

GHG Emissions and Carbon Capture in Canadian Agriculture



Ag Emissions





My Goal

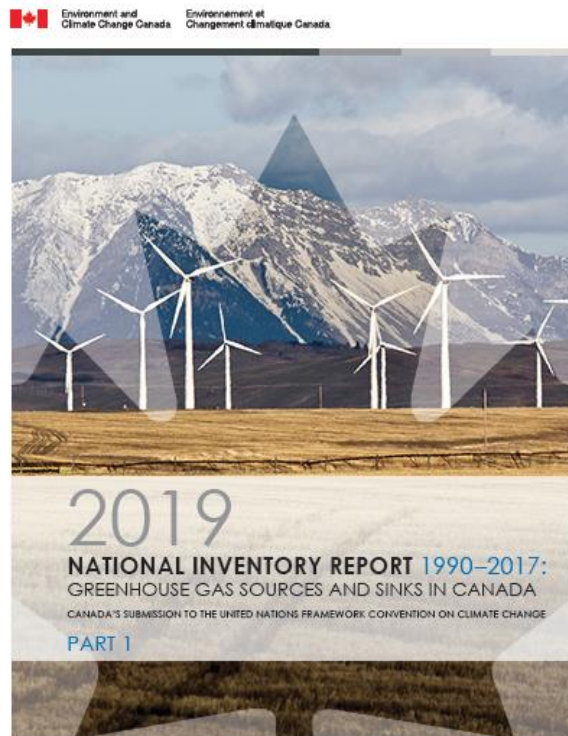
- How have we been justifying Ag GHG exemptions so far:

“because we are growing food”

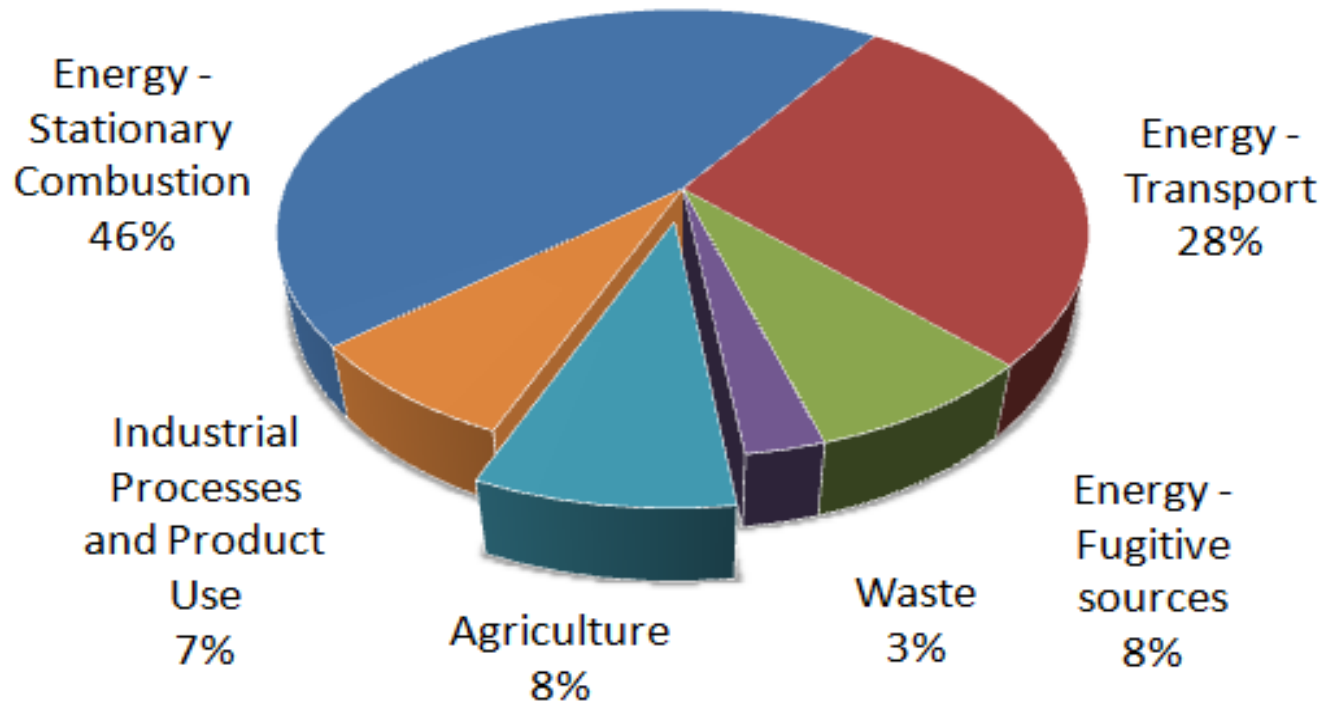
- We need to quantify the good we are doing in a new way – with a simple message....

My Source of GHG Emission Information Today

*First step:
Understanding
our GHG
emissions in
Government
language*



Canada 2017 Emissions by IPCC Sector 716 Mt CO₂e



2019 NIR – Part 1, page 5, figure ES-2

Emission Measurement

- CO₂ equivalent = CO₂e
- Global Warming Potential = GWP

Greenhouse gas	Symbol	Lifetime in atmosphere	100 year GWP (AR4)
Carbon dioxide	CO ₂	Variable	1
Methane	CH ₄	12	25
Nitrous Oxide	N ₂ O	114	298

