

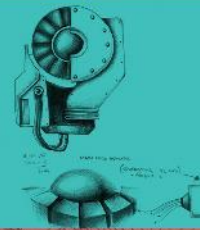
# Emissions Trading Game

1<sup>st</sup> December 2017



# Introduction

- This game was developed to give people an understanding of the basic concepts behind emissions trading.
- It demonstrates a simplistic textbook trading system where the economy consists of one electricity retailer and one aluminium smelter.
- It demonstrates how the ETS works when the point of obligation is at the firm level.



# Introduction

- Emissions trading is a market mechanism used to control the amount of pollution being emitted.
- Emissions trading schemes are in action worldwide, the largest is the European Union ETS.
- New Zealand's ETS currently includes foresters, industrial emitters, fuels, and energy generators.

# Format

- In each scenario, you will need to decide on a production level that will maximise your profit given the regulatory state.
- Three possible regulatory states:
  - No GHG emissions regulation
  - GHG emissions limits
  - GHG emissions trading

# Game Setup Basics

- Please form small groups of two or three people.
- Electricity retailer please pair up with an aluminium smelter.
- Please keep the handout information within your own group - **don't show the sheet to the other group.**

# Assumptions

- Your firms are the only sources of pollution in the economy.
- Your goal is to maximise profit by choosing how much to produce, while complying with regulations.

# The Production Schedule (1)

- Your handout has a production schedule similar to this one.
- This is an example, whose numbers are different from your schedule.

<b>Coal fired electricity supplied</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>
Profit from all electricity supplied	-\$10	\$0	\$9	\$12	\$20	\$22	\$24	\$23
Emissions	0	2	3	4	5	6	7	8

## The Production Schedule (2)

- If you reduce production from 3 to 2, your profit reduces  $\$12 - \$9 = \$3$ , and your firm's pollution reduces by one.
- If you increase production from 3 to 4, your profit increases  $\$20 - \$12 = \$8$ , and your firm's pollution increases by one.

Coal fired electricity supplied	0	1	2	3	4	5	6	7
Profit from all electricity supply	-\$10	\$0	\$9	\$12	\$20	\$22	\$24	\$23
Emissions	0	2	3	4	5	6	7	8



# Comparison

- We will use this table to compare the three regulatory states.

	<b>Total profit</b>	<b>Electricity retailer emissions</b>	<b>Aluminium smelter emissions</b>	<b>Total emissions</b>
No regulation				
Emissions limits				
Emissions trading				

# Scenario 1

- Decide on your production level under no regulation.

Under no regulation	Coal-fired electricity supplied	Profit	Emissions

# Scenario 1

- To maximise profit:

Firm type	Production	Profit	Emissions
Electricity retailer	8 units	\$27	7 units
Aluminium smelter	8 units	\$27	11 units
Total	--	\$54	18 units

# Comparison: After Scenario 1

	<b>Total profit</b>	<b>Electricity retailer emissions</b>	<b>Aluminium smelter emissions</b>	<b>Total emissions</b>
No regulation	\$54	7 units	11 units	18 units
Emissions limits				
Emissions trading				

## Scenario 2

- Decide on your production level with regulations in place to reduce GHG emissions.
- Each firm may **emit 6 emissions units**.
- Trading is not allowed.

With regulation limiting emissions	Coal-fired electricity supplied	Profit	Emissions

## Scenario 2

- To maximise profit:

<b>Firm type</b>	<b>Production</b>	<b>Profit</b>	<b>Emissions</b>
Electricity Retailer	7 units	\$26	6 units
Aluminium Smelter	3 units	\$14	6 units
Total	--	\$40	12 units

# Comparison: After Scenario 2

	<b>Total profit</b>	<b>Electricity retailer emissions</b>	<b>Aluminium smelter emissions</b>	<b>Total emissions</b>
No regulation	\$54	7 units	11 units	18 units
Emissions limits	\$40	6 units	6 units	12 units
Emissions trading				

## Scenario 3

- Trading system introduced.
  - Firms are **allocated 6 allowances each.**
- **Please start negotiating with your pair firm.**
  - Work out how much you are willing to pay to buy allowances and how much you would need to be paid to sell allowances.
- **Note:** Be sure to compare your profit before and after the trade before finalising the trade.



# Example trade

- If this firm were producing 3 units a year and allocated 3 allowances, she would make \$5 more profit from production by buying an extra allowance. She would be better off if the allowance cost less than \$5.
- In what circumstances would the allowance seller also be better off?

Aluminium produced	0	1	2	3	4	5	6	7
Profit from aluminium production	-\$12	-\$1	\$8	\$14	\$19	\$24	\$28	\$26
Emissions	0	1	2	3	4	5	6	7

# Scenario 3

- Decide on your production level with an emissions trading system in place.

<b>Under an emissions trading system</b>	<b>Coal-fired electricity/ aluminium produced</b>	<b>Allowances bought/sold</b>	<b>Allowance cost/revenue</b>	<b>Profit</b>	<b>Emissions</b>

# Discussion

- Who managed to undertake a trade?
- Who was the buyer/seller?
- How many allowances did you trade?
- How much did you increase your profit by?

## Scenario 3

- The optimal trade occurs when electricity retailers sell 2 allowances to aluminium smelters.

<b>Firm type</b>	<b>Production</b>	<b>Profit</b>	<b>Emissions</b>
Electricity retailer	5 units	\$29*	4 units
Aluminium smelter	5 units	\$17*	8 units
Total	--	\$46	12 units

\* Exact profit split depends on individual negotiations.

# Comparison: After Scenario 3

	<b>Total profit</b>	<b>Electricity emissions</b>	<b>Aluminium emissions</b>	<b>Total emissions</b>
No regulation	\$54	7 units	11 units	18 units
Emissions limits	\$40	6 units	6 units	12 units
Emissions trading	\$46	4 units	8 units	12 units

# Important Lessons

- Trading itself does not affect environmental outcomes.
- Limiting emissions can improve environmental outcomes but reduce profitability.
- Trading can reduce the costs of meeting a target.

# Extensions

- What are some of the problems of shifting this type of system into the real world?
- How does allowance trading affect firms' inclinations to invest in more environmental friendly technology relative to non-trading regulation?
- Could limiting emissions allow a business to continue as usual, or perhaps become more profitable? Could emissions trading?