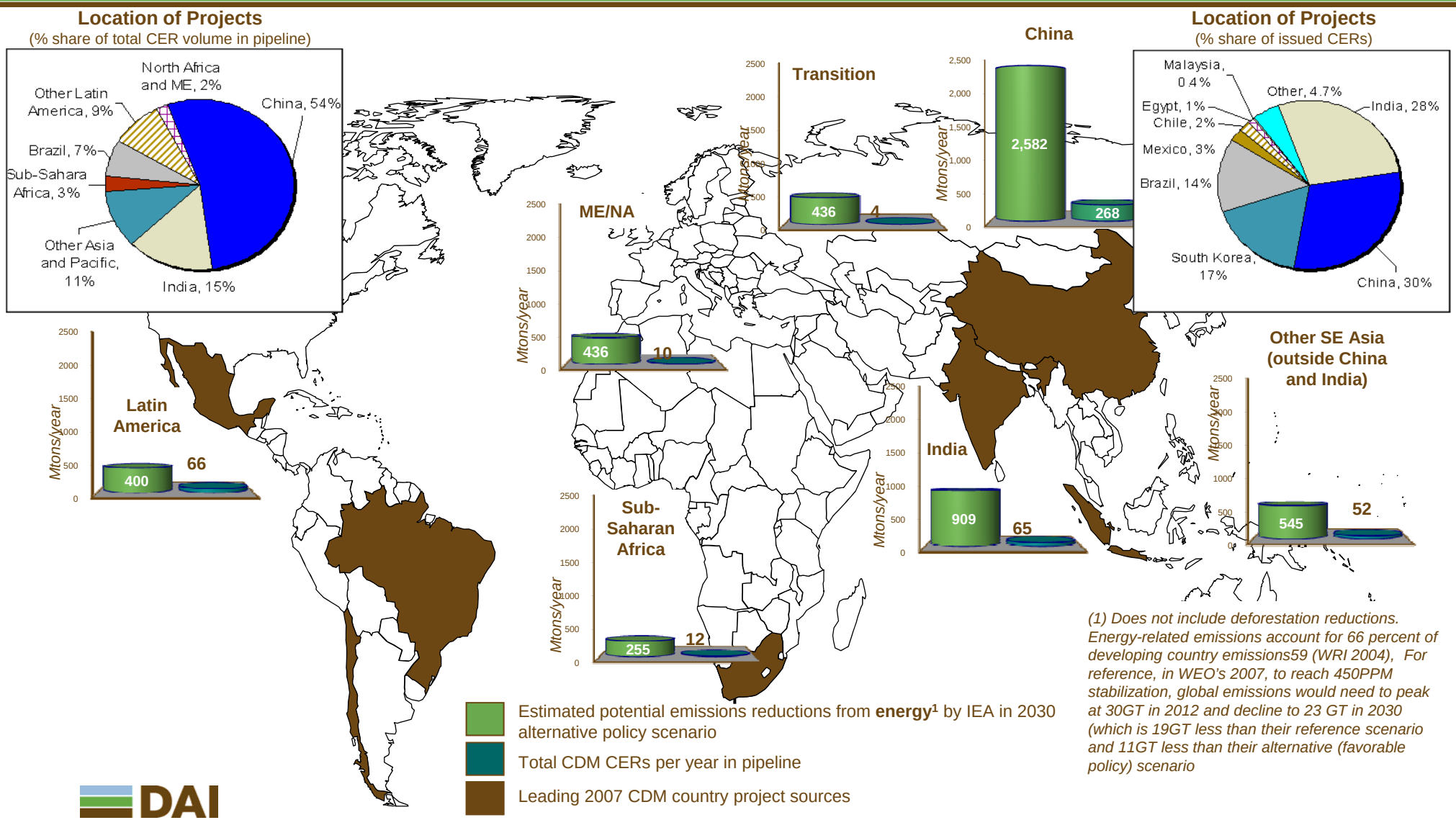
China and India currently dominate the market and will likely provide up to 70% of the future CDM credit opportunities