2019 NIR – Part 1, page 18, table 1-1

Ag Emissions 60 Mt CO₂e

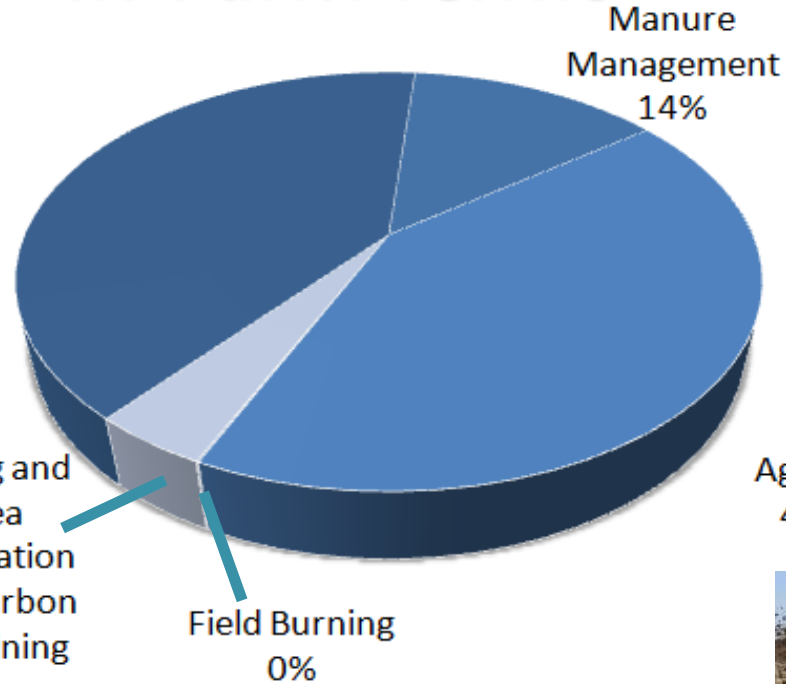
In Farm Terms



Enteric
Fermentation
40%



Liming and
Urea
Application
and Carbon
containing
fertilizers
4%



Field Burning
0%



Ag Soils
42%



Ag Emissions *Factors*

- Enteric Fermentation
 - Livestock numbers
- Manure Management
 - Livestock numbers
- Ag soils direct/indirect
 - Livestock numbers,
 - Acres,
 - Fertilizer sales
- Field residue burning
 - Acres burnt
- Liming, Urea Application
 - Fertilizer sales



Ag Emissions

Uncertainty in the NIR



66%



Enteric
Fermentation
40%

22%



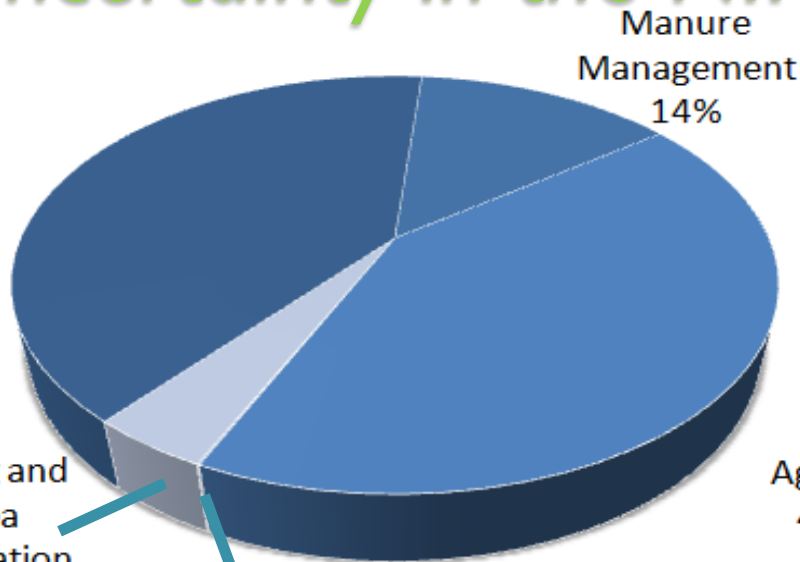
54%

Liming and
Urea
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and Carbon
containing
fertilizers
4%

Field Burning
0%



64%



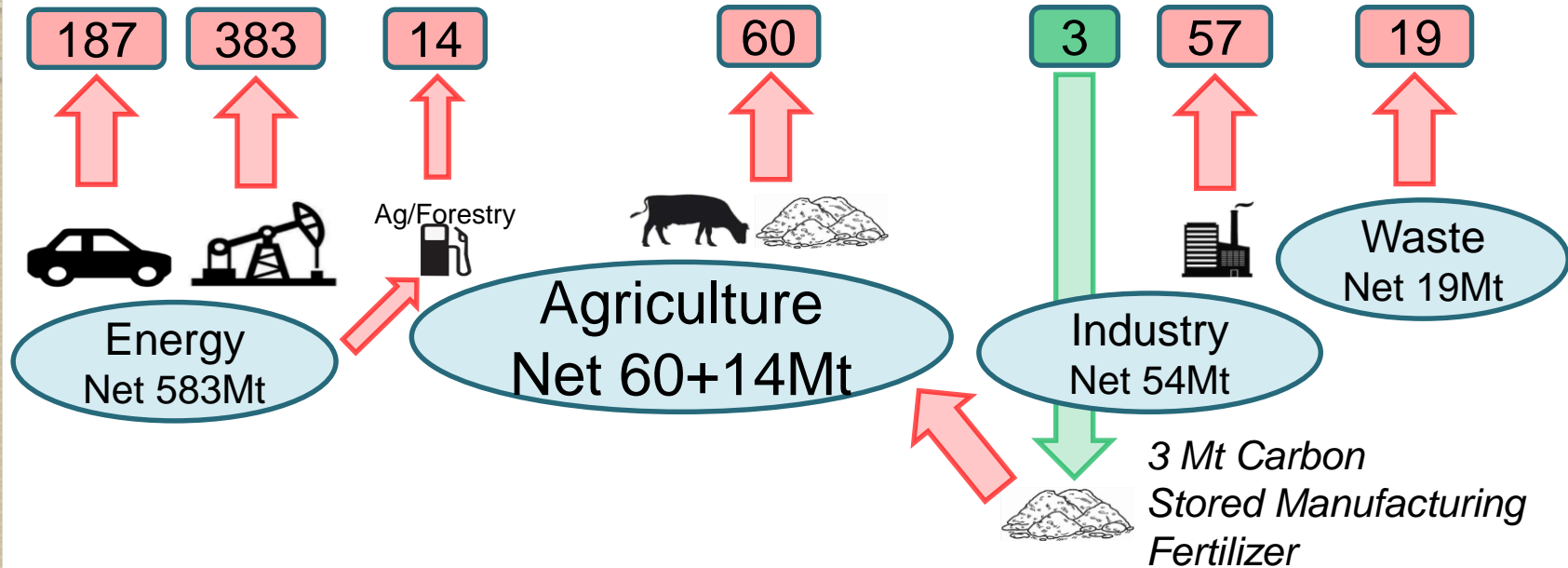
Ag Soils
42%

66%



Canada 2017 Emissions by IPCC Sector

716 Mt CO₂e



NIR - NH₃ vs Urea In the Soil

- “Carbon dioxide emissions from liming, urea application and other carbon-containing fertilizers are calculated based on the total quantity of C contained in these products.”

