



JOINT GLOBAL CHANGE RESEARCH INSTITUTE

Voluntary Carbon Markets and NDC Implementation

Sep. 21, 2023

IETA Workshop
NY Climate Week

Mel George and Jae Edmonds

Motivation

- Voluntary carbon markets (VCMs) have been growing rapidly and induce activities with real-world consequences for the countries in which those actions occur, other countries connected in the global energy network, international financial transfers and for the Earth's climate.
- Article 6 enables nations to cooperate to meet Nationally Determined Contributions (NDCs).
- Private sector parties which engage in VCMs potentially change the circumstances under which nations achieve their NDCs.

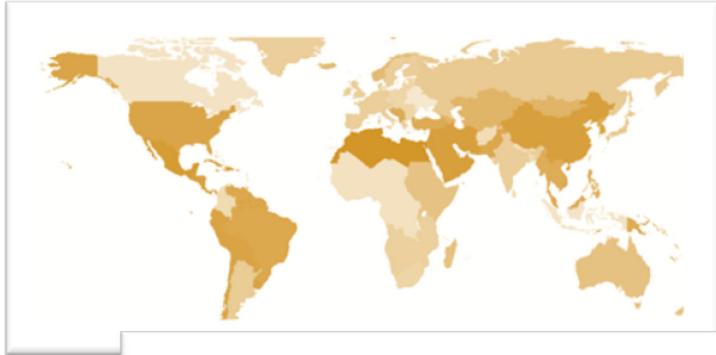
Our Research Questions

How will VCMs interact with implementation of NDCs, with and without Article 6?

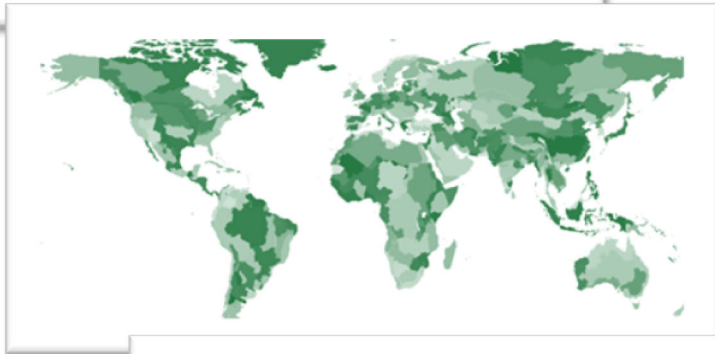
The Global Change Analysis Model (GCAM)

Model Coverage

32 Energy &
Economy
Regions



384 Land
Regions



235 Water
Basins



- Dynamic-recursive, (NOT optimization).
- Simultaneously resolves **energy**, **water**, land, and **economic** markets, and **climate systems** it solves in a single unified code.
- **Five-year time steps** but can run on one-year time steps.
- Time horizon is 2100.
- **Community model**
(<https://github.com/JGCRI/gcam-core/releases>) source code, data, and documentation
- Tracks emissions of KP gases, aerosols and short-lived species.

Approach

Create a hypothetical **Voluntary Carbon Market (VCM)**

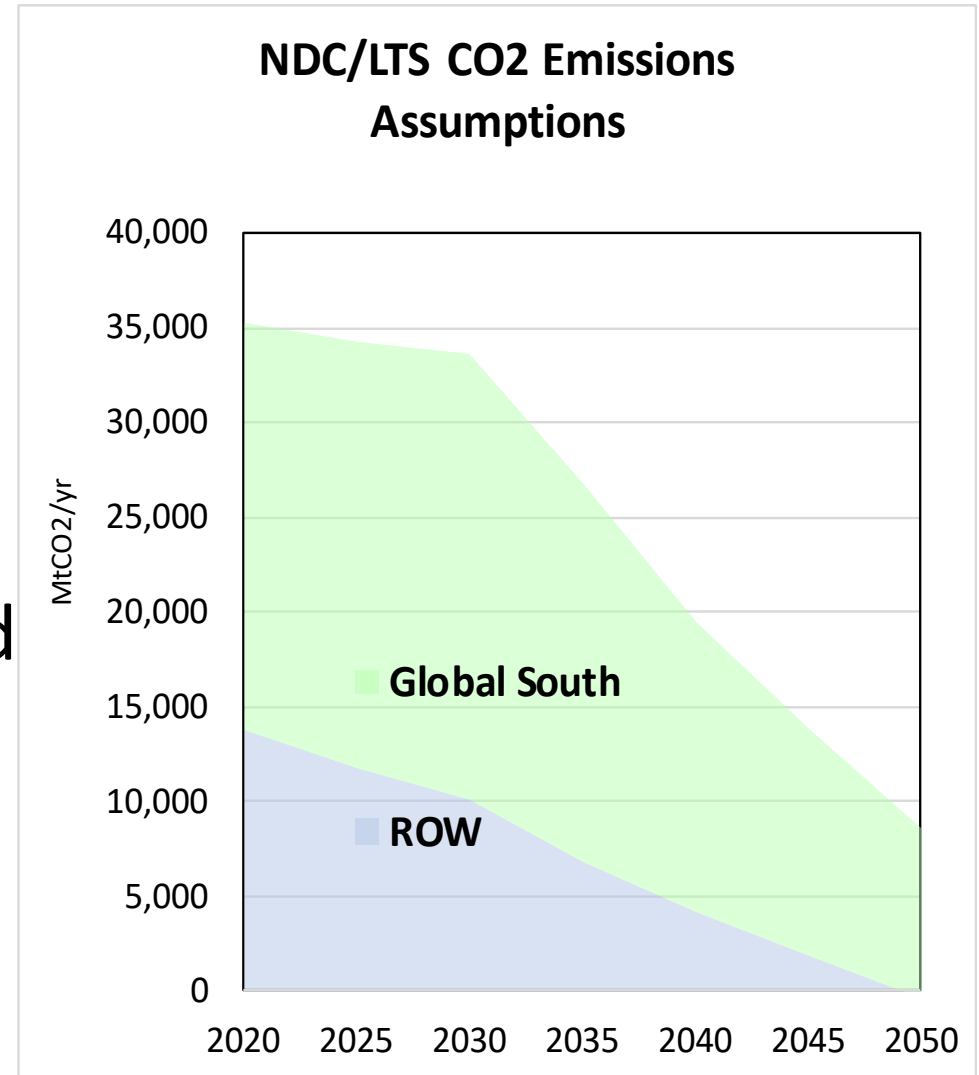
- We assume a **Voluntary Carbon Commitment** by U.S. energy-intensive industries in which CO₂ emissions decline to net zero in 2030.
- The hypothetical Voluntary Carbon Commitment is independent of the U.S. **Nationally Determined Contribution (NDC)** and Long-Term Strategy.



- U.S. Industry engages in transactions to meet its Net Zero goals in a VCM formed with the private sector in the **Global South (GS)**.
- **We only allow transactions that create net reductions in emissions.**

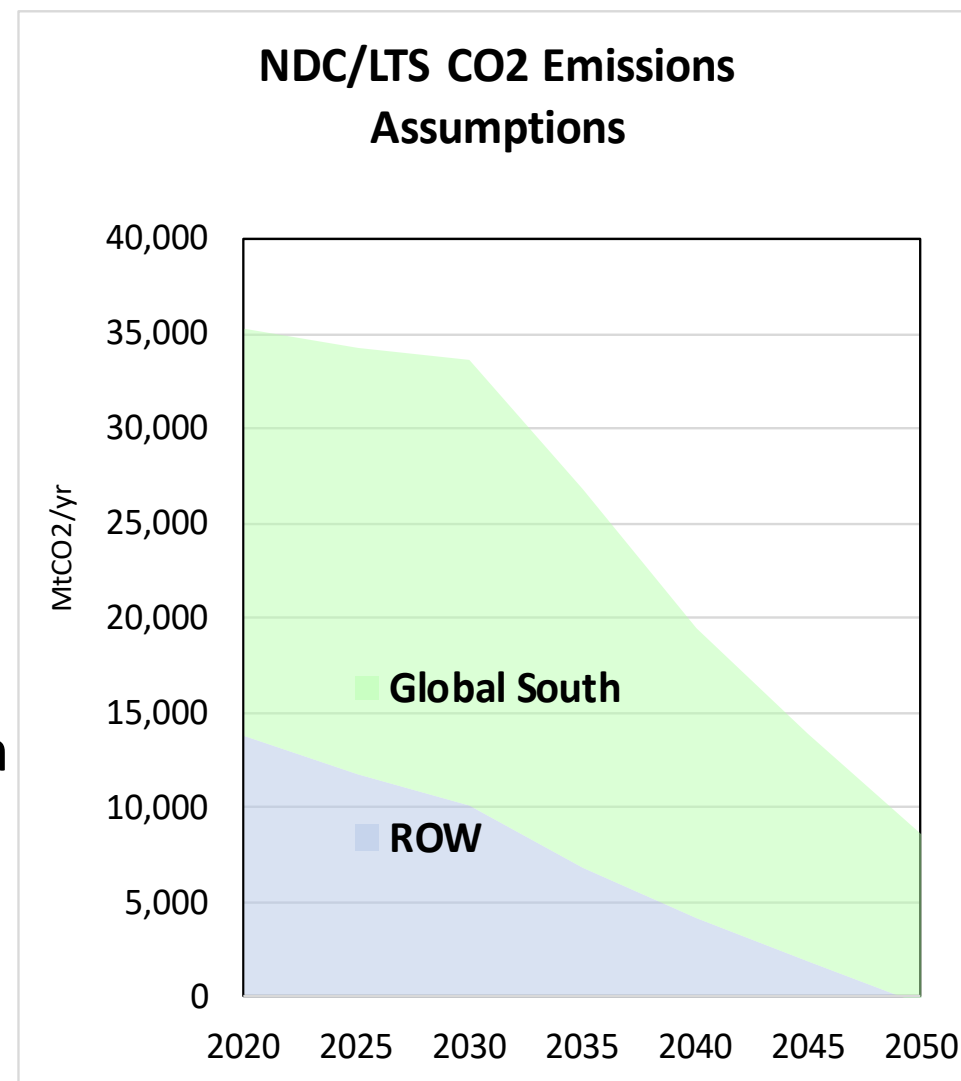
NDC Assumptions

- Use announced NDCs through 2030 as national commitments—that can be implemented either independently (**I-NDC**) or cooperatively (**C-NDC**).
- Cooperative implementation (C-NDC) is **GLOBAL**, i.e. NOT restricted to the Global South.
- Create a hypothetical post-2030 set of NDC commitments consistent with Paris goals.



Post-2030 NDC Assumptions

- **Countries with UNFCCC LTSs will,**
 - Follow it till the target year
 - After the target year, they adopt the minimum annual decarbonization rate (improvement in GHG emissions per unit of GDP) between 2015 & the target year
 - Those with net-zero pledges achieve it in the target year and continue to keep emissions constant after that.
- **Countries without UNFCCC LTSs will,**
 - Achieve the same rate of decarbonization as current policies require, OR
 - Increase it to 5% per year if the current decarbonization rate is less than 5% per year.



Approach

- 2 market condition assumptions
 - Independent or Cooperative NDC implementation?
 - Does the VCM have a corresponding adjustment (CA) or not?
 - And where not, does the VCM create additional (AD) mitigation relative to the C-NDC scenario or are double sales (DS)?
- **7 cases**
 - 3 Single Market Cases
 - 1 I-NDC + VCM Cases
 - 3 C-NDC + VCM Cases
- We assume VCM to solve after NDC attainment in each 5-year time step

Case	Name	NDC Fulfillment	With or without CA
1	noVCM-noCA I-NDC	I-NDC	NA
2	noVCM-noCA C-NDC	C-NDC	NA
3	VCM noNDCs	I-NDC	NA
4	I-NDC VCM-noCA	I-NDC	No
5	C-NDC VCM-noCA AD	C-NDC	No
6	C-NDC VCM-noCA DS	C-NDC	Yes
7	C-NDC VCM+CA	C-NDC	Yes

Key Issues

- We assume that trades take place in an integrated carbon market where sellers and buyers can execute transactions that correspond to real emissions mitigation
- Transactions in the VCM may have associated corresponding adjustments (CAs) or not.