(1) Does not include deforestation reductions. Energy-related emissions account for 66 percent of developing country emissions59 (WRI 2004), For reference, in WEO's 2007, to reach 450PPM stabilization, global emissions would need to peak at 30GT in 2012 and decline to 23 GT in 2030 (which is 19GT less than their reference scenario and 11GT less than their alternative (favorable policy) scenario

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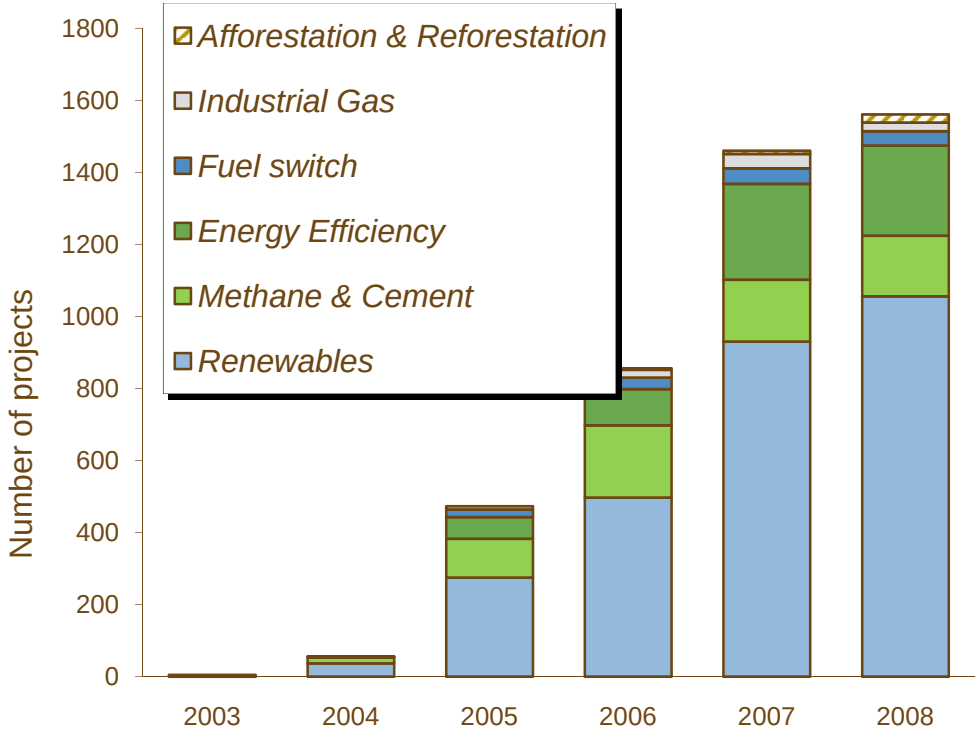
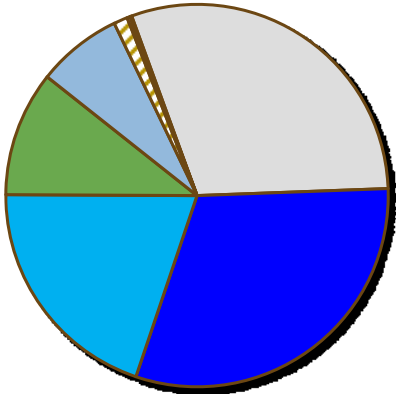
The majority of *new* CDM projects are renewable and supply-side energy efficiency but total CERs *issued* are still primarily industrial gas reduction projects

Number of projects in each sector in CDM Pipeline



Type of Projects
(as share of CER volume through 2012)



Comments

- Hydrofluorocarbon (HFC) and Methane reduction projects represent a small share of projects, but a large share of issued credits due to weighting
- China has 75% of the HFC, N2O and medium to large scale hydro (20MW+) projects
- However, HFC-23 projects are largely exploited and the flow is expected to decline