2019 NIR – Part 2, page 233

- | | |
|-------------------------------------------|------------|
| • Anhydrous Ammonia (NH ₃) | 0% Carbon |
| • Urea (CH ₄ N ₂ O) | 20% Carbon |

Better for Emissions?

- Enhanced efficiency fertilizers

N-Serve™

Optinyte™ technology

NITROGEN STABILIZER



eNtrench™

Optinyte™ technology

NITROGEN STABILIZER

Enhanced Efficiency N Fertilizers

- *Goal to reduce Nitrous Oxide emissions and agronomic losses*
- *Current factors in the NIR to estimate N₂O emissions:*
 - N content of fertilizer sales,
 - Topography,
 - Moisture regimes,
 - Soil texture
 - Application method

canola DIGEST

The Source for Canada's Canola Growers

Table 1. How management changes can reduce nitrous oxide emissions (Alberta study)

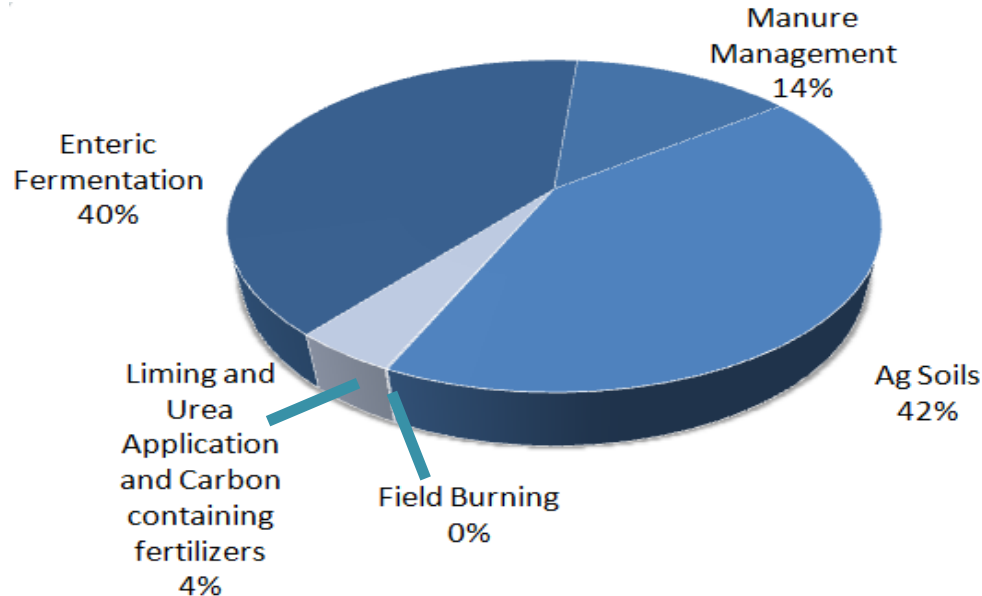
Nutrient Stewardship Spring vs Fall Urea vs ESN Banded	Dark Brown Chernozem Irrigated (2008 – 2011)		Black Chernozem (2008 – 2011)		Dark Gray Luvisol (2008 – 2012)*	
Management Change	120 kg N ha ⁻¹		120 kg N ha ⁻¹		120 kg N ha ⁻¹	
	Average	std err	Average	std err	Average	std err
Fall Urea→Fall ESN	-6.1	11.9	-16.3	3.5	4.2	29.5
Fall Urea→Spring Urea	-29.9	18.3	-17.9	13.4	-6.1	34.7
Fall Urea→Spring ESN	-39.4	17.8	-22.1	12.8	-13.0	22.6
Fall	-32.4	18.8	-6.0	16.9	-11.4	21.0

“Typically there was between 17 and 25 per cent reduction in nitrous oxide emissions by going from fall-applied to spring-applied nitrogen. Spring application avoids that most critical time for nitrogen loss – the thawing period.”

—Len Kryzanowski

Soil Nitrogen

- How much Nitrogen are we loosing to GHG from fertilizer in our soil?



NIR – Soils in Canada

- **0.5 lbs N /acre lost as GHG emissions**

NIR – Soils in Canada

- Ag soils emissions - inorganic N
- 11,000,000 t CO₂e (div GWP 298)
- 37,000 t N₂O (N₂O is 64% N by weight)
- 24,000 t N (*2204.5)
- 52,000,000 lbs N
- 110,000,000 acres of farmland
- **0.5 lbs N /acre**

Soil Carbon Sequestration

- What does the NIR say about soil carbon?