REPORT EFFECTS ON

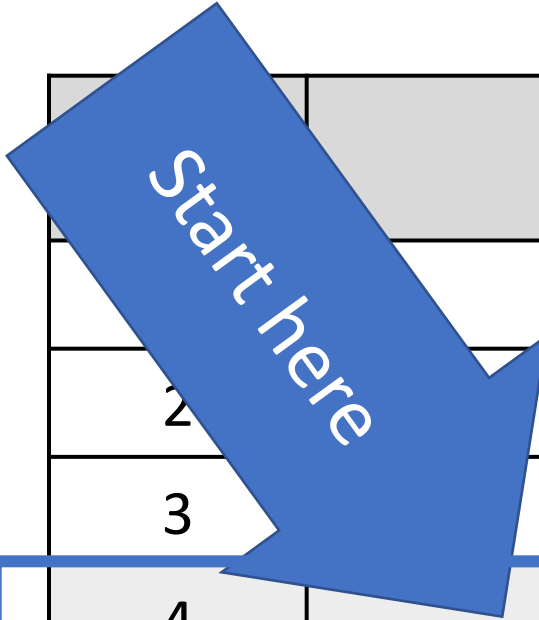
- CO₂ Prices: VCM, A6
- CO₂ Trades: VCM, A6
- Resource transfers to South: VCM, A6
- Emissions mitigation
 - By North vs South
 - Global

Results

Some Initial Findings

- **VCMs have a potentially important role to play in enabling emissions mitigation in the near term.**
- **The role of VCMs fade as NDCs approach net zero.**
- **When NDCs are implemented COOPERATIVELY using Article 6, the VCM plays a larger role transferring resources to the Global South than when NDCs are implemented independently (I-NDCs).**

Results

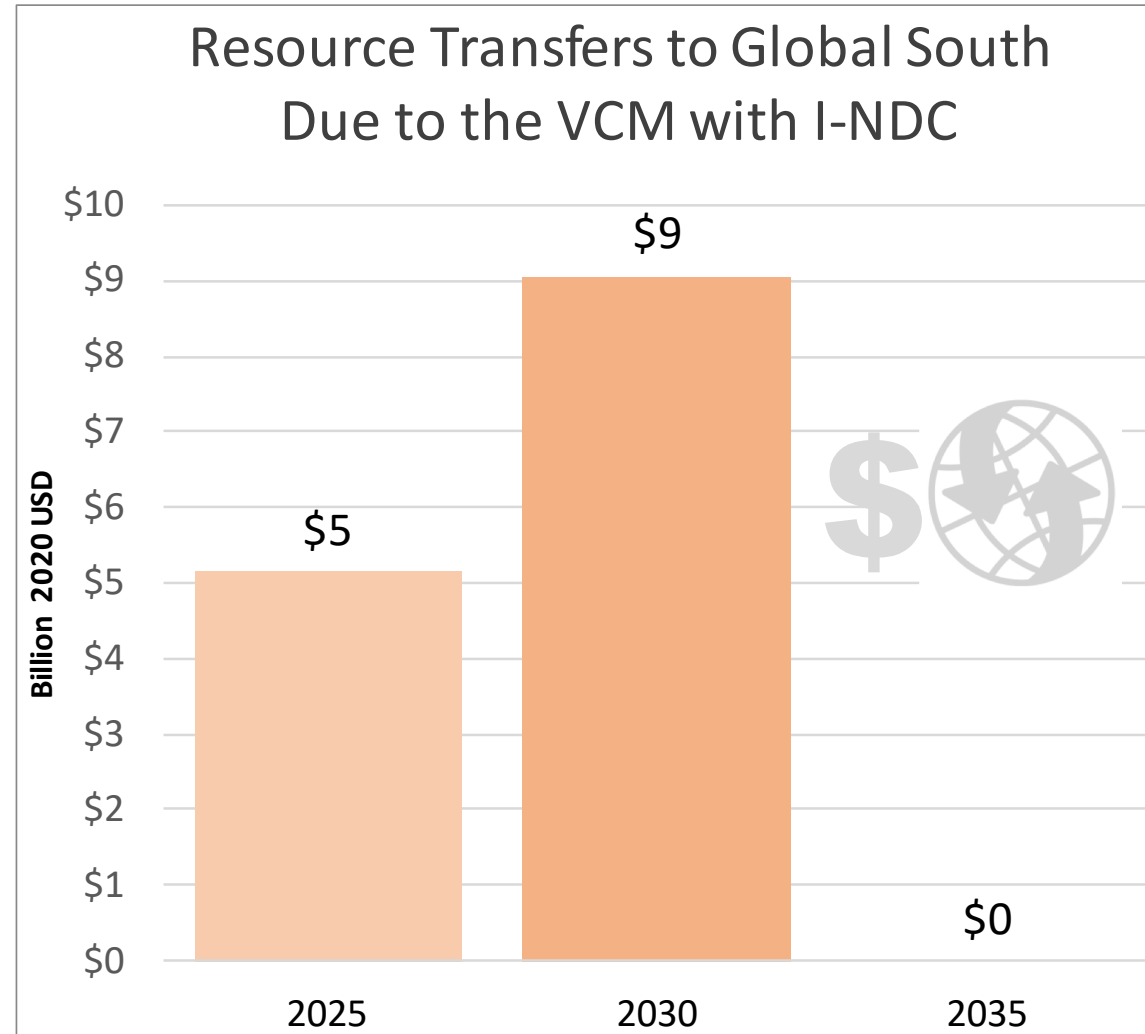


	Name	NDC Fulfillment	With or without CA
	noVCM-noCA I-NDC	I-NDC	NA
2	noVCM-noCA C-NDC	C-NDC	NA
3	VCM noNDCs	I-NDC	NA
4	I-NDC VCM-noCA	I-NDC	No
5	C-NDC VCM-noCA AD	C-NDC	No
6	C-NDC VCM-noCA DS	C-NDC	Yes
7	C-NDC VCM+CA	C-NDC	Yes

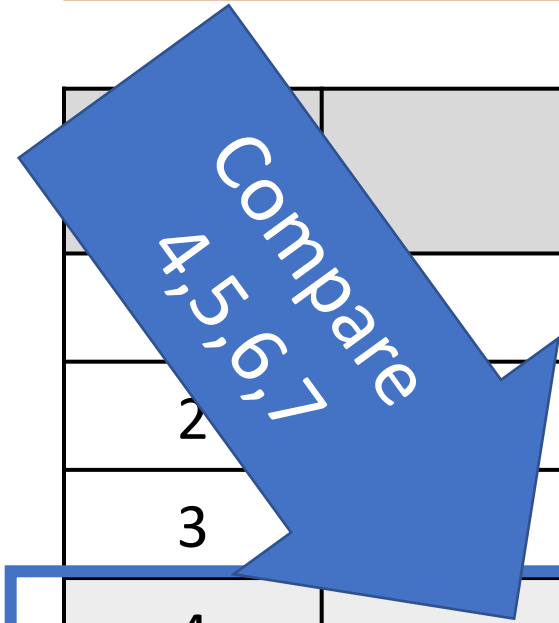
VCM Transfers to Global South, I-NDC

VCM markets transfers additional resources to the Global South, even when countries implement their NDCs independently (I-NDC).

Assuming that VCM activities create additional mitigation.



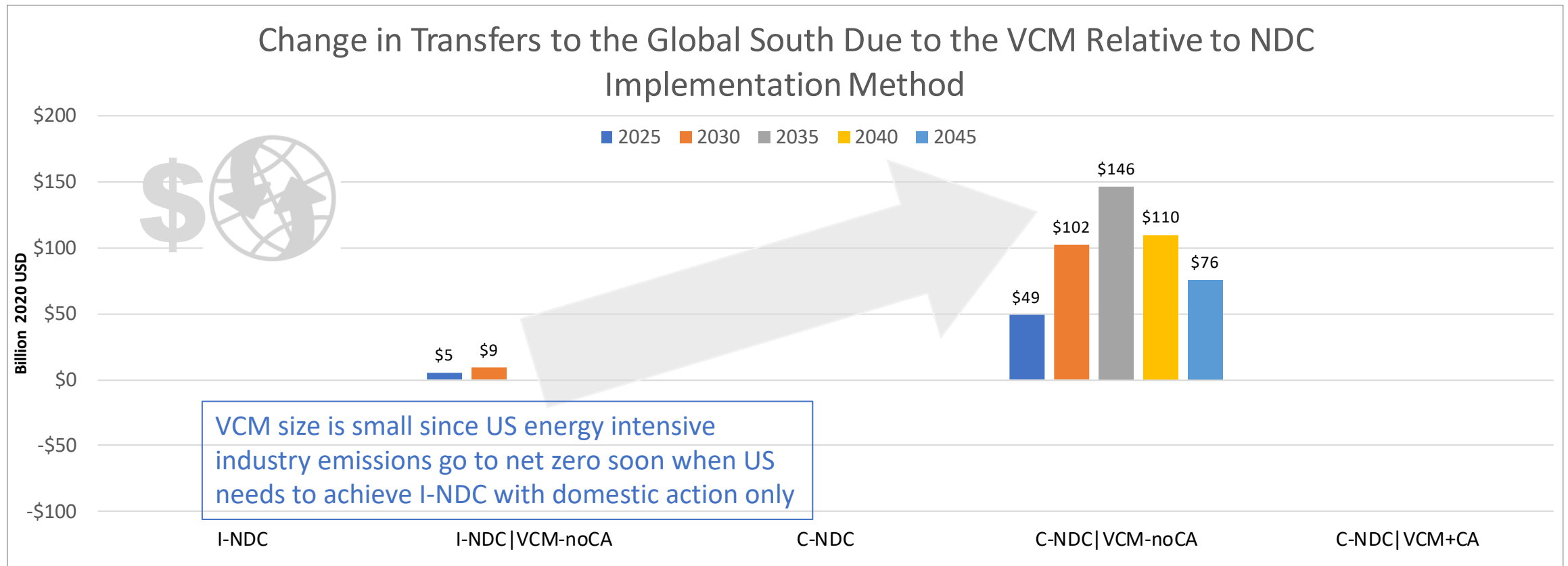
Results



	Name	NDC Fulfillment	With or without CA
	noVCM-noCA I-NDC	I-NDC	NA
2	noVCM-noCA C-NDC	C-NDC	NA
3	VCM noNDCs	I-NDC	NA
4	I-NDC VCM-noCA	I-NDC	No
5	C-NDC VCM-noCA AD	C-NDC	No
6	C-NDC VCM-noCA DS	C-NDC	Yes
7	C-NDC VCM+CA	C-NDC	Yes

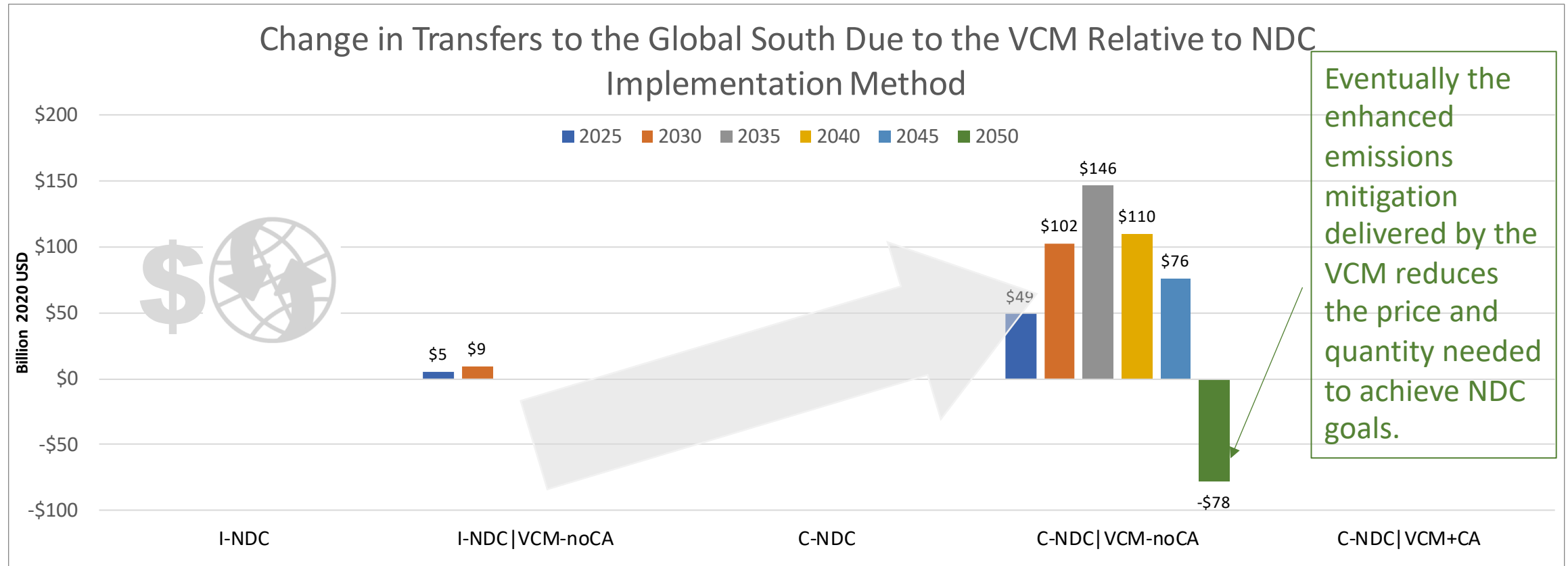
Some Initial Findings

VCM markets **without** Corresponding Adjustments transfer greater resources to the Global South than either I-NDC or C-NDC markets alone.



Some Initial Findings

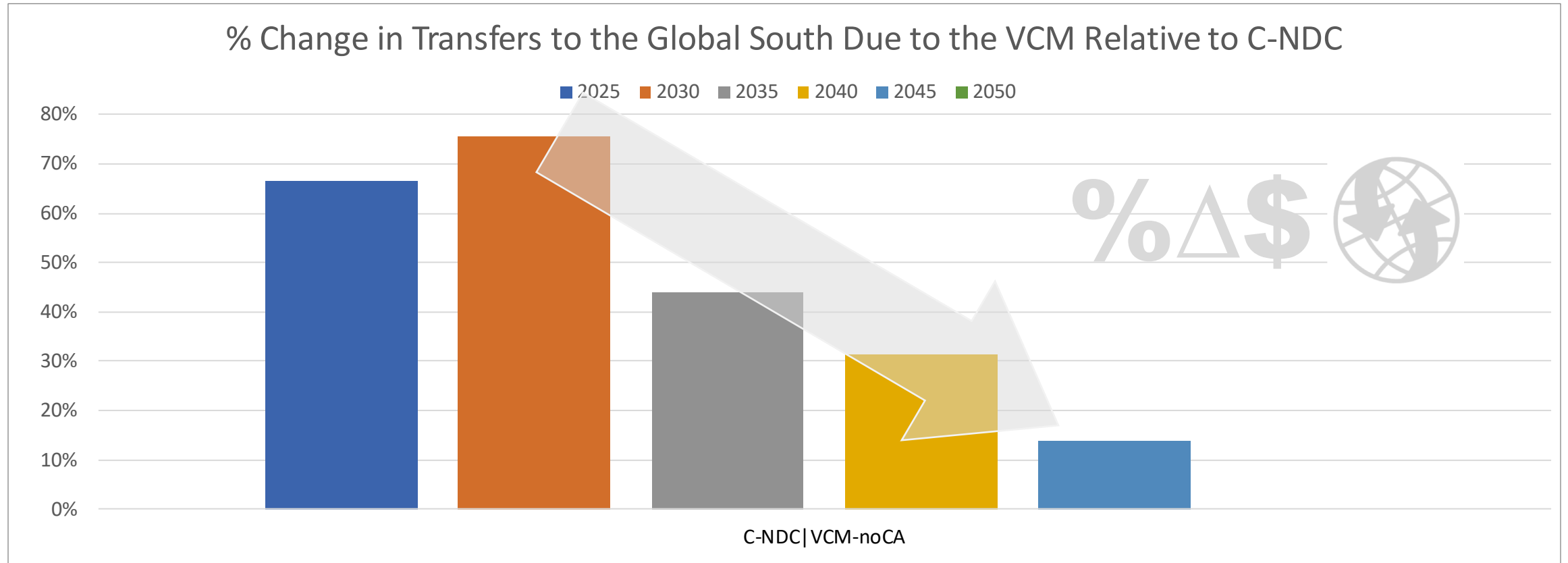
VCM markets **without** Corresponding Adjustments transfer greater resources to the Global South than either I-NDC or C-NDC markets alone.