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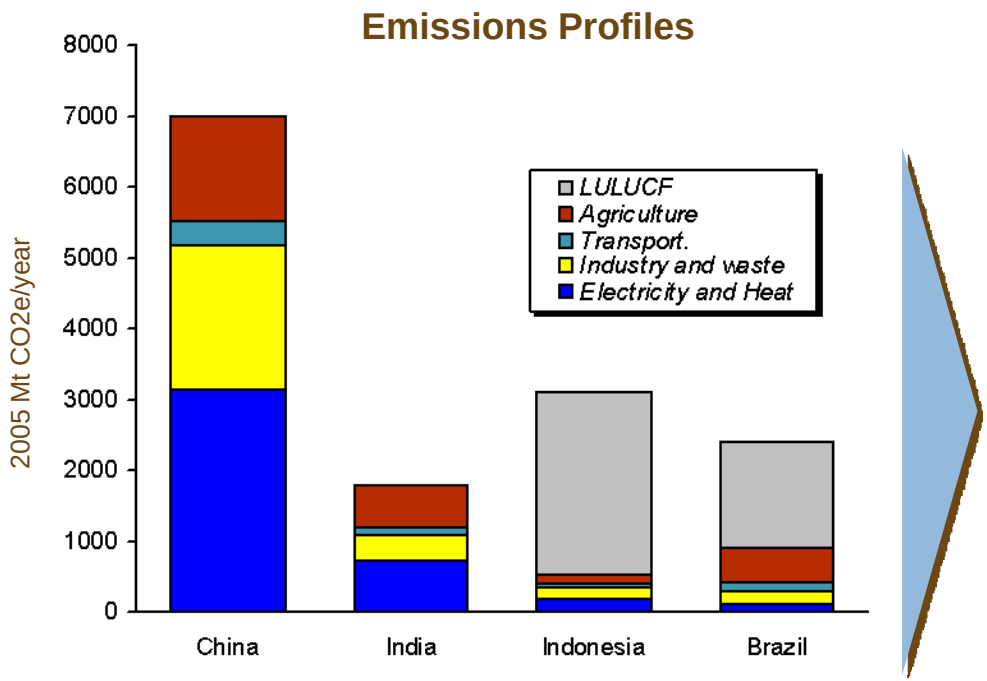
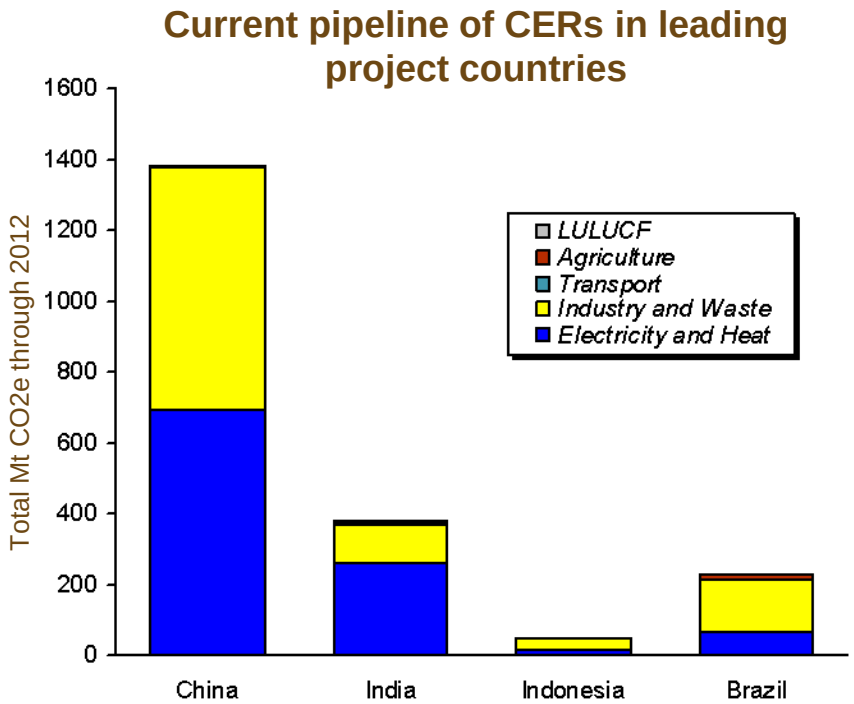
Emissions sources are not correlated with CDM credits, forestry, agriculture, transportation and demand-side efficiency projects are challenging