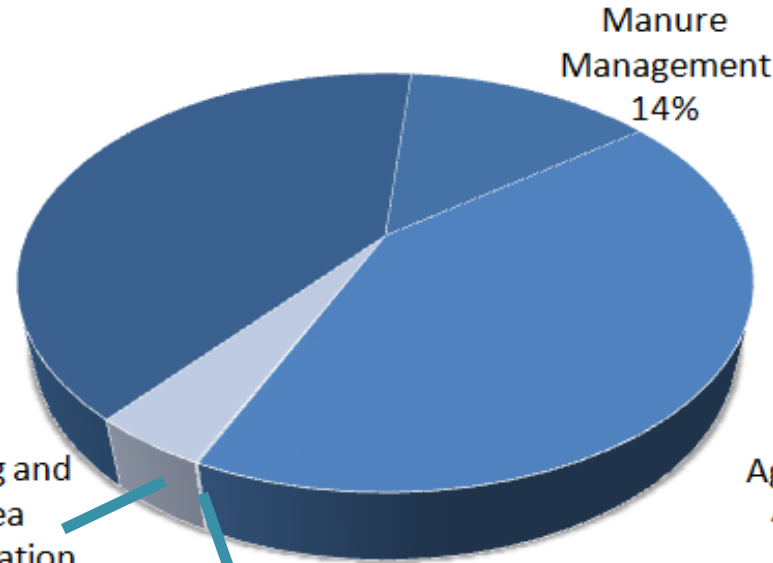
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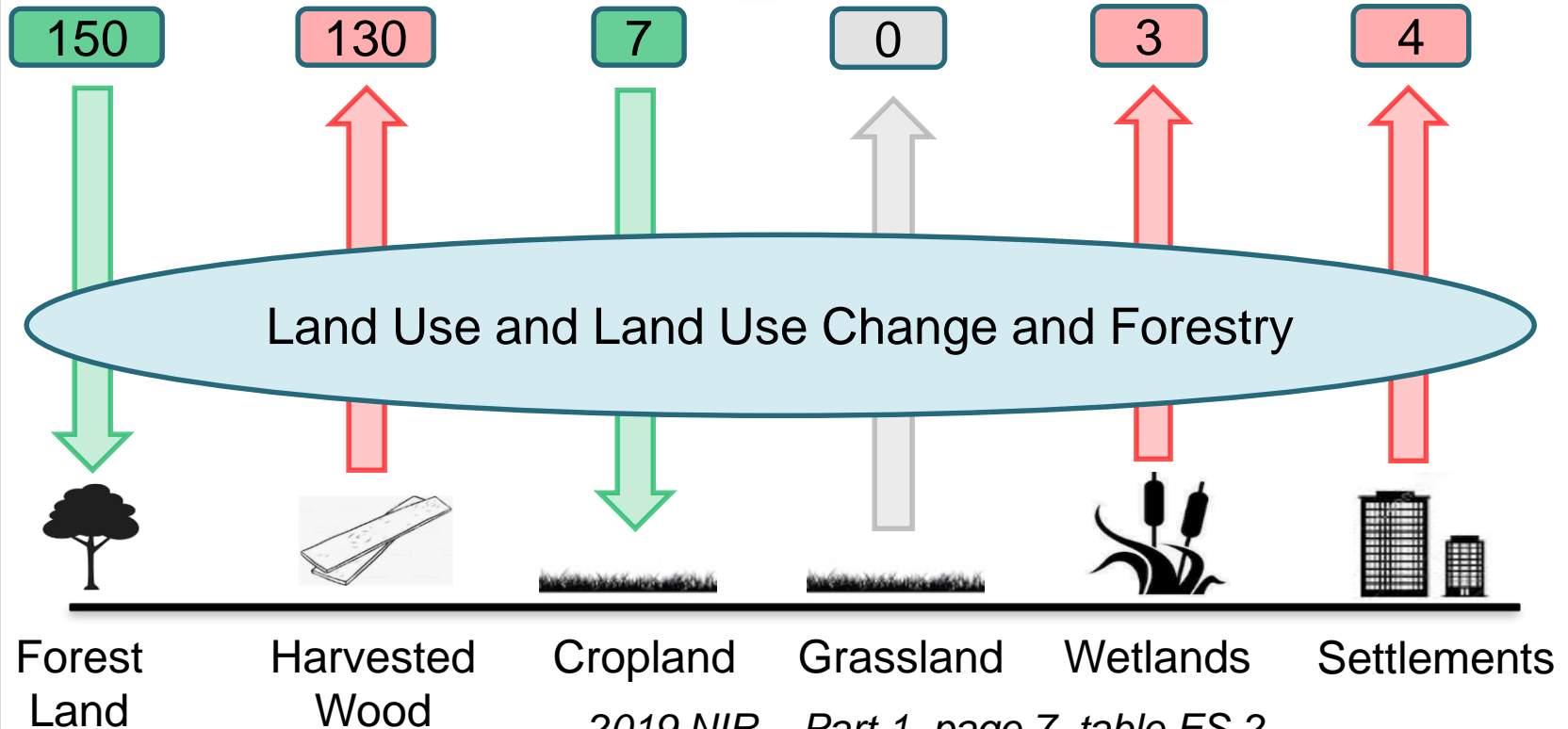


Manure
Management
14%

Ag Soils
42%



Land Use and Land Use Change and Forestry



Canada's NIR - LULUCF

- NIR - “National totals exclude all GHGs from the Land Use, Land-use Change and Forestry Sector.” - Why?

Notes:

1. National totals exclude all GHGs from the LULUCF sector.
2. These summary data are presented in more detail at open.canada.ca.