Transfers to Global South are shown relative to the corresponding I-NDC or C-NDC scenario. The negative value does not mean negative transfers, but implies lower transfers in the compliance trading regime due to reduction in costs of mitigation over time achieved through VCMs

Change in Resource Transfers to Global South

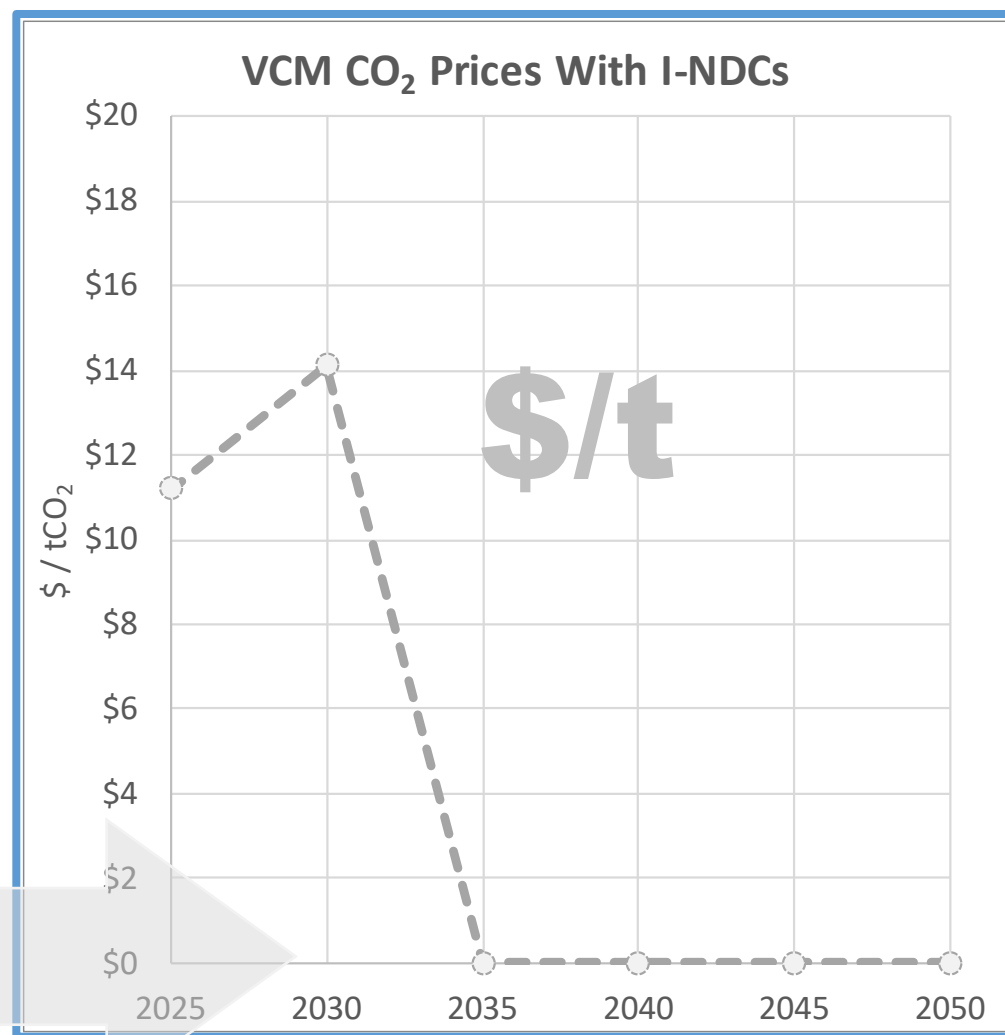
- VCM markets play a larger role in transferring resources to the Global South in the initial phases of transition pathways than in the later phases.



VCM Interactions with I-NDC and C-NDC Markets

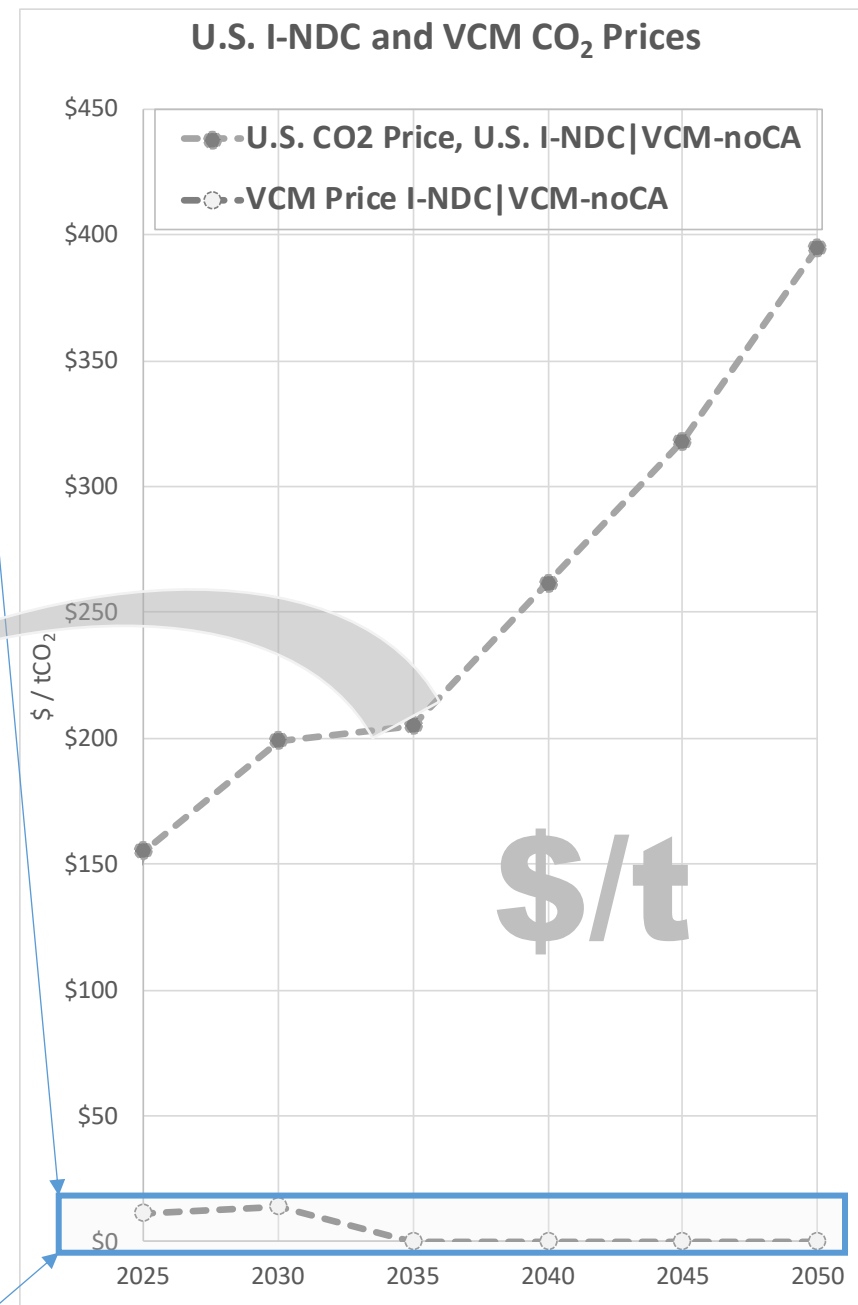
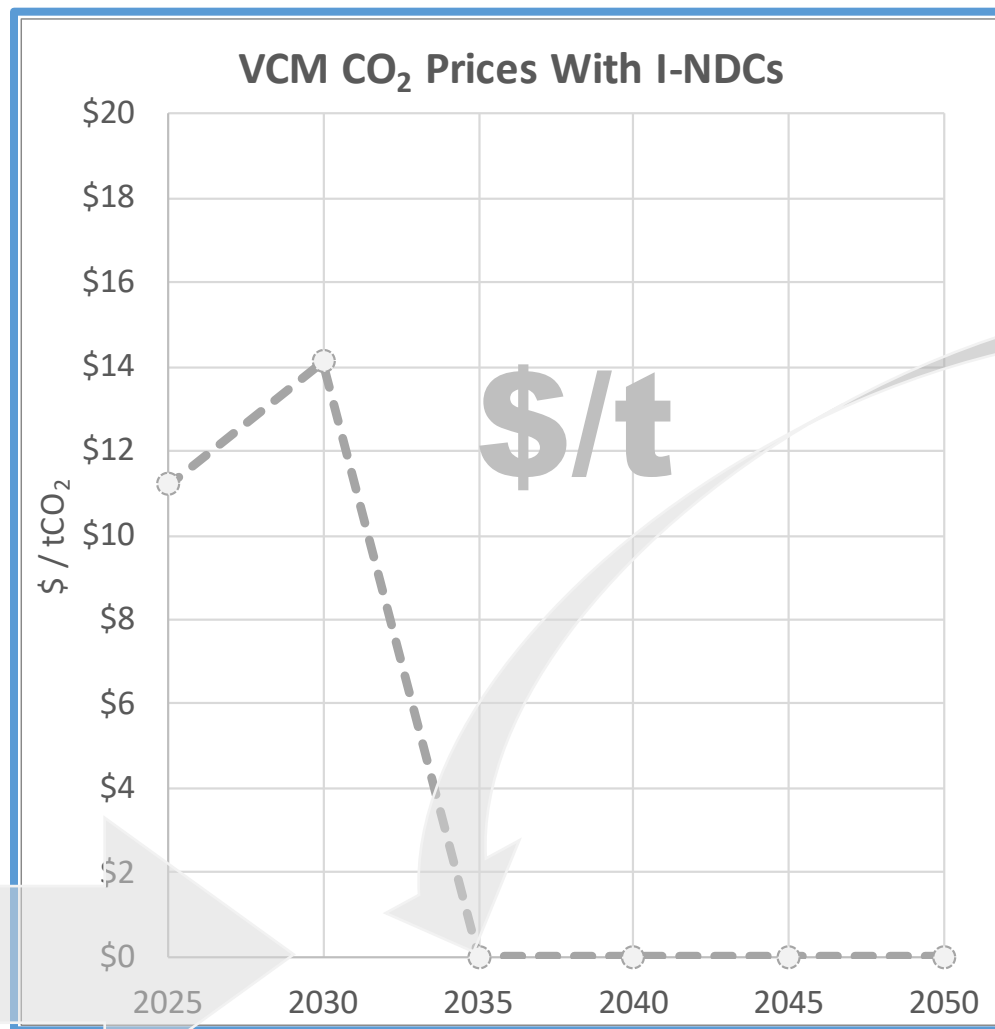
The Carbon Market Prices with I-NDCs

VCM markets are short-lived when nations implement their NDCs independently.



The Carbon Market Prices with I-NDCs

The VCM disappears by 2035, because I-NDC prices are so high in the U.S. that the voluntary mitigation obligation is met without offsets.

