

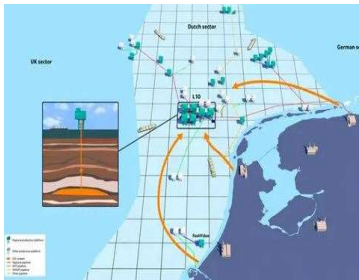
## CCUS INDUCED EARTHQUAKE PREDICTION COMBINING THE SUBSURFACE MODELING AND FISH ACTIVITIES

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### CCUS >

#### CARBON CAPTURE & STORAGE TECHNOLOGIES

It captures CO<sub>2</sub>, then transports it away and store it. For storage the big volume of CO<sub>2</sub>, carbon sequestration process is used to inject the captured CO<sub>2</sub> in geological formations deep underground, for example the massive CCUS feasibility studies in the depleted gas field in North Sea.



The direct carbon capturing from the source and storing it in large geological formations can reduce ~ 20% of total CO<sub>2</sub> emissions from industrial and energy production facilities. It also can lead to significant reduction of NO<sub>x</sub> and sulfur dioxide gases. By removing CO<sub>2</sub> directly from the source, the carbon social cost could be reduced dramatically.

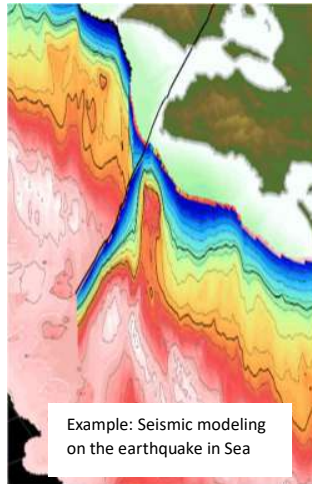
Despite the benefit that carbon capture and storage underground helps with big amount of CO<sub>2</sub> emission reduction, there are also potential disadvantages related to this technology. Besides the high cost, difficult to get license, uncertain storage capacity, risk of transportation and uncertain public support, the potential induced seismicity in the storage region needs to pay special attention to. The stress CO<sub>2</sub> storage fields within the subsurface could cause the earthquakes in the sea.

### EXISTING TECHNOLOGY >

#### SUBSURFACE MODELING

To mitigate the potential induced seismicity and secure geological storage of CO<sub>2</sub>, we could use the current seismic subsurface technology:

1. Careful select the suitable geological fields
2. Operators of injection CO<sub>2</sub> projects must safe guide the injection rates
3. Set up the modelling system for the seismicity
4. Set up the robust monitoring for seismicity and CO<sub>2</sub> leakage



### EXPLORING IDEAS >

#### COMBINING THE SUBSURFACE MODELING AND FISH ACTIVITIES

As the sea fish is part of ecosystems in the offshore CCUS area, the unusual fish activities may indicate the possibilities of the earth activities, for example: the alteration of tectonic plates and reactive of the faults zone. Since the current CCUS induced earthquake prediction is still in the developing phase, we could explore with combining the subsurface simulation & modeling of the geological fields with the observation of the fish activities, in order to reduce the risks of the CCUS induced earthquake in the sea.

The challenges of this exploring idea will be how we can separate the causes of the abnormal fish actives. Are these caused by potential induced earthquake, or global warming related abnormal conditions, or others? With the increasing of global warming, the marine life and ecosystems are both impacting. The sudden rises in temperature and shifting ocean currents are changing the distribution of fish stocks and altering the structure of ecosystems. So we need both of the geologists and biologists sitting together to make an integrated plan on this idea and further exploring the possibilities to predict the CCUS induced earthquakes.