2019 NIR – Part 1, page 7, table ES-2

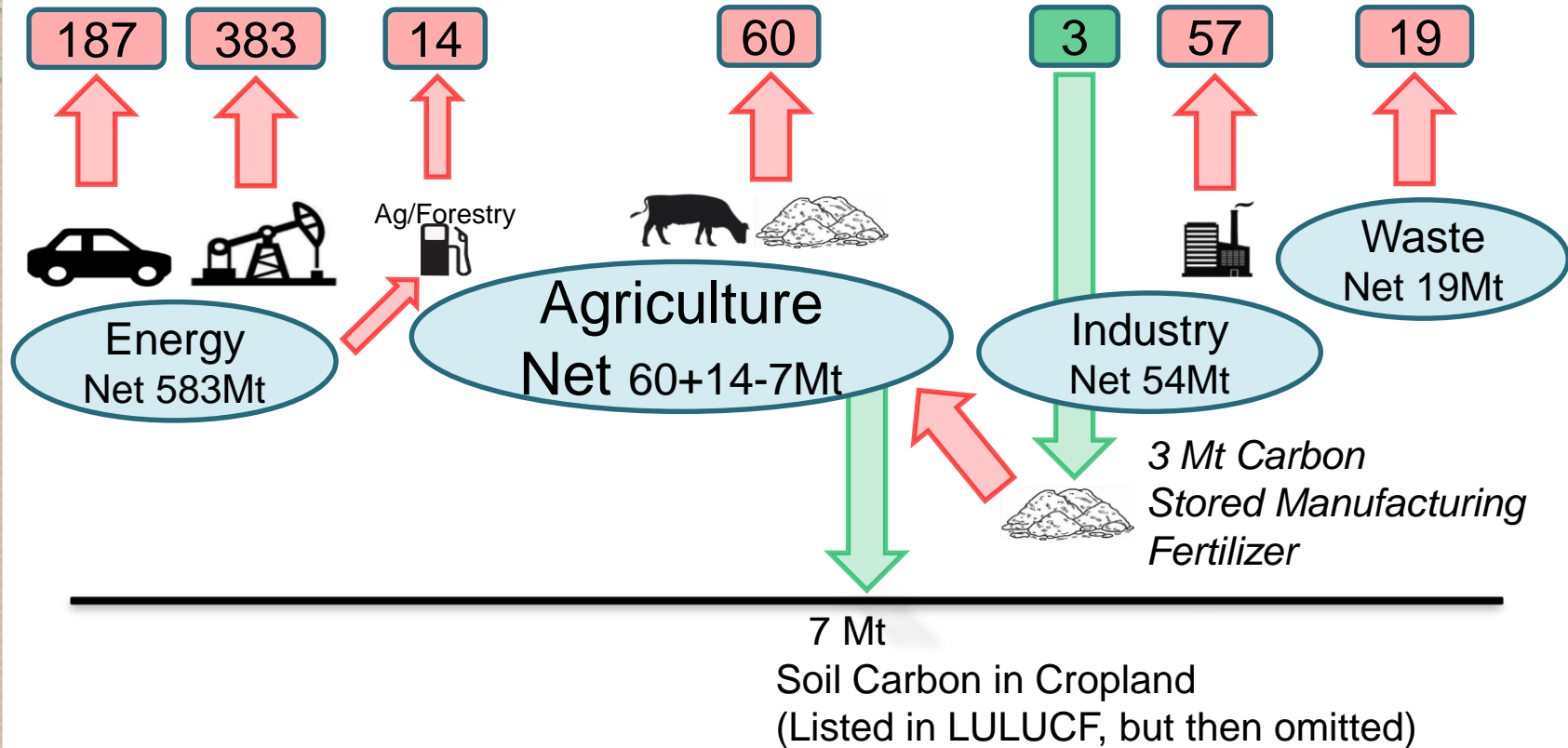
- At the moment, any practice that we adopt or have used in the past on our farms to capture more carbon in our soil, will not be recognized in Canada's national emission totals

Canada's NIR - LULUCF

- 11% Agriculture GHG could be offset by Cropland LULUCF
- We can lobby to ask Cropland carbon capture to be included in the AG sector.