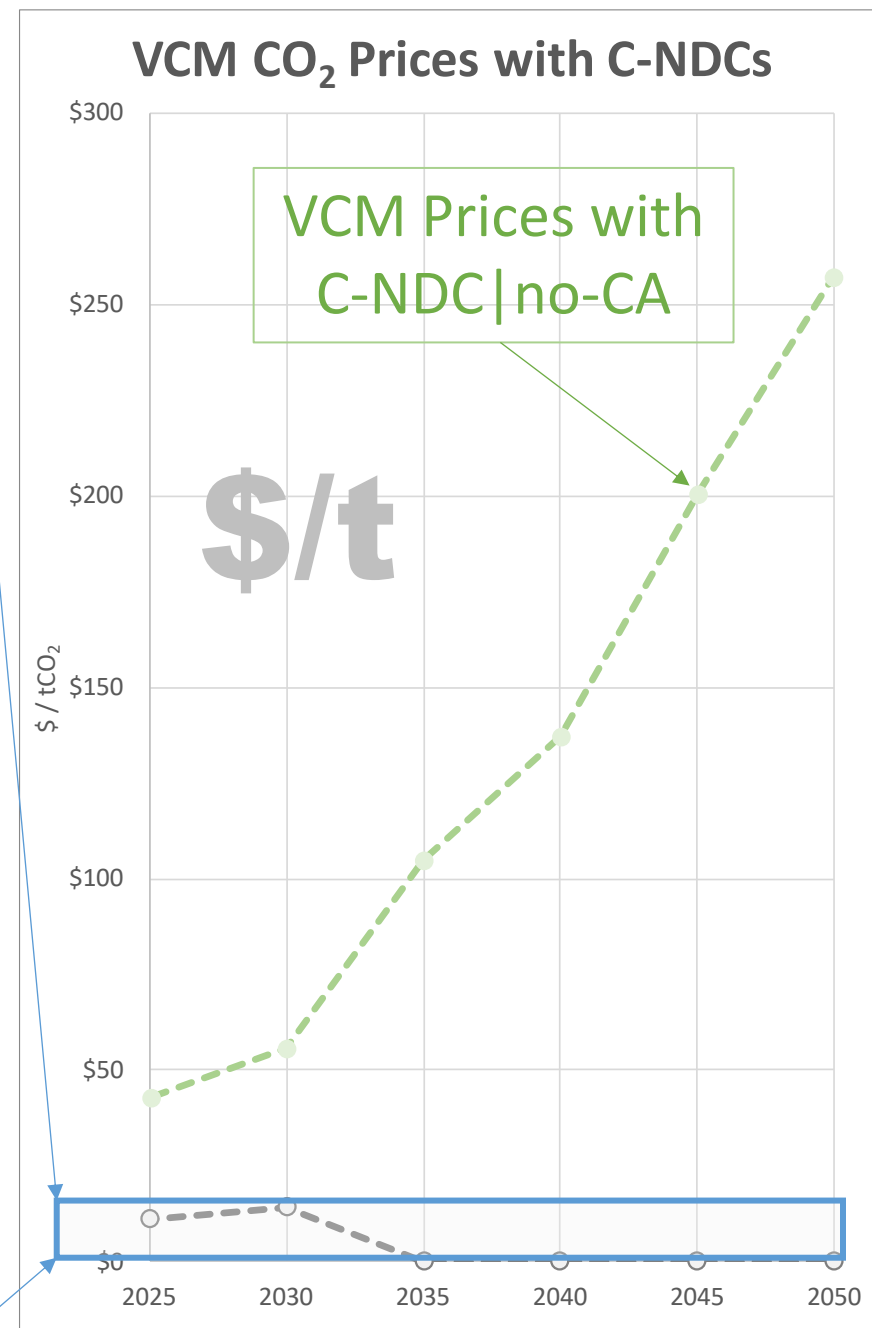
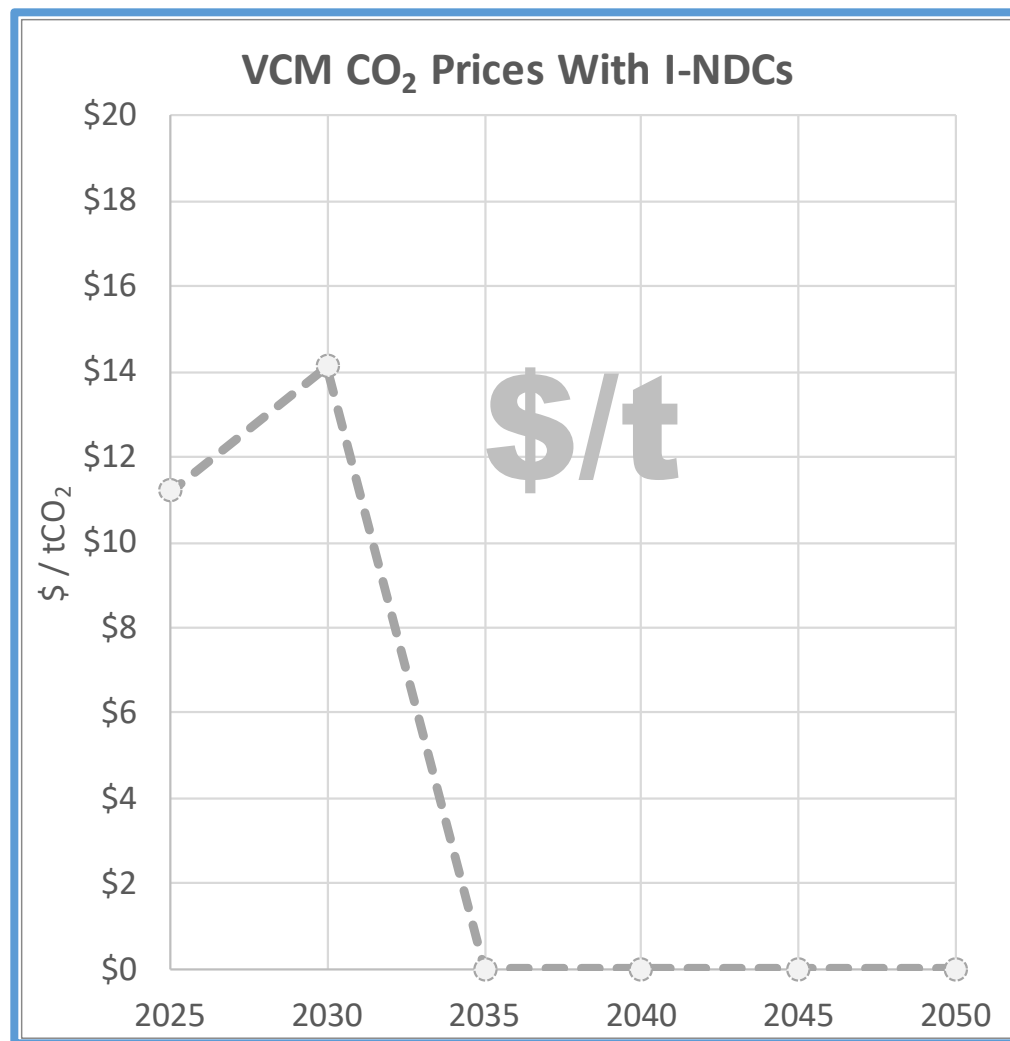


I-NDC and C-NDC VCM Prices

VCM prices are HIGHER when combined with C-NDC markets and no-CA.

AND

Converge to the C-NDC price.



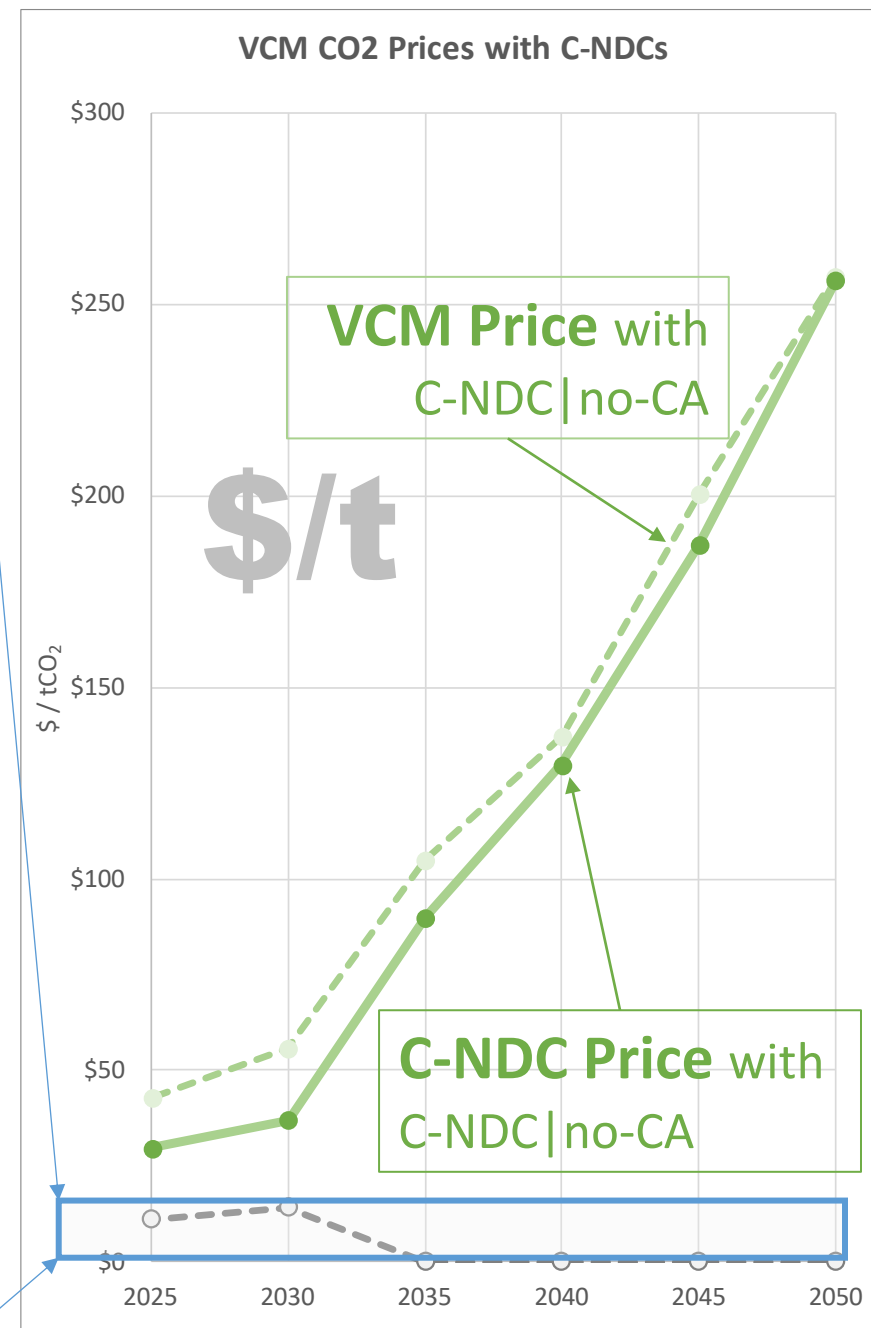
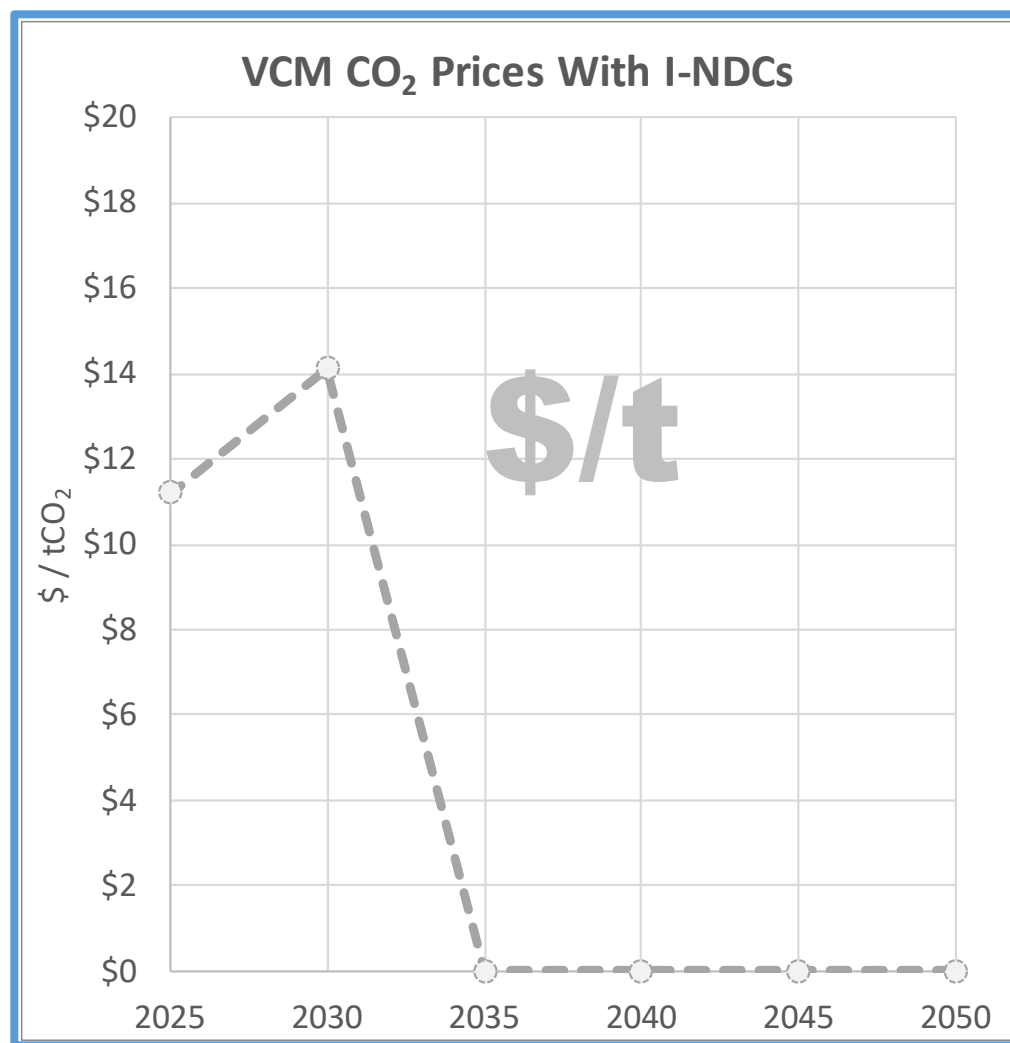
I-NDC and C-NDC VCM Prices

VCM prices are *HIGHER* when combined with C-NDC markets and no-CA.

