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# Carbon Capture and Storage

Capture et stockage du dioxyde de carbone

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Niveau : BTS Métiers de la Chimie

Type d'enseignement : ESLV



Attribution - Pas d'Utilisation Commerciale - Partage dans les Mêmes Conditions

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## Capture et stockage du dioxyde de carbone

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### Niveau et type d'enseignement

Niveau : BTS Métiers de la Chimie  
 Type d'enseignement : ESLV

### Sources

CCS video : <http://bellona.org/about-ccs/bellona-and-ccs>  
 Chemical World Podcasts (mp3) : <https://www.chemistryworld.com/>

### Étapes de la séquence

**Séance 1 : durée 1h**  
 Activité documentaire, compréhension orale (étude d'un mp3)  
 Les activités développées sont les suivantes :  
 - relevé de mots clés et idées principales,  
 - acquisition de vocabulaire,  
 - Reconnaissance de vocabulaire au sein d'un texte,  
 - Réinvestissement du vocabulaire

**Séance 2 : durée 1h**  
 Compréhension orale (étude d'une vidéo, d'un schéma de principe)  
 - Réflexion autour du principe du CCS

### Présentation

Que faire du dioxyde de carbone produit lors de la combustion du charbon ? Existe-t-il un moyen pour le capter et le stocker ? Cette ressource variée utilise un mp3 et une vidéo afin de comprendre le procédé de capture et stockage du CO<sub>2</sub>

### Référentiel, programme

#### Synthèse

- Lire et exploiter un schéma de procédé pour reconnaître les différentes étapes du procédé
- Identifier les points de prélèvement de matière et les communiquer avec la production ;
- Comment choisir un solvant : adapter la nature et la quantité d'un solvant pour minimiser les impacts environnementaux.

### Compétences travaillées

S'approprier      
 Analyser      
 Réaliser      
 Valider

### Niveaux de compétence en langue

Langue : Anglais

Comprendre	Écouter	<input type="checkbox"/> A2	<input type="checkbox"/> B1	<input checked="" type="checkbox"/> B2
	Lire	<input type="checkbox"/> A2	<input checked="" type="checkbox"/> B1	<input type="checkbox"/> B2
Parler	Prendre part à une conversation	<input checked="" type="checkbox"/> A2	<input type="checkbox"/> B1	<input type="checkbox"/> B2
	S'exprimer oralement en continu	<input checked="" type="checkbox"/> A2	<input type="checkbox"/> B1	<input type="checkbox"/> B2
Écrire	Écrire	<input type="checkbox"/> A2	<input checked="" type="checkbox"/> B1	<input type="checkbox"/> B2

### Mots clés

ESLV, environnement, génie des procédés, solvant, absorption

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# For students

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# Carbon Capture and Storage

## Capture et stockage du dioxyde de carbone

### Part 1 : Carbon Capture Trial

#### ■ Question loop

Play the question loop using the papers provided by your teacher.

#### ■ Vocabulary quiz

Fill in the empty boxes

English	Français
storage	
On a full scale	
Oil refinery	
Fertiliser plant	
coal	
The CO is shifted by the reaction	

#### ■ Fill in the gaps

- *Listen to the mp3 in order to acquire key words.*
- *List the main ideas*
- *Fill in the blanks*

The first thing to say is that nobody's done \_\_\_\_\_ and \_\_\_\_\_ on the \_\_\_\_\_ which we're anticipating. So what is happening is that we're trying to adapt technology from places like \_\_\_\_\_, or \_\_\_\_\_ plants to capture the CO<sub>2</sub> and make that equipment much bigger to fit onto \_\_\_\_\_ stations.