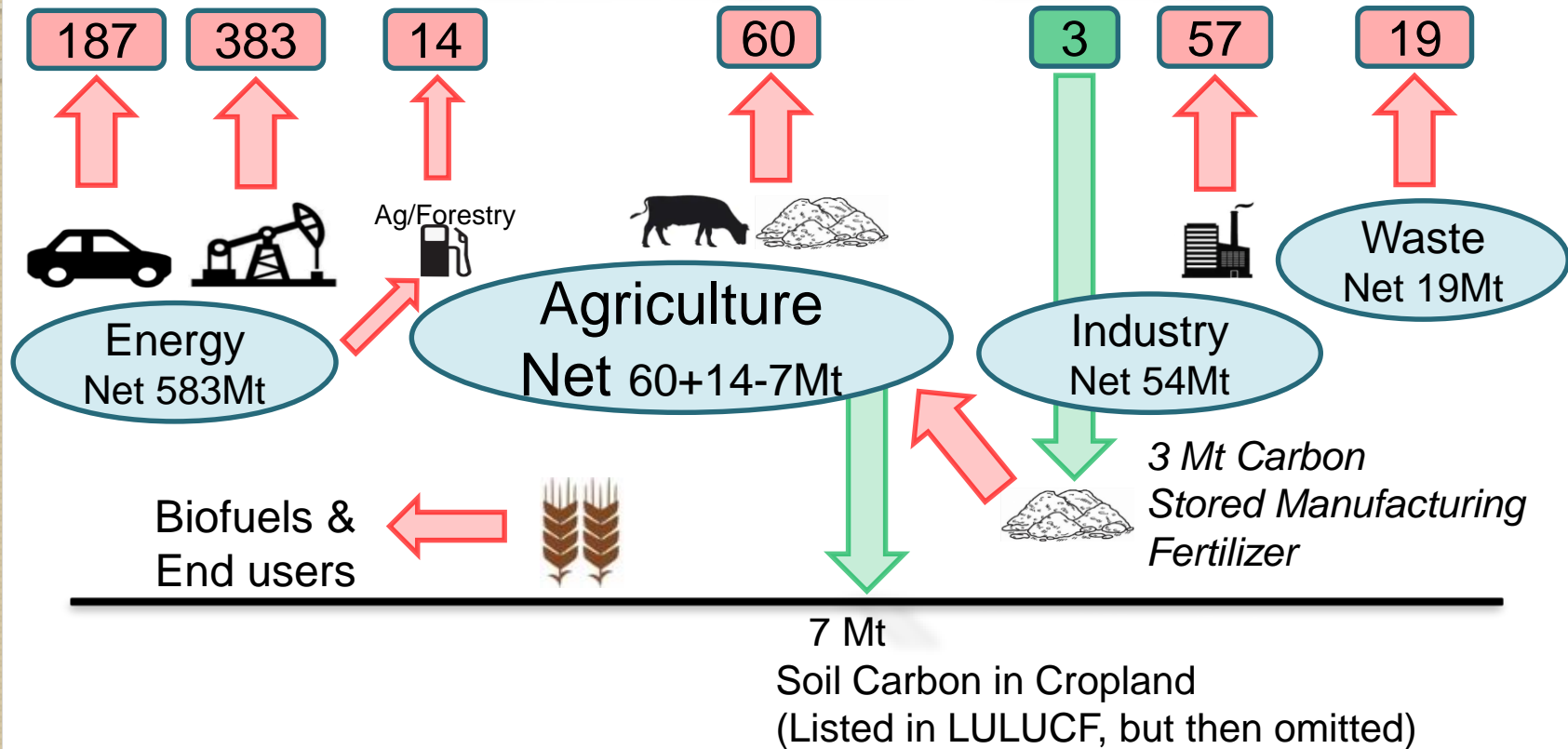
Canada 2017 Emissions by IPCC Sector

716 Mt CO₂e with Grain and Soil



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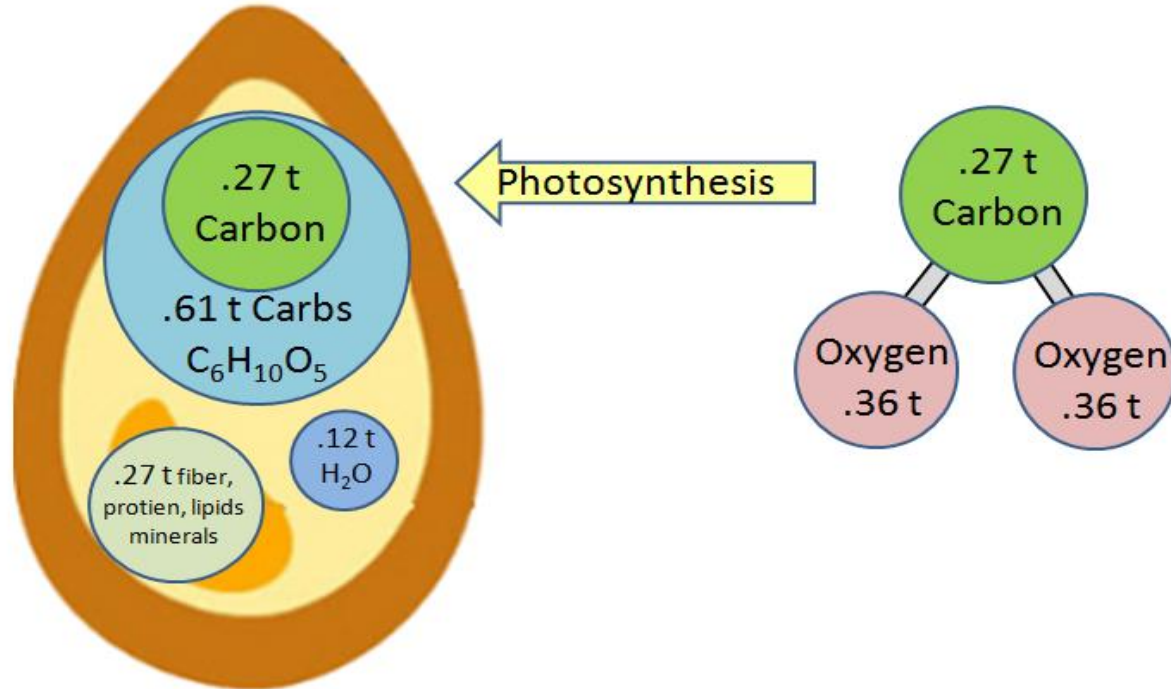
Biodiesel and Biofuel

- The CO₂ emissions that come from biofuels are considered biogenic by the NIR (net zero)
- Emissions from Biofuels are similar to regular fuels
- This also applies to CO₂ from landfill gas (flaring)
- N₂O and CH₄ is still counted

Carbon Capture in Grain - Cereals

1 t Cereal Grain
(61% carbs = 27% carbon)

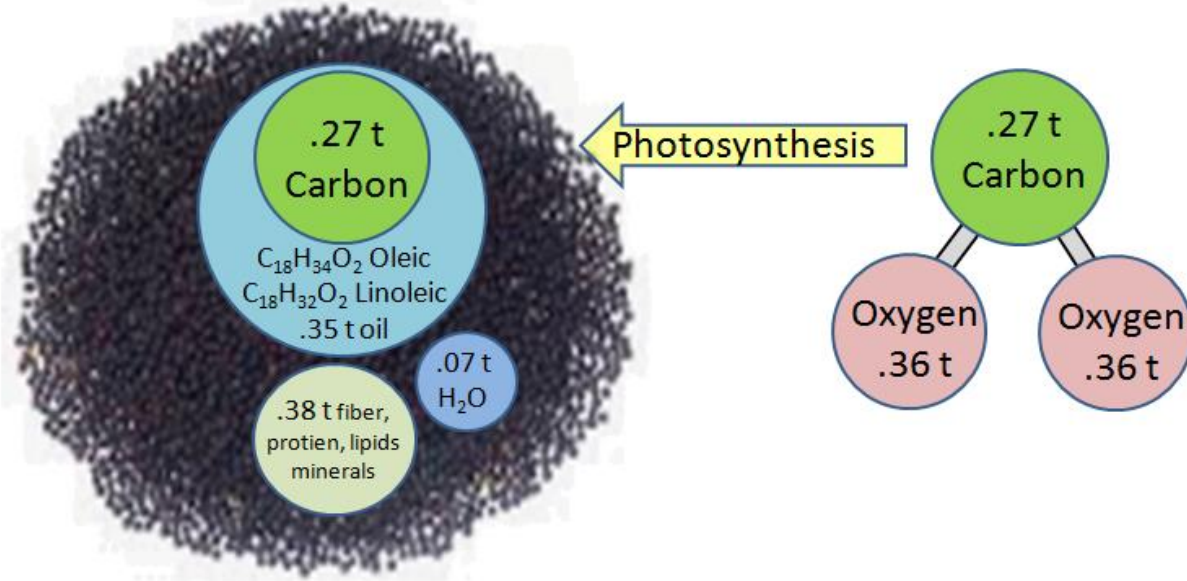
1 t CO₂
(27% carbon)



Carbon Capture in Grain - Canola

*.8 t Canola
(44% oil = 75% carbon)*

*1 t CO₂
(27% carbon)*



Grain Production in Canada

- 95 MT of Grains and oilseeds =
100 Mt of CO₂e captured and stored in grain
- Conservative estimates – meat not included



The screenshot shows the Statistics Canada website interface. At the top, there is a header with the Canadian flag, the text 'Statistics Canada' and 'Statistique Canada', and a search bar. Below the header is a navigation menu with tabs for 'Subjects', 'Data', 'Analysis', 'Reference', 'Geography', 'Census', 'Surveys and statistical programs', 'About StatCan', and 'Canada.ca'. The 'Data' tab is selected, and the breadcrumb trail reads: 'Home → Data → Estimated areas, yield, production, average farm price and total farm value of principal field crops, in metric and imperial units'. Below the breadcrumb trail is a link '→ Add/Remove data'. The main heading is 'Add/Remove data'. Underneath, the title of the data table is 'Estimated areas, yield, production, average farm price and total farm value of principal field crops, in metric and imperial units', followed by a warning icon and the numbers '1 2 3 4'. Below the title, it specifies 'Frequency: Annual', 'Table: 32-10-0359-01 (formerly CANSIM 001-0017)', and 'Geography: Canada'. In the bottom right corner, there is a 'Help' link and a 'Save my customizations' button.