AND

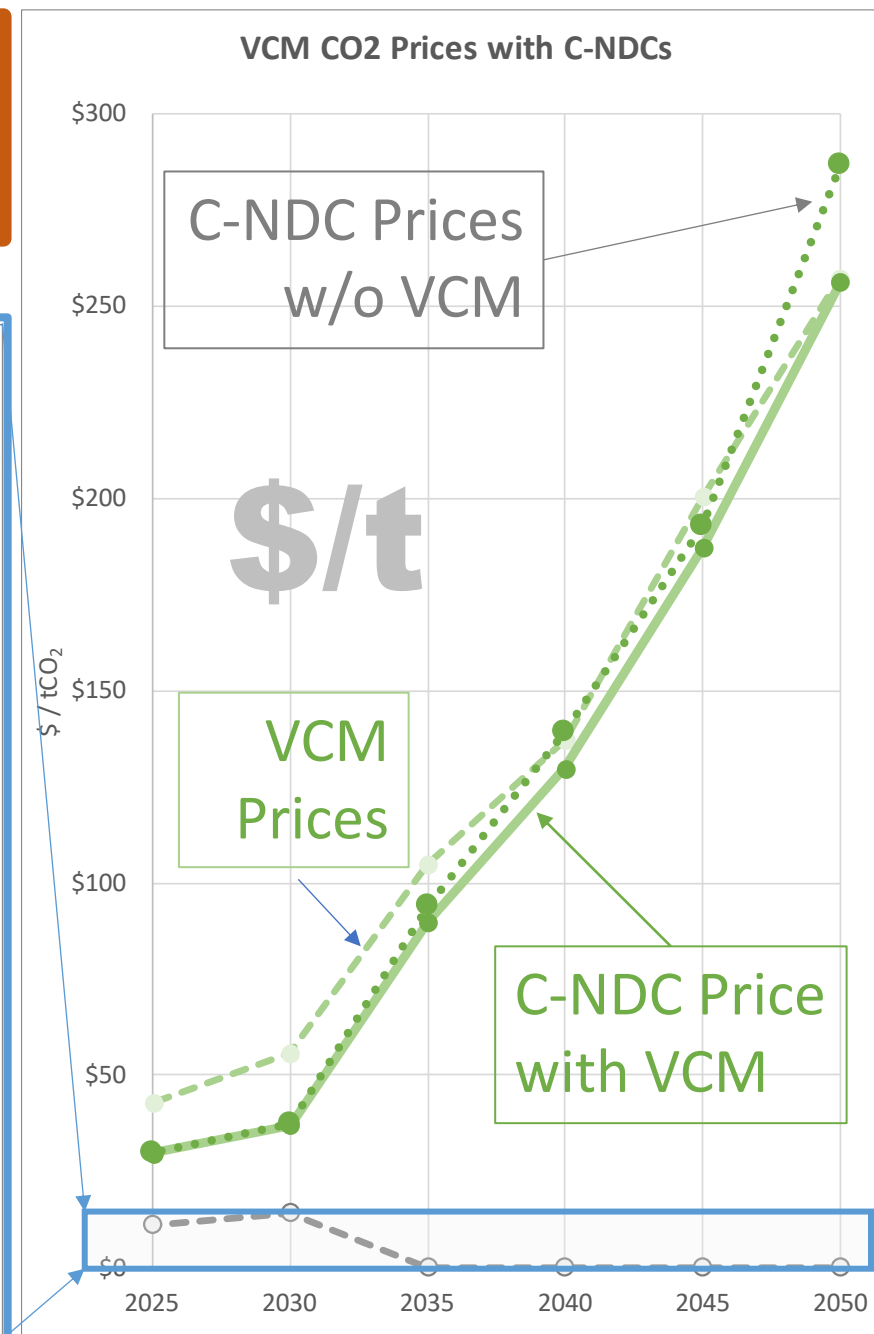
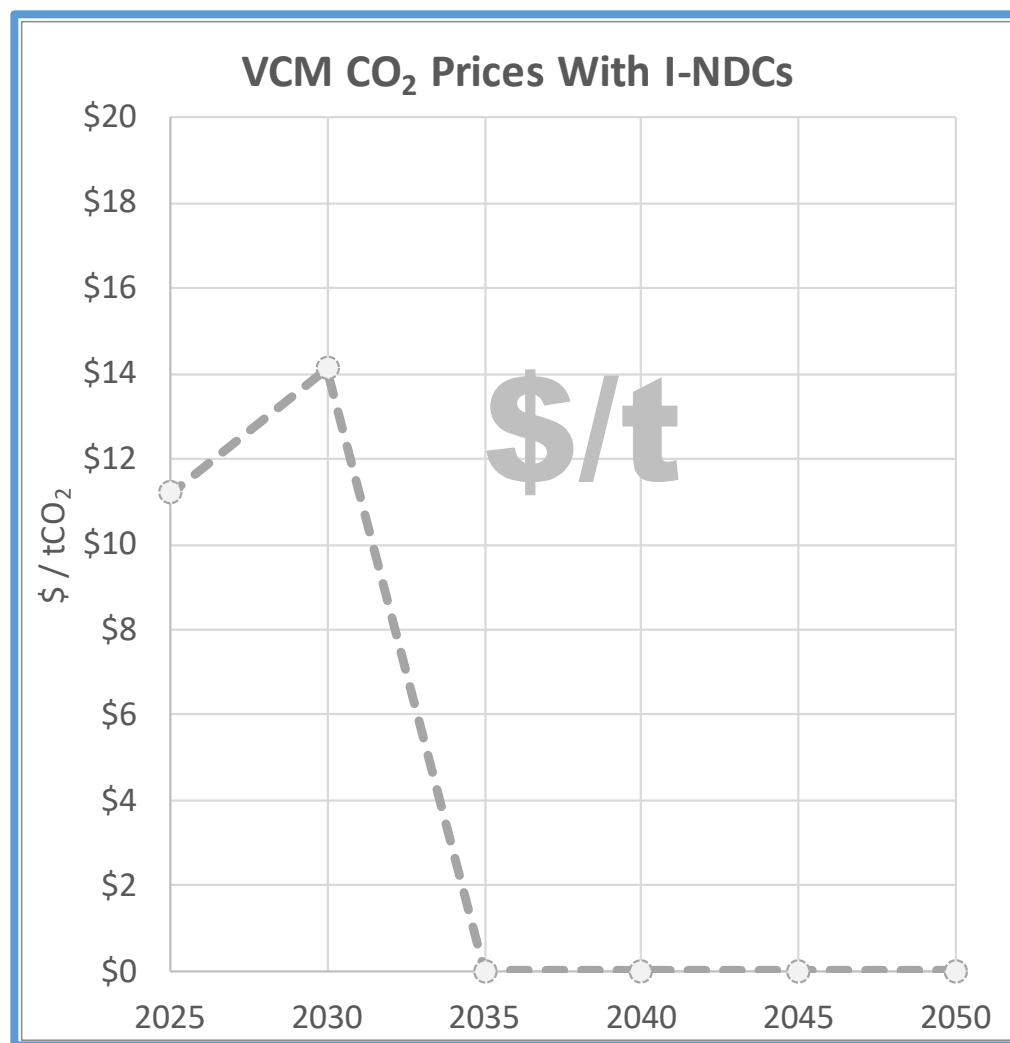
Converge to the C-NDC price.

VCM prices are higher than compliance market prices since they operate after the NDC attainment in each time step, but both finally converge



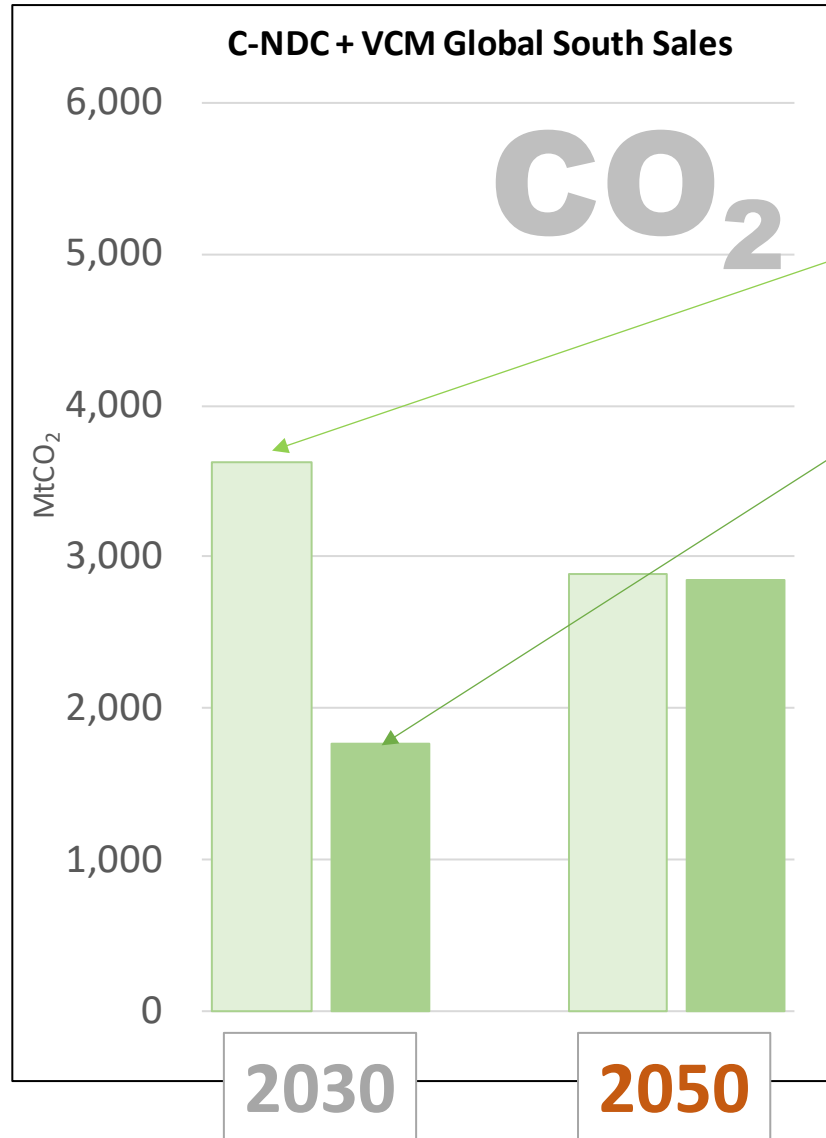
I-NDC and C-NDC VCM Prices

VCM markets lower the 2050 C-NDC price by accelerating investments in emissions mitigation technologies.



The C-NDC Carbon Market and Resource Transfers

The Carbon Market Emissions Trading: 2030 and 2050



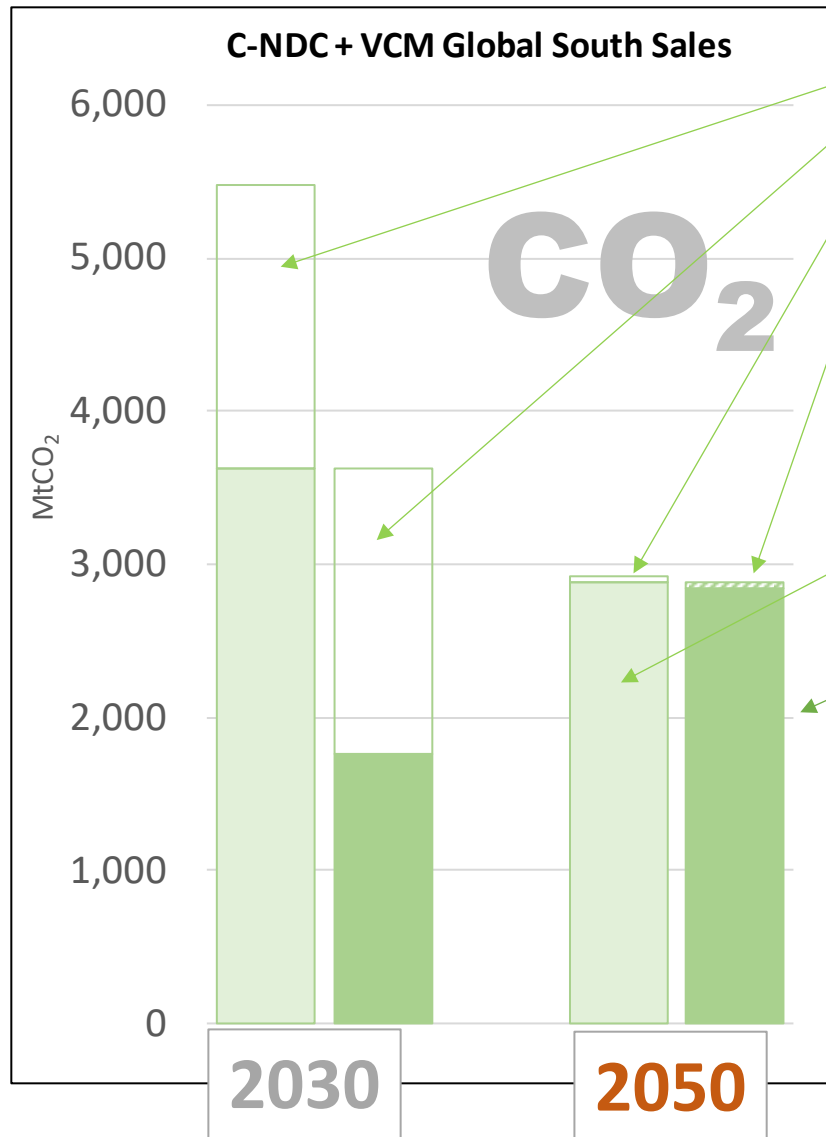
C-NDC, VCM w/o CA

C-NDC, VCM+CA

Lower size since the CA leads to reduction in offsets to be purchased from the compliance market due to VCM trades.