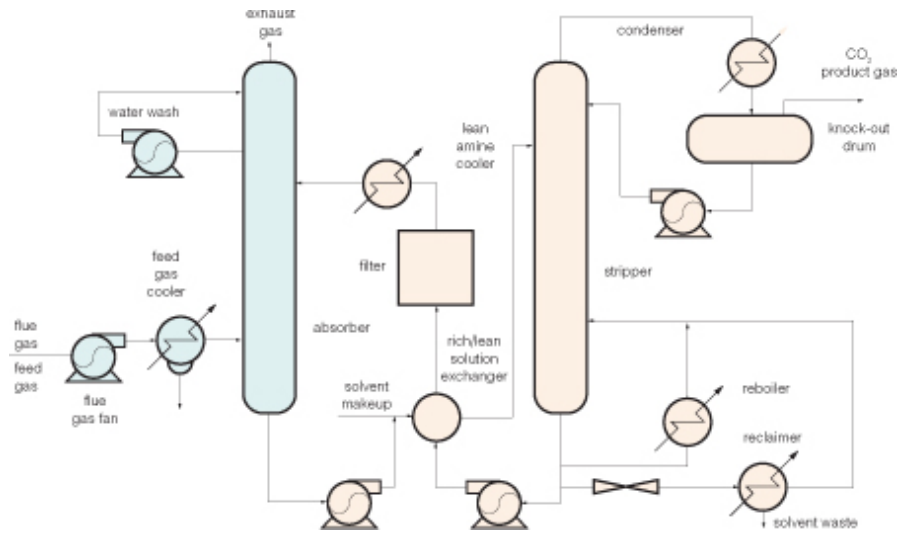
The first way of doing it is to use a \_\_\_\_\_, like an amine solvent. After burning the coal or gas, you can bubble that gas through the solvent and that absorbs the CO<sub>2</sub>. The nitrogen and steam go up the \_\_\_\_\_ and the solvent is then recirculated, heated and the CO<sub>2</sub> is taken off and the solvent is \_\_\_\_\_ to catch more CO<sub>2</sub>.

So that's so called « \_\_\_\_\_ » (after the fuel's burned)

The second method is \_\_\_\_\_ and this involves \_\_\_\_\_ the fossil fuel, the gas or the coal to split that into CO (carbon monoxide) and hydrogen without actually burning it in oxygen. And that H<sub>2</sub> can be taken away and burned as hydrogen so it's free of \_\_\_\_\_.

The CO is then \_\_\_\_\_ by the water gas reaction to make carbon dioxide and more hydrogen and the CO<sub>2</sub> is then again taken away, \_\_\_\_\_ and stored deep underground.

■ Analyze the CCS process

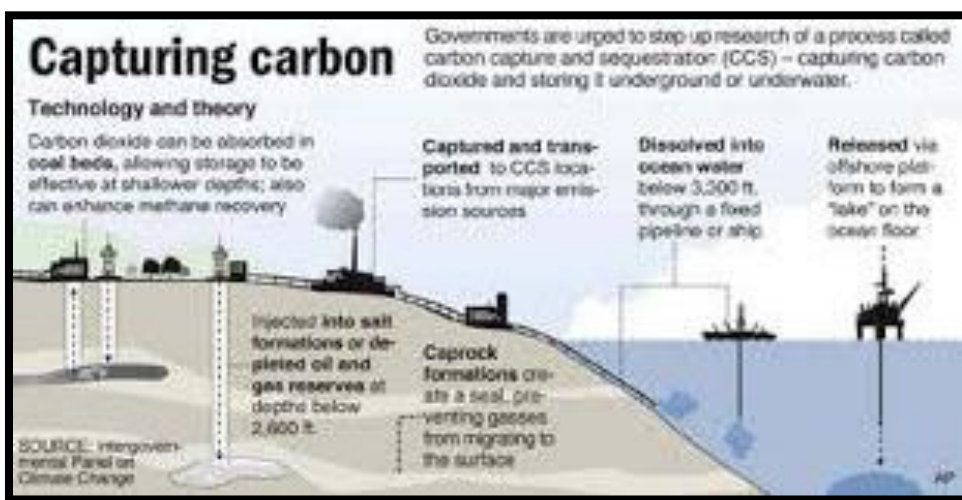


Using what you learned from the previous process, explain the flow diagram above:

**Part 2 : Carbon Capture explanation**

Watch the video on CCS explanation (Bellona foundation)

**Document** : Capturing Carbon (Intergovernmental Panel on Climate Change)



Answer the following questions using the video and above document.