Statistics Canada Statistique Canada

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Subjects Data Analysis Reference Geography Census Surveys and statistical programs ▼ About StatCan Canada.ca

Home → Data → Estimated areas, yield, production, average farm price and total farm value of principal field crops, in metric and imperial units

→ Add/Remove data

Add/Remove data

Estimated areas, yield, production, average farm price and total farm value of principal field crops, in metric and imperial units ⚠ 1 2 3 4

Frequency: Annual

Table: 32-10-0359-01 (formerly CANSIM 001-0017)

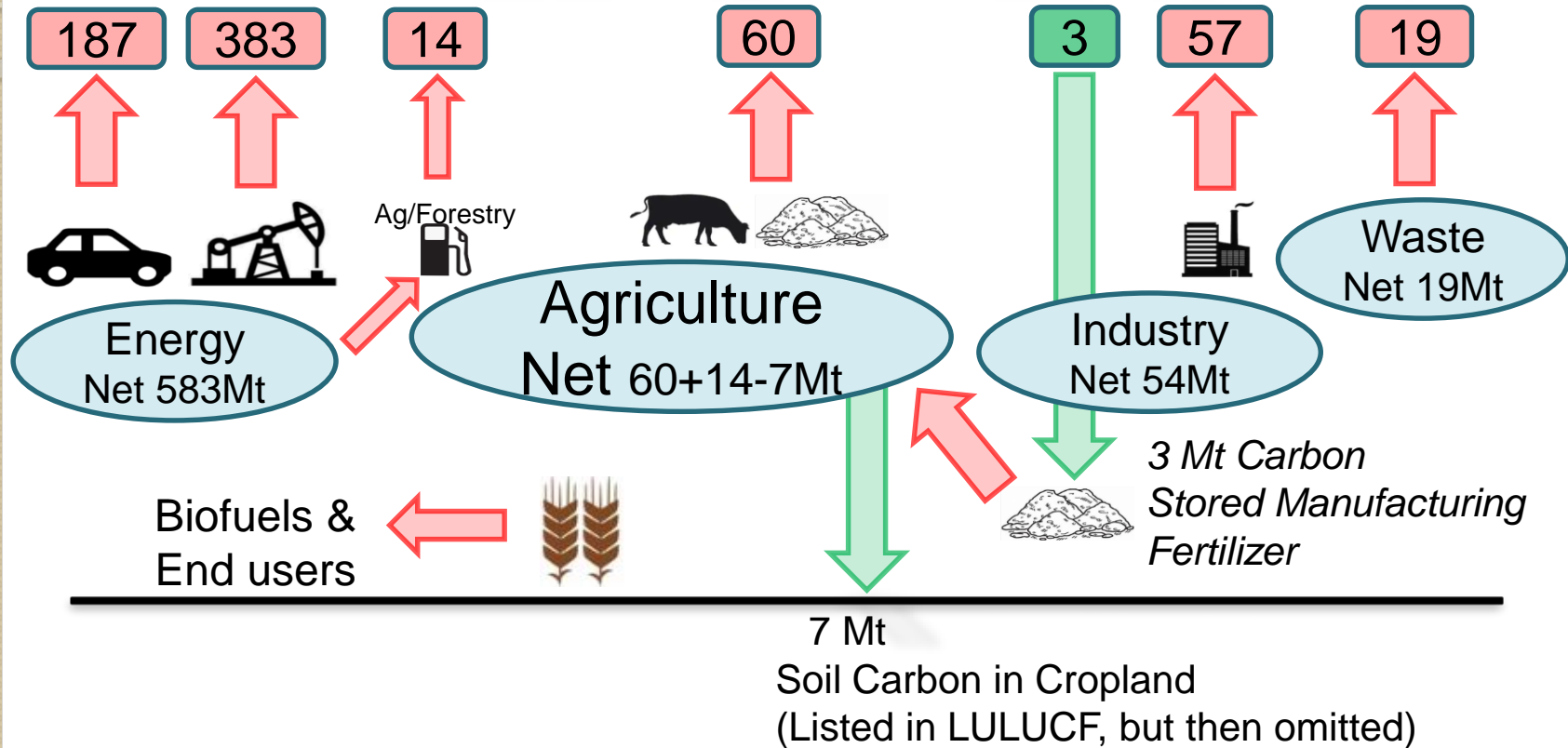
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Help