Sales in the **C-NDC** Market
(Million Tons of CO₂)

The Carbon Market Emissions Trading: 2030 and 2050



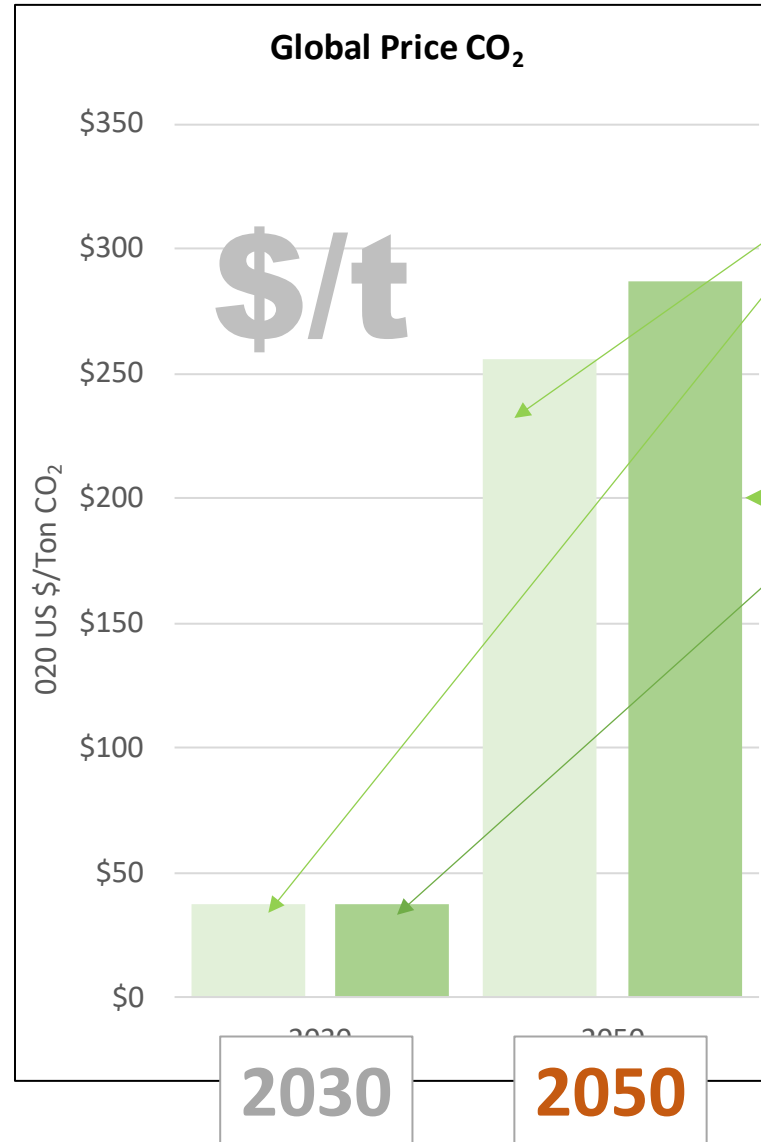
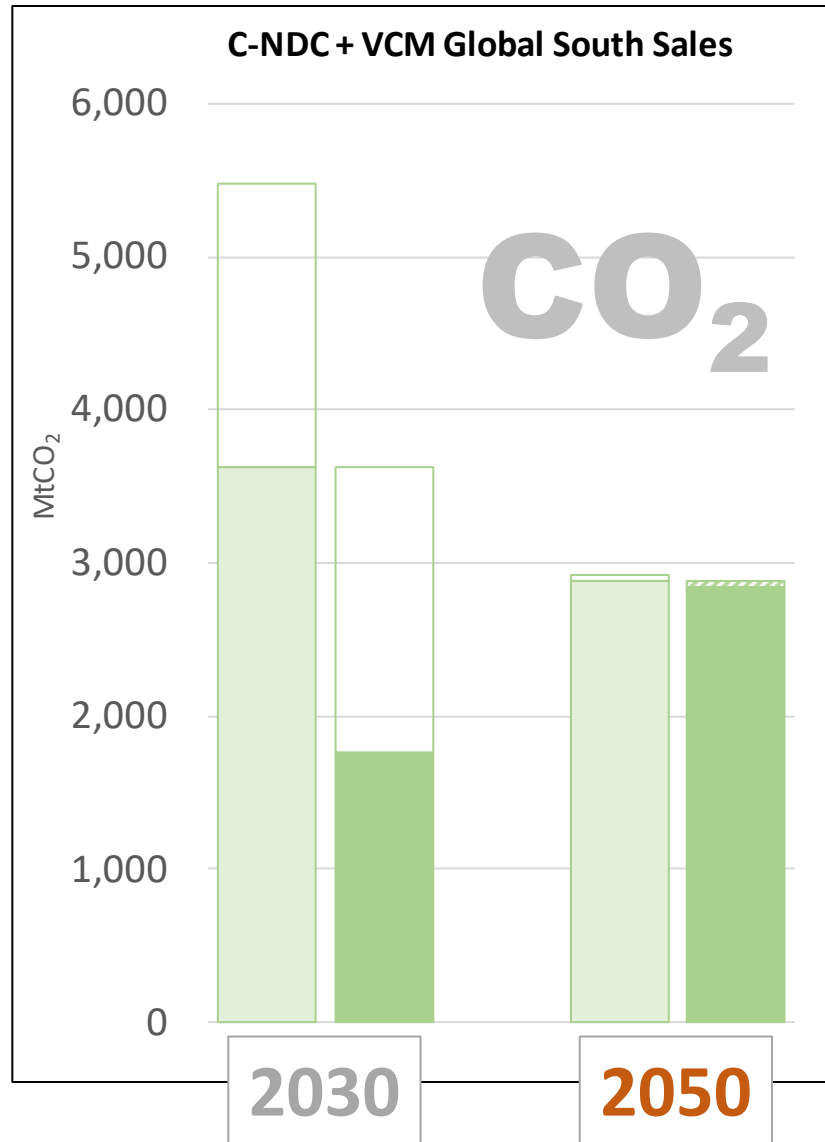
VCM transactions

C-NDC, VCM w/o CA

C-NDC, VCM+CA

Sales in the C-NDC and VCM Markets (Million Tons of CO₂)