Source: IEA 2007 World Energy Outlook



Source:CD4CDM UNEP Risoe Center

LULUCF: Land Use, Land Use Change and Forestry projects

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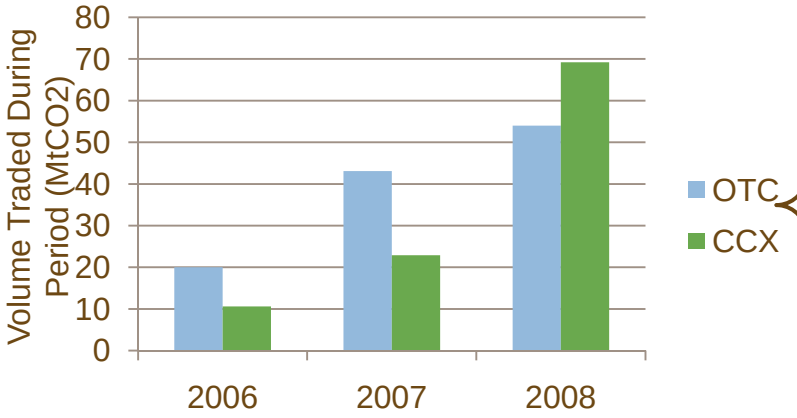
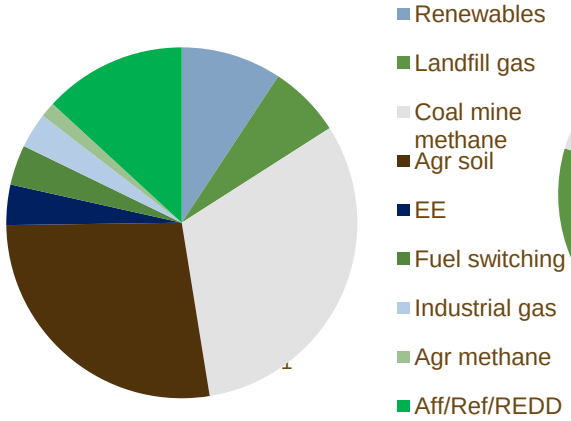
Voluntary markets are increasingly significant sources of carbon finance, particularly for non-CDM qualifying projects/sectors

- Voluntary Markets exist outside of any regulatory mandate and are typically used by corporations and organizations in the U.S. and Europe who want to brand themselves or their products as “green”, or in preparation for an eventual regulatory market.
- Projects that don’t qualify for the CDM due to their country of origin, their project type (forestry and soil credits) or other barriers make up large portions of the market
  - The Chicago Climate Exchange has a large number of soil and coal mine methane credits
  - Over the counter (OTC) transactions are primarily landfill gas, forestry and renewables
- The market is dominated by US companies, US emissions are 16 per cent higher than in 1990 and proposed legislation could create a massive regulated CDM market

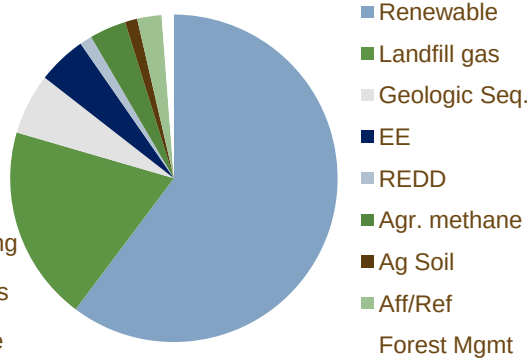
Voluntary Market Volumes Traded
(Est. OTC and CCX)



CCX: Projects Types
(% share registered in CCX 2007 and 2008)



OTC: Project Types
(Est. % share transacted, Voluntary OTC 2008)



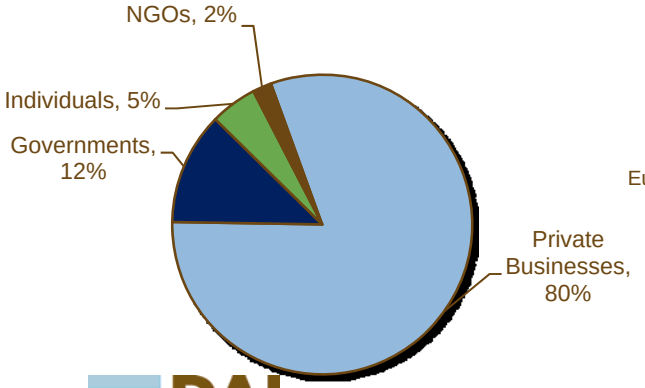
(1) Soil sequestration primarily from changed agricultural practices, some question permanency and additionality, see http://www.epa.gov/sequestration/ag.html or the CCX website for more info