Save my customizations

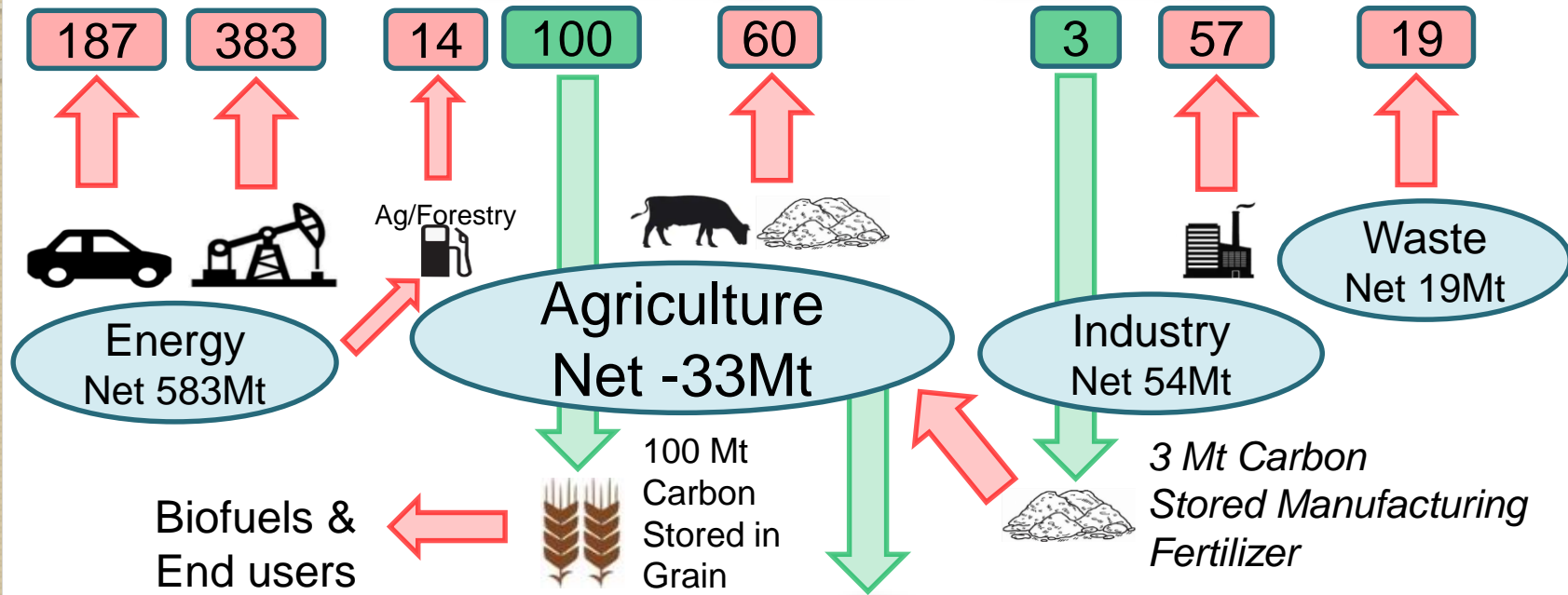
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Agriculture has a net capture of 33Mt CO₂e when soil and grain are included

7 Mt
Soil Carbon in Cropland
(Listed in LULUCF, but then omitted)

Agriculture is Net-Zero

- *Farmers in Canada store 33Mt /yr more CO₂e in our grain and soil than we emit*



Is This Concept in the NIR?

- Yes – Carbon stored in Fertilizer
- Yes – Carbon stored by farmers in grain offsets Biofuel emissions
- Why is the grain left out of the picture?



Why is Carbon Stored in Grain Important?

- It helps us justify our current exemptions
- Its simple - easy to measure tonnes of grain
- Since we export most of our grain, the CO₂e we capture in Canada can be accounted for here.

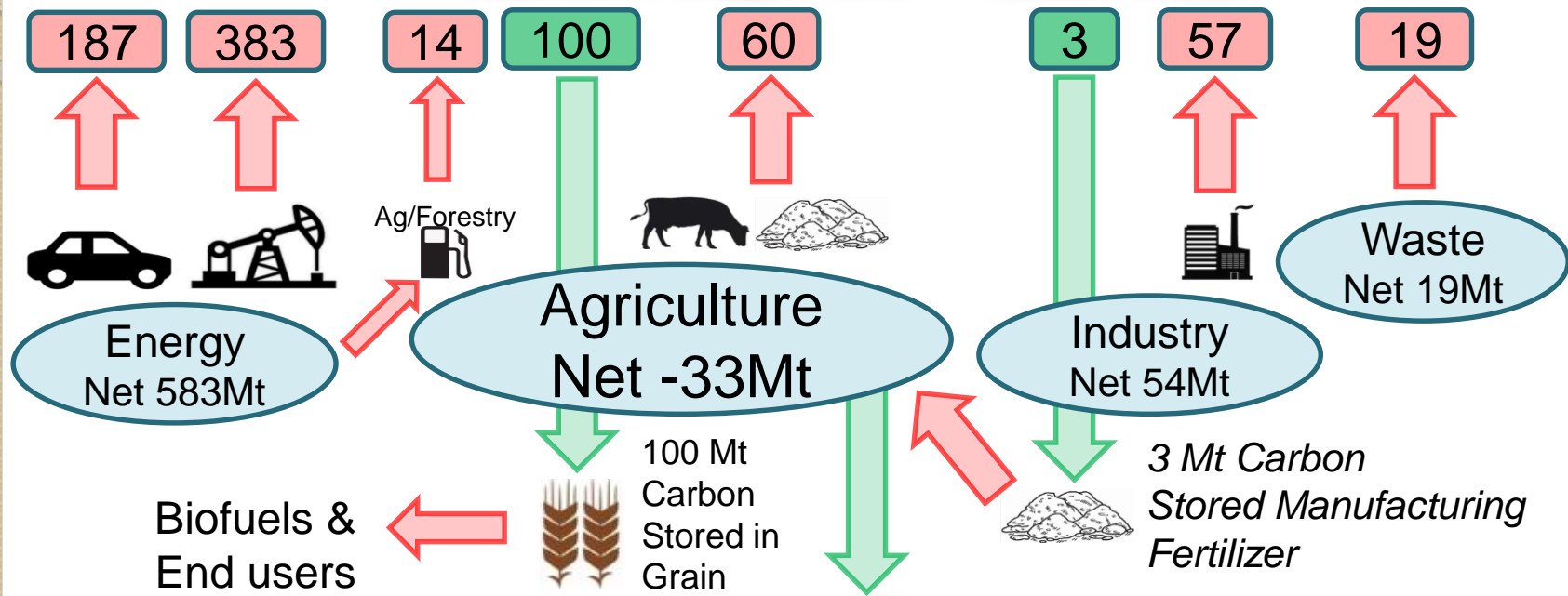
Benefits to this Approach?

- Livestock farmers and grain farmers can take one approach as a sector and as a country we can look at our overall totals
- It is universal, if you farm organic, conventional, livestock or grain, its one pool of farmers – an easy calculation

Final Thought

- *The Carbon we store in our grain, is one of the most important things we do for the atmosphere, but its going mostly unnoticed and we are giving it away for free, what is the next step?*

Questions?



Agriculture has a net capture of 33Mt CO₂e when soil and grain are included

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