The C-NDC Market Prices: 2030 and 2050



C-NDC, VCM w/o CA

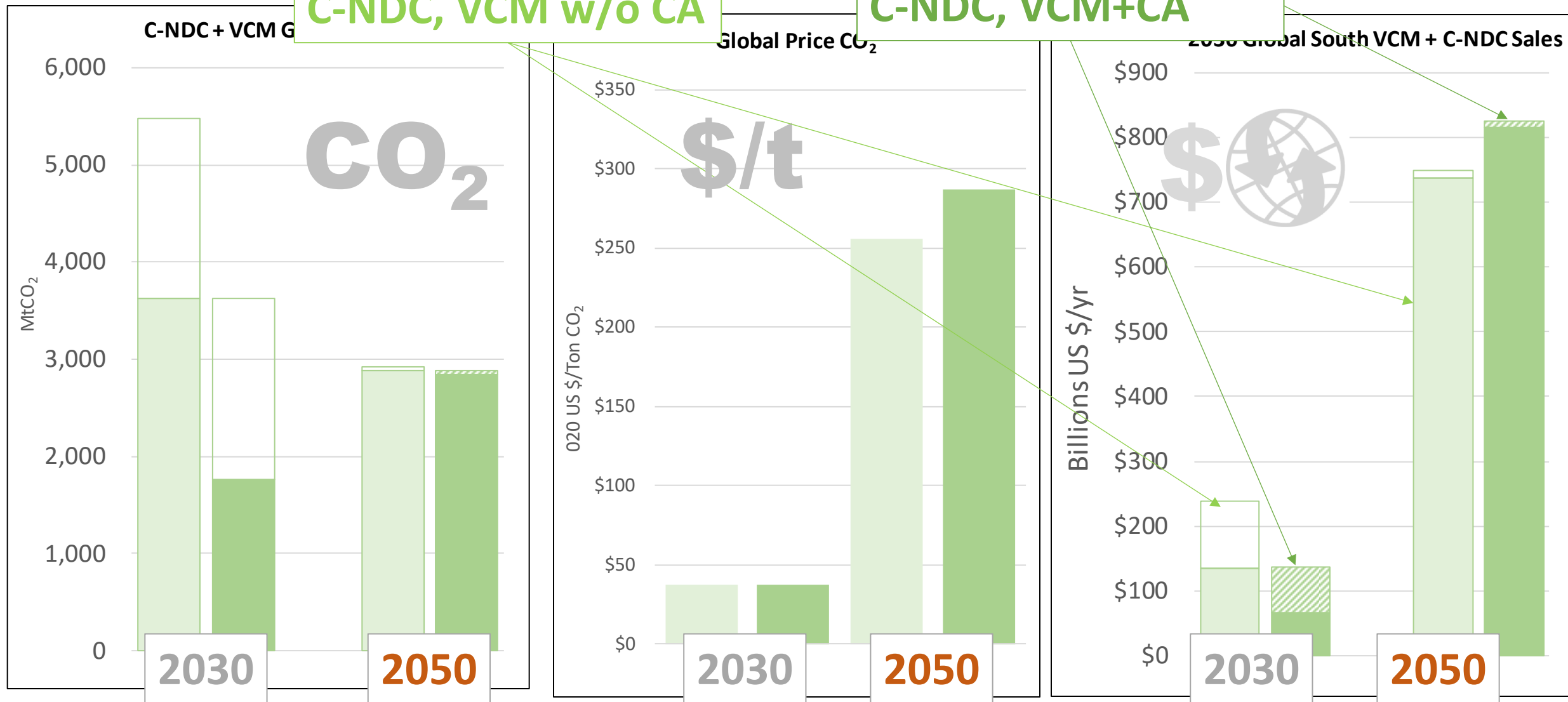
C-NDC, VCM+CA

**C-NDC CO₂
Prices**

The C-NDC Market Financial Transfers: 2030 and 2050

C-NDC, VCM w/o CA

C-NDC, VCM+CA

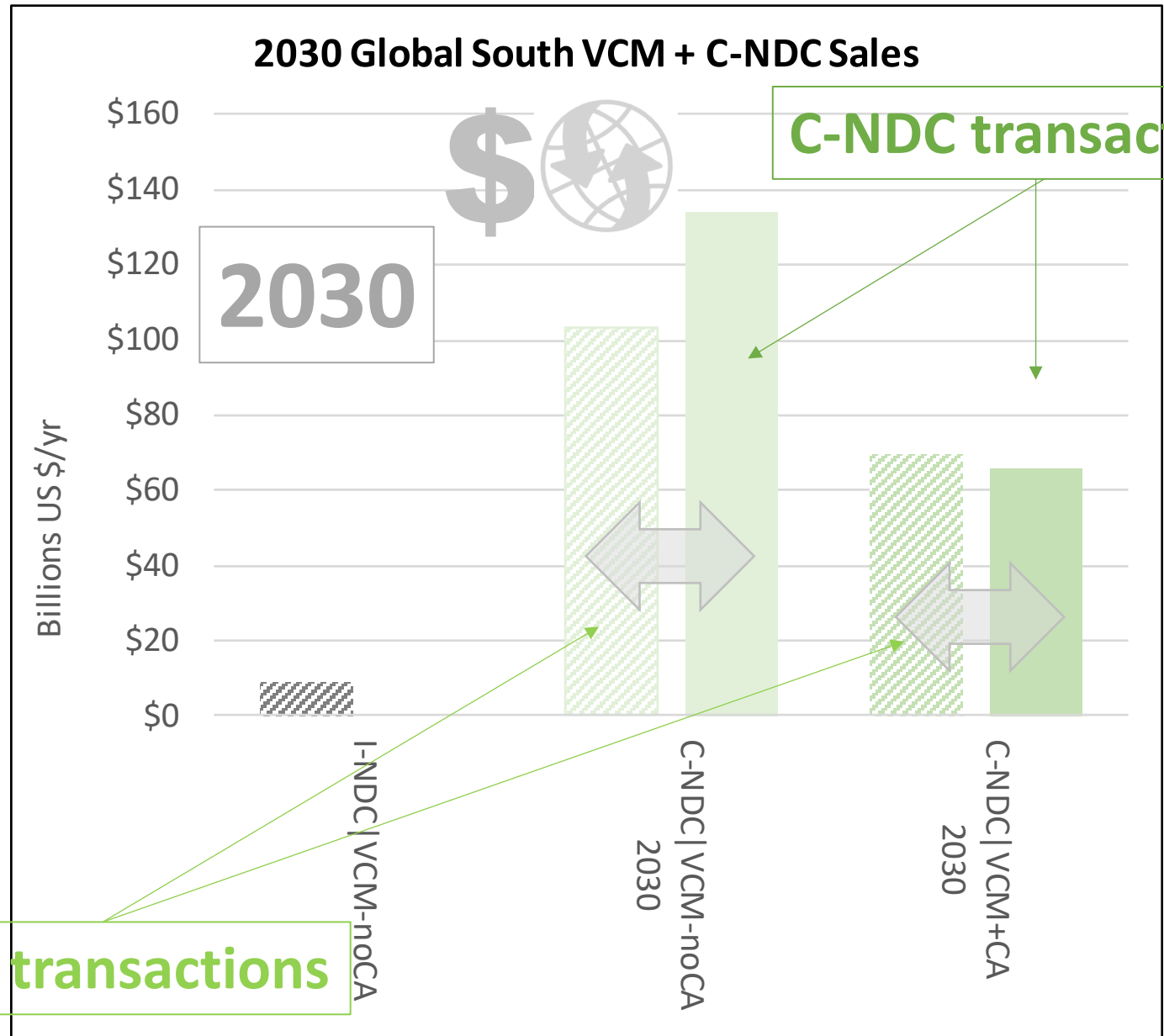


The Combined VCM + C-NDC Markets

*C-NDC and VCM
are of similar size
in 2030.*

VCM transactions

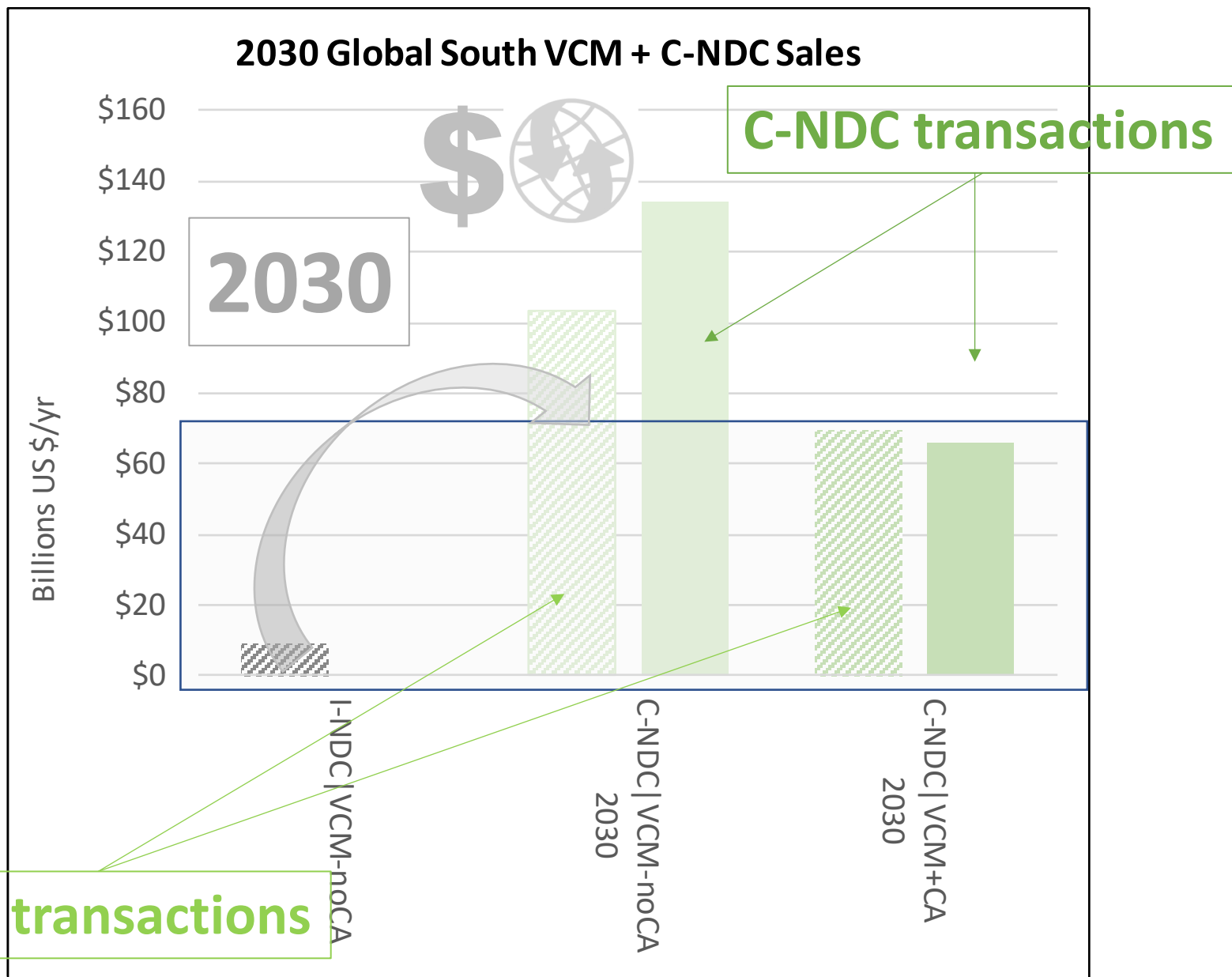
C-NDC transactions



The Combined VCM + C-NDC Markets

*The VCM market is
larger under the C-
NDC than under I-
NDC.*

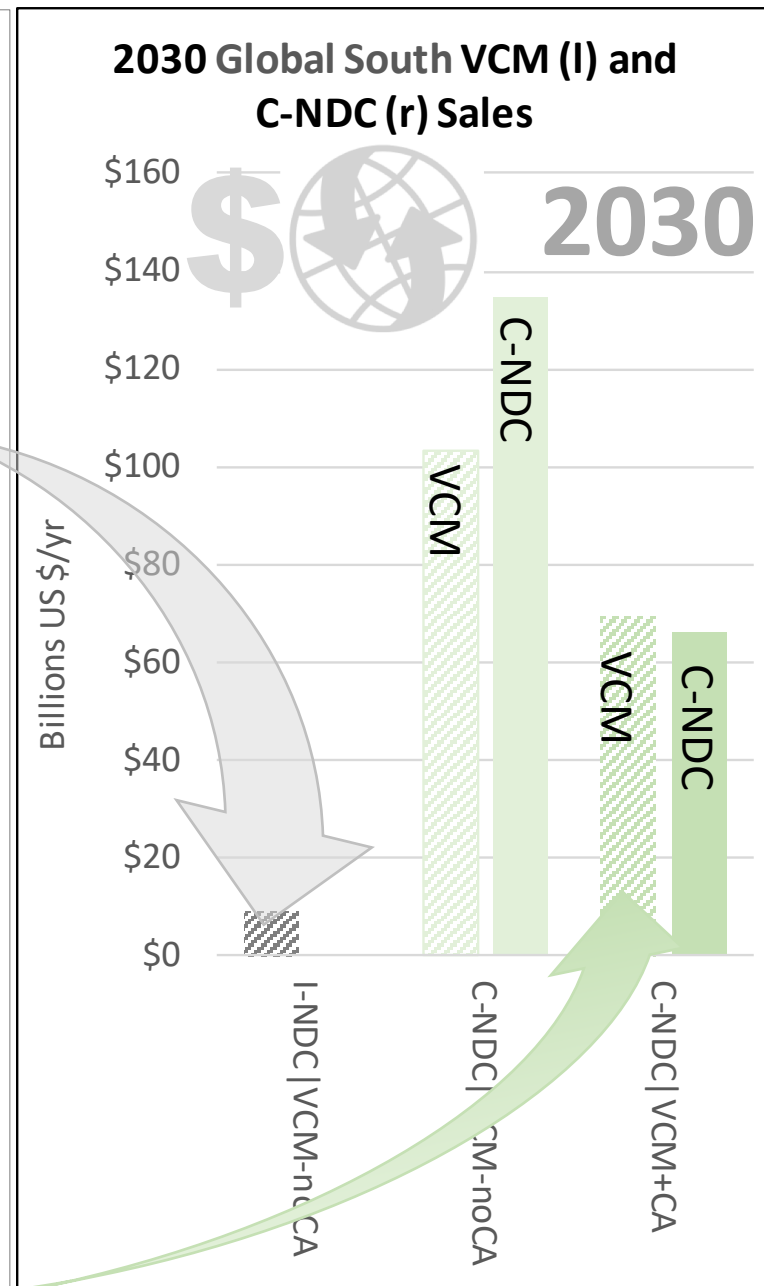
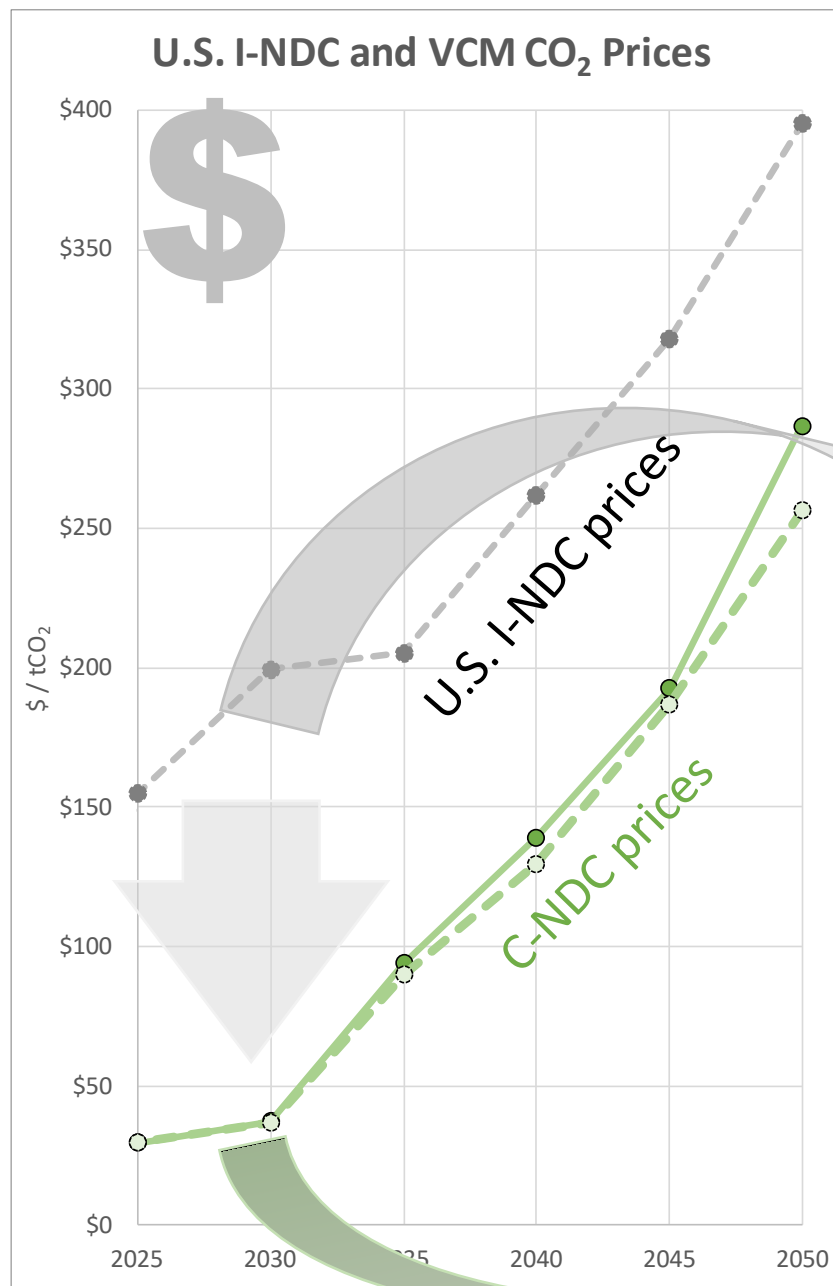
VCM transactions