Source: Survey of participants, New Carbon Finance, State of the Voluntary Carbon Markets 2008

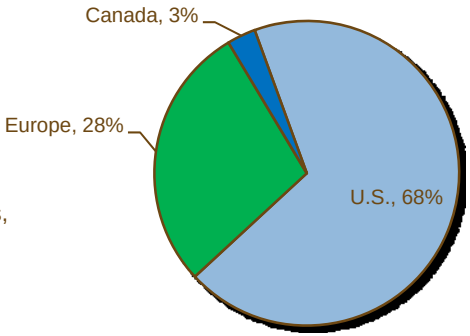
Standardization efforts are progressing in voluntary markets, their future is dependent on the outcome of US regulations

- Voluntary buyers include consumers and businesses, consumers offset their carbon usage and fund projects in their area of interest
- Businesses dominate the market (estimated over 80%) and buy primarily for sustainability reporting/internal goals, public relations/branding, and to allow the sales of carbon-neutral products
- The advent of US regulation (expected by 2012) is a potential threat to the voluntary market due to the potential reduced demand due for credits from the withdrawal of newly regulated entities from the market and corporate reluctance to "pay twice" after increased power and fuel bills
- However continued growth is expected prior to US regulations coming into force
- Long-term demand expected from non-regulated consumer, retail and Corporate Social Responsibility (CSR) buyers
  - Particular interest of these segments are forestry and "community development" credits with sustainable development aspects

Types of Voluntary Buyers



Locations of Voluntary Buyers



Standardization efforts

- **The Voluntary Carbon Standard** was initiated by The Climate Group, the International Emissions Trading Association, WBCSD and the World Economic Forum in 2005, it was launched formally in 2007 (www.v-c-s.org)
- **Gold Standard** credits for renewable energy and energy efficiency projects with sustainable development benefits (www.cdmgoldstandard.org)
- **CAR, The Climate Action Reserve Protocols** is a private non-profit organization originally formed by the State of California, it serves as a voluntary greenhouse gas (GHG) registry to protect and promote early actions (www.theclimateregistry.org)

Registries

- Registries are designed to track credit transactions and ownership to reduce the risk that a single credit can be sold to more than one buyer
- Climate Action Registry's Climate Action Reserve (www.theclimateregistry.org)
- APX VCS Registry (www.vcsregistry.com)
- TZ1, New Zealand Exchange, but expanding internationally, (www.tz1market.com)

Source: Survey of participants, New Carbon Finance, State of the Voluntary Carbon Markets 2007