- What does CCS stand for?

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- Where do 50% of our CO<sub>2</sub> emissions come from?

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- What does the flue gas mainly consist of?

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- Which chemical is injected at the top of the tower?

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- What happens in tank 2?

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- Which two streams escape from tank 2?

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- Which step makes the CCS process expensive?

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- What then happens to the CO<sub>2</sub>?

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- How deep is the gas buried?

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### **Part 3 : Carbon Capture conclusion**

Prepare a short presentation in which you should detail:

- The main principle of CCS
- The pros and cons of CCS

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# For teachers

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## Part 1 : Carbon Capture Trial

### ■ Question loop you should print (teacher)

Règles :

- Un papier par élève.
- L'élève 1 démarre par son mot en anglais et l'élève qui possède la bonne réponse s'exprime. Il peut alors donner son expression en anglais. Ainsi de suite.

English	French
storage	A grande échelle
On a full scale	raffinerie
Oil refinery	usine d'engrais
Fertiliser plant	charbon
coal	Le CO est converti lors de la réaction
The CO is shifted by the reaction	stockage

### ■ Vocabulary:

English	Français
storage	stockage
On a full scale	A grande échelle
Oil refinery	raffinerie
Fertiliser plant	usine d'engrais
coal	charbon
The CO is shifted by the reaction	Le CO est converti lors de la réaction

### ■ Full transcript

The first thing to say is that nobody's done carbon capture and storage on the full scale which we're anticipating. So what is happening is that we're trying to adapt technology from places like oil refineries, or fertiliser plants to capture the CO<sub>2</sub> and make that equipment much bigger to fit onto power stations.

The first way of doing it is to use a solvent, like an amine solvent. After burning the coal or gas, you can bubble that gas through the solvent and that adsorbs the CO<sub>2</sub>. The nitrogen and steam go up the chimney and the solvent is then recirculated, heated and the CO<sub>2</sub> is taken off and the solvent is returned to catch more CO<sub>2</sub>.

So that's so called « **post-combustion capture** » (after the fuel's burned)

The second method is **pre-combustion capture** and this involves heating the fossil fuel, the gas or the coal to split that into CO (carbon monoxide) and hydrogen without actually burning it in oxygen. And that H<sub>2</sub> can be taken away and burned as hydrogen so it's free of carbon dioxide emissions.

The CO is then shifted by the water gas reaction to make carbon dioxide and more hydrogen and the CO<sub>2</sub> is then again taken away, injected and stored deep underground.

## Part 2 : Carbon Capture explanation

What does CCS stand for?

*CCS stands for Carbon Capture and Storage*

Where do 50% of our CO<sub>2</sub> emissions come from?

*50% of our emissions come from industry (ex : oil refineries, coal power plant)*

What does the flue gas mainly consist of?

*The flue gas consists of: CO<sub>2(g)</sub>, N<sub>2(g)</sub>, H<sub>2</sub>O<sub>(g)</sub>, other chemical compounds*

Which chemical is injected at the top of the tower?

*The solvent is injected at the top of the tower*

What happens in tank 2?

*The solvent is heated and the CO<sub>2</sub> is released. Desorption takes place.*

Which two streams escape from tank 2?

*Pure CO<sub>2</sub> and purified solvent escape*

Which step makes the CCS process expensive?

*Step number 2 (desorption) is the most expensive step.*

What then happens to the CO<sub>2</sub>?

*The CO<sub>2</sub> is then stored far away and buried deep underground*

How deep is the gas buried?

*The gas is buried 800 meters deep.*

## Part 3 : Carbon Capture conclusion

Prepare a short presentation in which you should detail:

- The main principle of CCS
- The pros and cons of CCS