The Combined VCM + C-NDC Markets

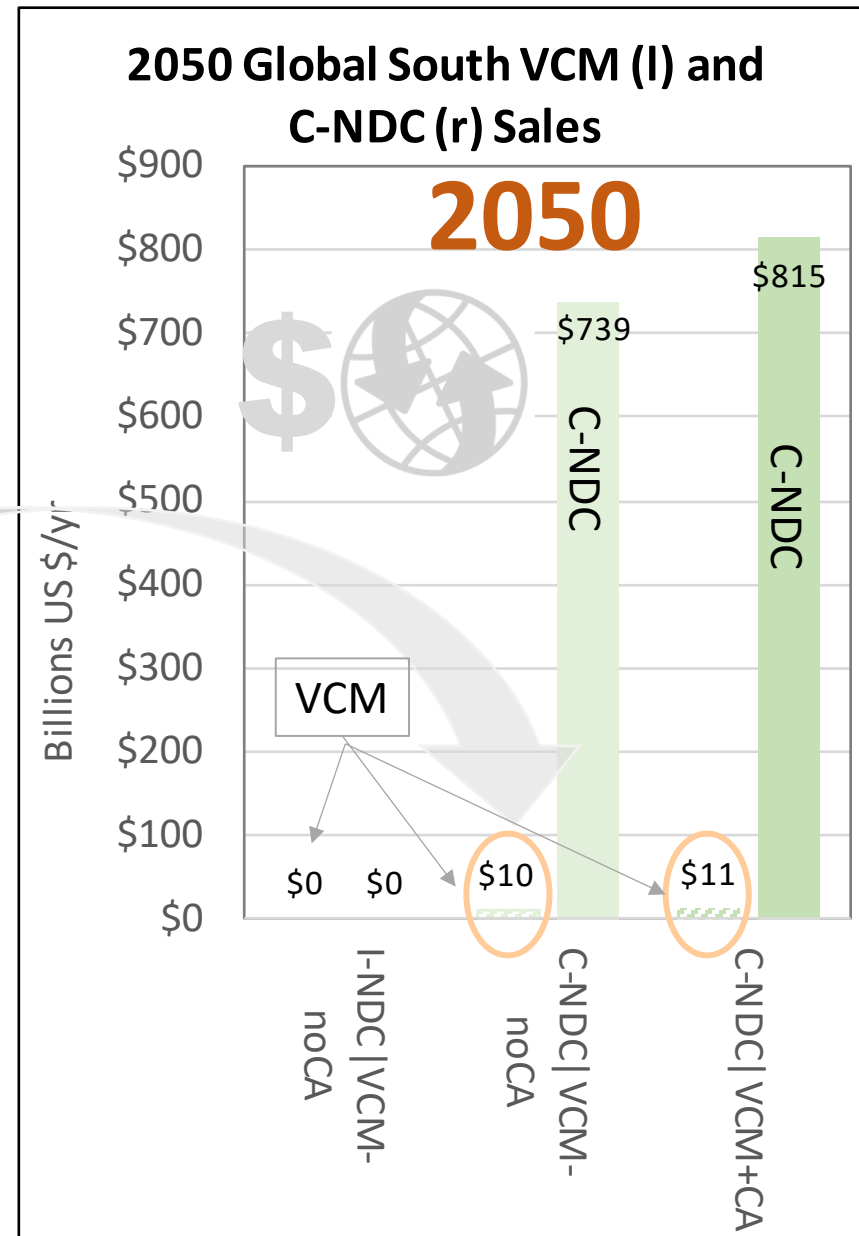
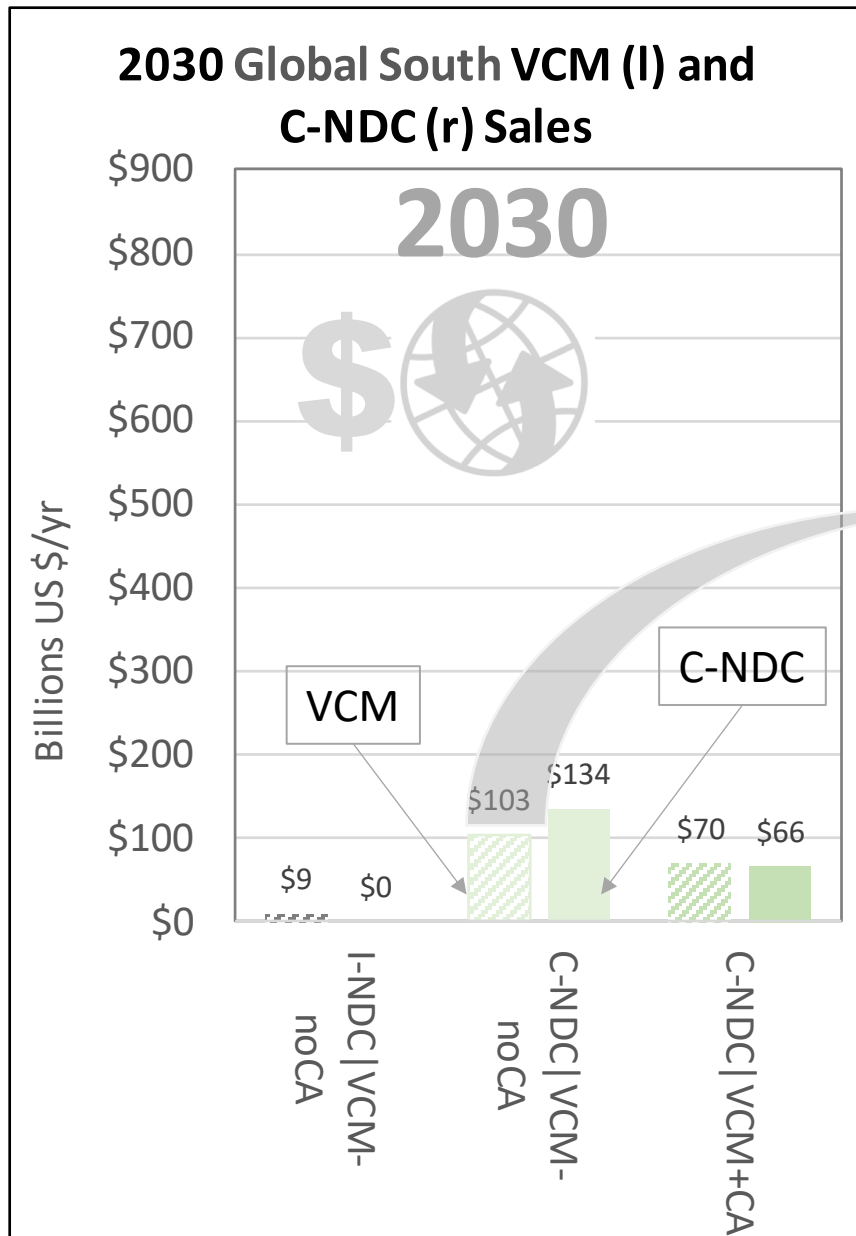
*The VCM market is
larger under the C-NDC
than under I-NDC.*

*Due to lower U.S. CO₂
Prices under C-NDC*



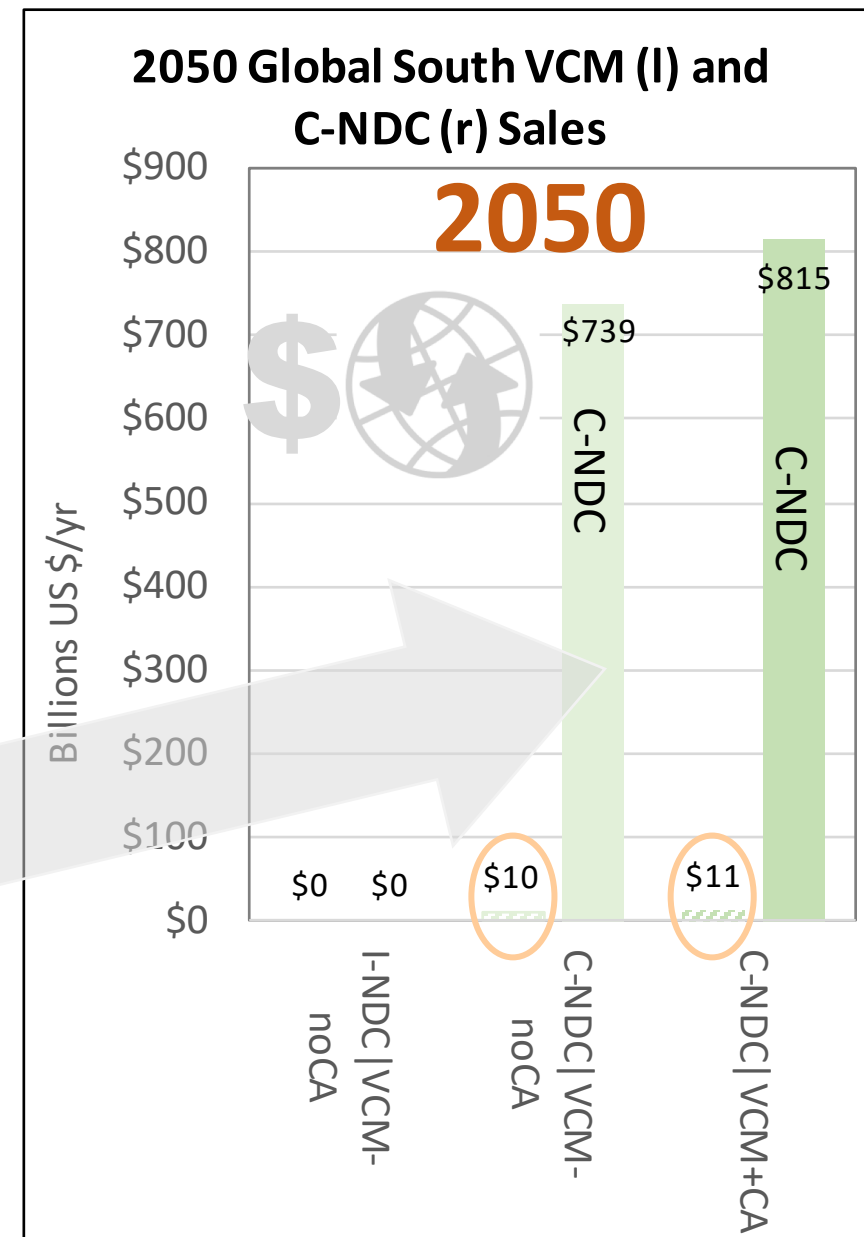
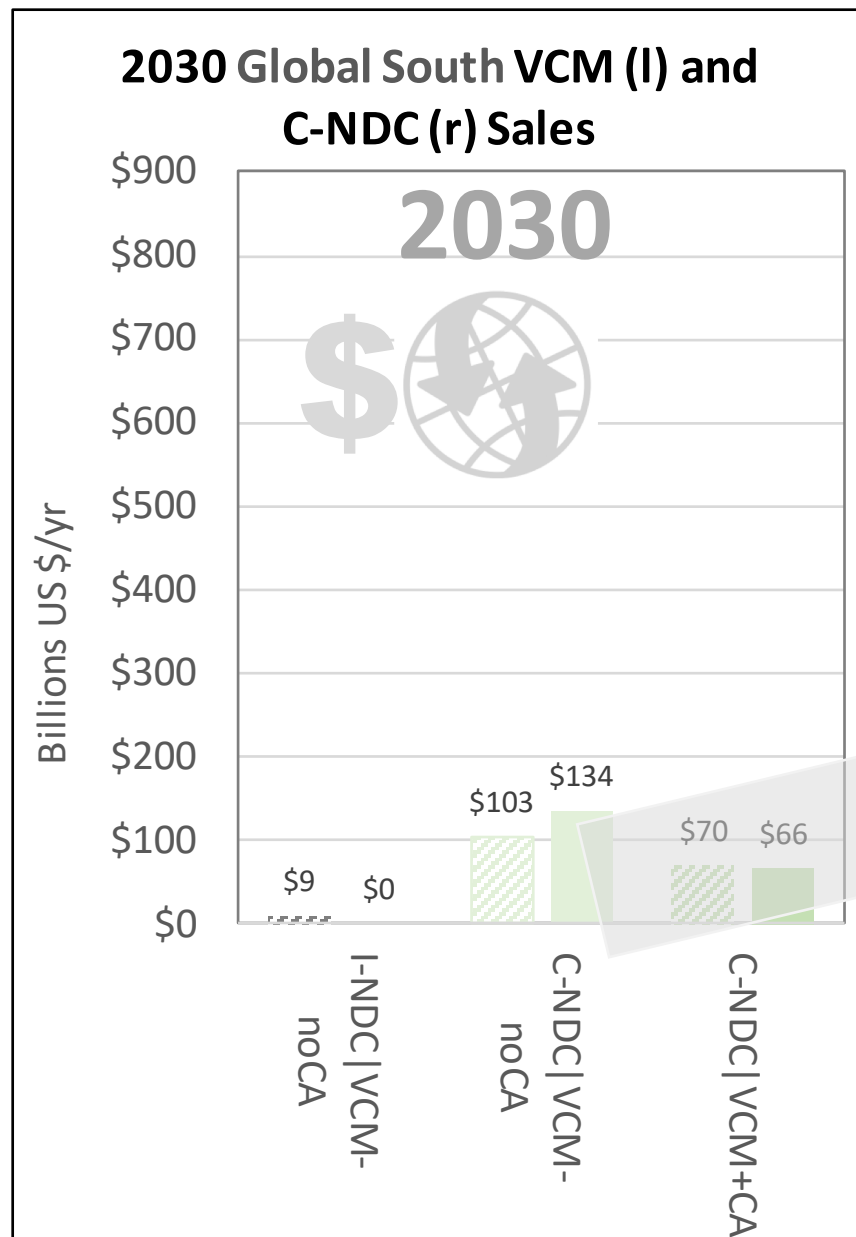
Financial Transfers C-NDC + VCM Markets

The VCM market is smaller in 2050 than in 2030. While the C-NDC market is much larger.



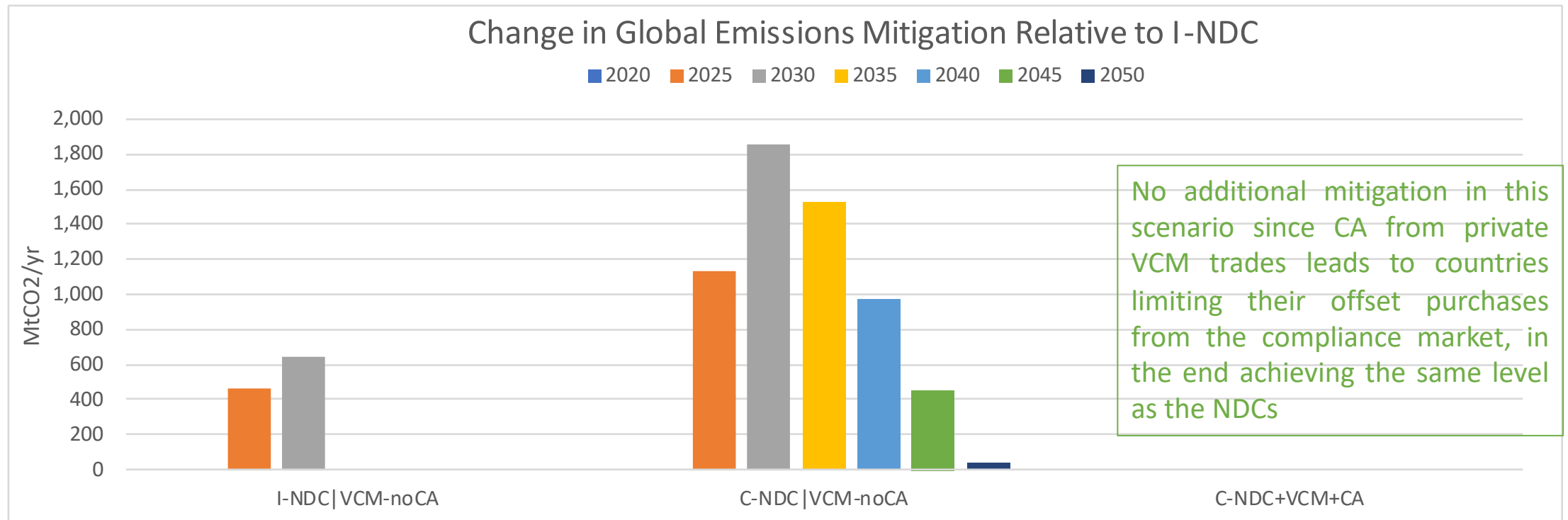
Financial Transfers C-NDC + VCM Markets

The C-NDC market dominates in 2050.



VCM and C-NDC market effects on Global Emissions Mitigation

Increase in Emissions Mitigation from VCMs



Some Initial Findings

- **VCMs have a potentially important role to play in enabling emissions mitigation in the near term.**
- **The role of VCMs fade as NDCs approach net zero.**
- **When NDCs are implemented COOPERATIVELY using Article 6, the VCM plays a larger role transferring resources to the Global South than when NDCs are implemented independently (I-NDCs).**