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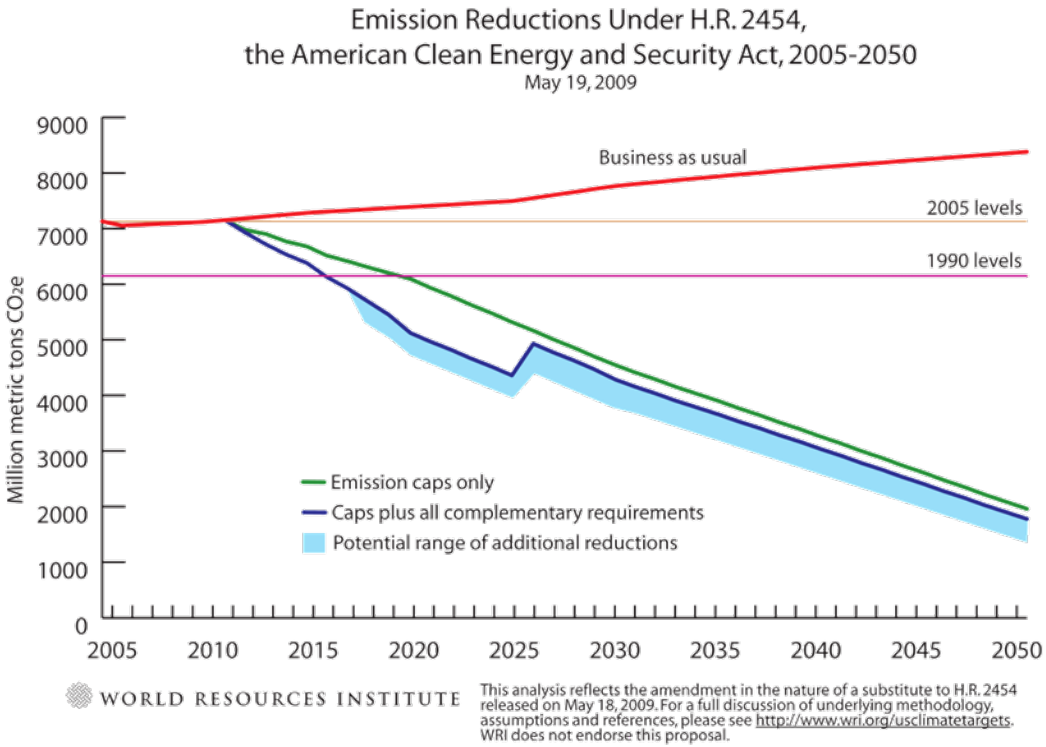
U.S. Federal greenhouse gas cap and trade regulations will likely enter into force by 2012

- Key questions on any policy are:
  - Who is covered and what is the point of regulation?
  - Who will be awarded (grandfathered) permits?
  - What will be done with the auction revenues?
  - What types of projects are eligible for offsets?
- Many uncertainties on these questions, but some sureties:
  - Government entities that have power plants or large industrial sources of emissions could be regulated
  - Government agencies may be able to develop carbon credits to offset emission reduction project costs, but there will be no 'free lunch' for actions already taken



  - Transportation fuels will likely be regulated upstream, driving fuel prices higher (estimates above $0.50/gallon by 2030)
  - Electricity generators will be regulated upstream, driving power costs higher (estimates vary, likely 30% by 2030)
  - There will be significant government revenues generated via auctioned permits (value could be $150-$300B by 2020)
- A US policy with nearly full coverage of U.S. emissions would dwarf existing carbon markets – could be a $1 trillion carbon emission market by 2020

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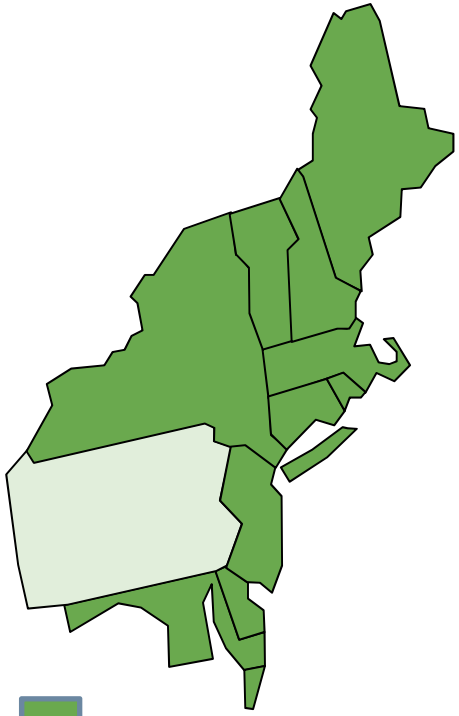
The Regional GHG Initiative (RGGI) is a small market covering only power plants and is not expected to significantly impact costs

- The Regional GHG Initiative (RGGI) is comprised of a group of 10 States[1]
- Target Emissions Reductions:
  - from 2009 to 2014, the states will stabilize the region's emissions at 188 million short tons (not metric tons) of CO2 per year, roughly 2008 levels
  - From 2015 to 2018, the signatories will reduce emissions by 2.5% per year, resulting in 2018 emissions 10% lower than the initial 2009 budget
- Regulated Entities: fossil-fired electric power generating units 25 megawatts (MW) or larger
- Allowances: allocated by auction. The initial auction took place in September, 2008.
  - Each allowance carries a minimum price of $1.86, but in the first round of auctioning, for example, allowances sold for $3.07, raising $39M
  - Two more auctions have been held, the three auctions sold 77.9 million allowance credits raising $262 million



RGGI member

RGGI Observer (and DC)

1. Participating States are Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island, and Vermont. The District of Columbia, Pennsylvania, Ontario, Quebec, the Eastern Canadian Provinces, and New Brunswick have observer status.

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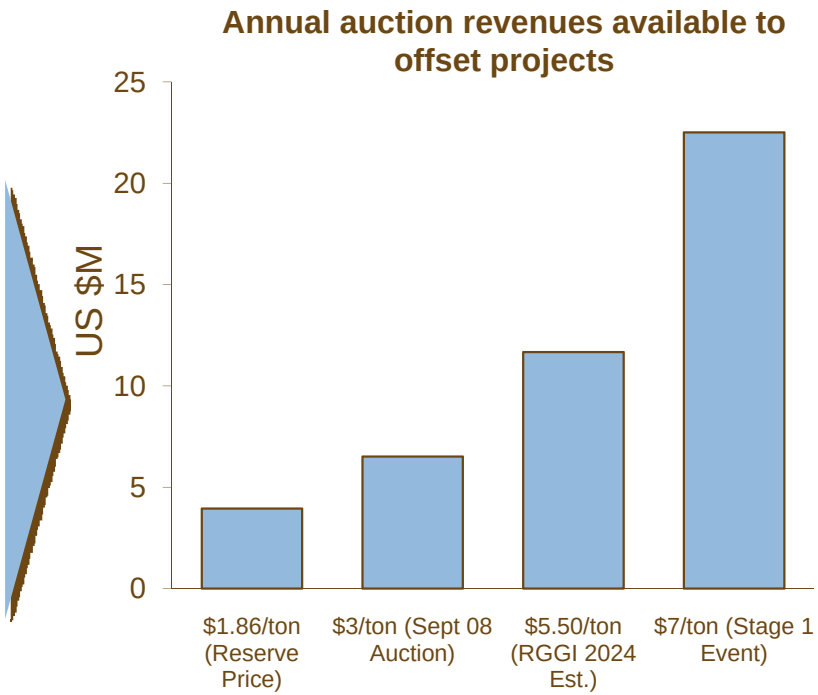
RGGI is approving offsets from particular types of projects but they are not expected to be a significant source of project funding

- Approved offsets include:
  - Landfill methane capture and destruction
  - Reduction in emissions of sulfur hexafluoride (SF6) in the electric power sector
  - Sequestration of carbon due to afforestation;
  - Reduction or avoidance of CO_2 emissions from natural gas, oil, or propane end-use combustion due to end-use energy efficiency in the building sector
- Offsets/Carbon Credits are not expected to provide significant revenues for emissions reduction projects
  - Because the purpose of RGGI is to reduce power plant emissions, the use of offsets is limited to 3.3% of the CO2 emitter's emissions.
  - The use of offsets can rise to 5% if allowance prices average more than $7 over the year (termed a "Stage 1 event') and 10% if they average $10 or more (a "Stage 2 event")
  - But with low expected prices, offset revenues are unlikely to contribute significantly to emissions reduction projects
- However, allowance auction revenues will provide funding for EE projects



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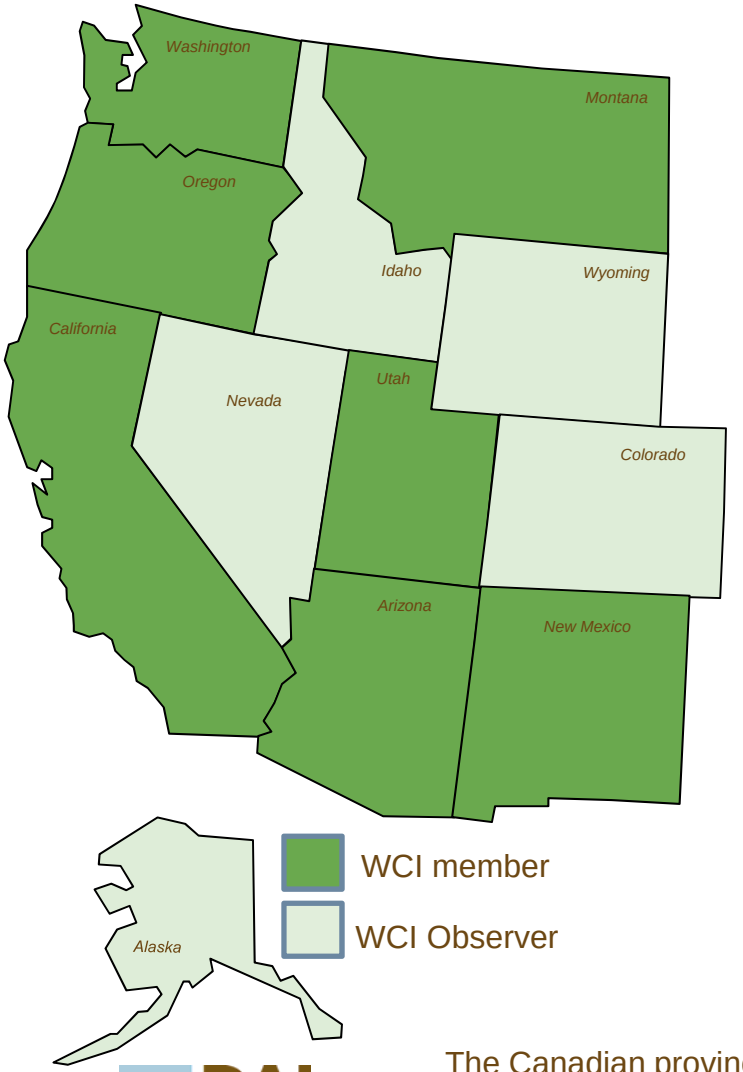
California is leading the way in the Western Climate Initiative with aggressive goals and broad sector coverage



- CA Global Warming Solutions Act (AB 32) Targeted Emissions Reductions (monitored by *California Air Resources Board (“**CARB**”):*
  - 1990 levels by 2020, roughly 169 Mtons CO2e or 30% below business as usual
  - 80% reduction by 2050, roughly 341 Mtons CO2e from BAU
- WCI Target Emissions Reductions:
  - 2012, the WCI will set a regional cap on GHG emissions; this cap will be lowered between 2012 and 2020 in three-year compliance periods, so that by 2020 regional emissions will have been reduced by 15% below 2005 levels
- Regulated Entities:
  - Beginning in January 2010, all entities and facilities with than 10,000 metric tons emissions must monitor and measure the six regulated GHG emissions
  - Phase 1, starting in 2012 , covers electricity generators and (imported electricity) and industrial facilities emitting more than 25,000 metric tons of CO2e
  - Phase 2, starting in 2015, covers transportation and all residential, commercial and industrial **fuel** use, where the fuel enters commerce. Also industrial facilities below 25,000 metric tons

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The Canadian provinces of British Columbia, Manitoba, Ontario, and Quebec are participants and Saskatchewan, and six Mexican states are WCI Observers

Most allowances may be given away, and offsets will be restricted

- Allowances:
  - Minimum of 10 percent of a jurisdiction's allowances be auctioned in 2012 and 25 percent by 2020
  - Minimum percentage of allowances or revenues must be devoted to energy efficiency, alternative energy, and other programs
- Offsets: no more than 49 percent of the total emission reductions from 2012 to 2020, priority types:
  - Agriculture (manure management and soil sequestration);
  - Forestry (afforestation/reforestation, forest preservation/conservation, and wood products);
  - Waste management (landfill gas and wastewater management); and
  - Clean Development Mechanism projects established under Kyoto
- International offsets:
  - Only CDM projects under current proposal
  - But likely to include projects approved under the Climate Action Reserve (formerly the California Climate Action Registry), which was endorsed by the California Air Resources Board (CARB). CAR currently has protocols for forestry, landfill, and livestock methane projects and is developing others, but CAR does not accept international projects outside of the US, Mexico and Canada to be incorporated
  - California and two other states signed a MOU with governors from Indonesia and Brazil to work cooperatively to incorporate REDD credits, but little hope of near term acceptance

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Questions?

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