

# Cambay

# Carbon Capture & Storage Scheme

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# Cambay CCS Overview

- Transportation and storage of CO<sub>2</sub> from up to 16 major CCGT and coal-fired power stations located in the proximity of the Synergia-operated Cambay field, Gujarat state
- Scheme involves CO<sub>2</sub> extraction from exhaust streams of power stations resulting in zero-CO<sub>2</sub> emission power generation
- Gaseous CO<sub>2</sub> transported via onshore pipeline network to a CCS hub located on the Cambay field for permanent storage in extensive Olpad saline aquifer

**11.2 GW**

Peak power generation  
capacity

14 CCGT & coal-fired power  
stations

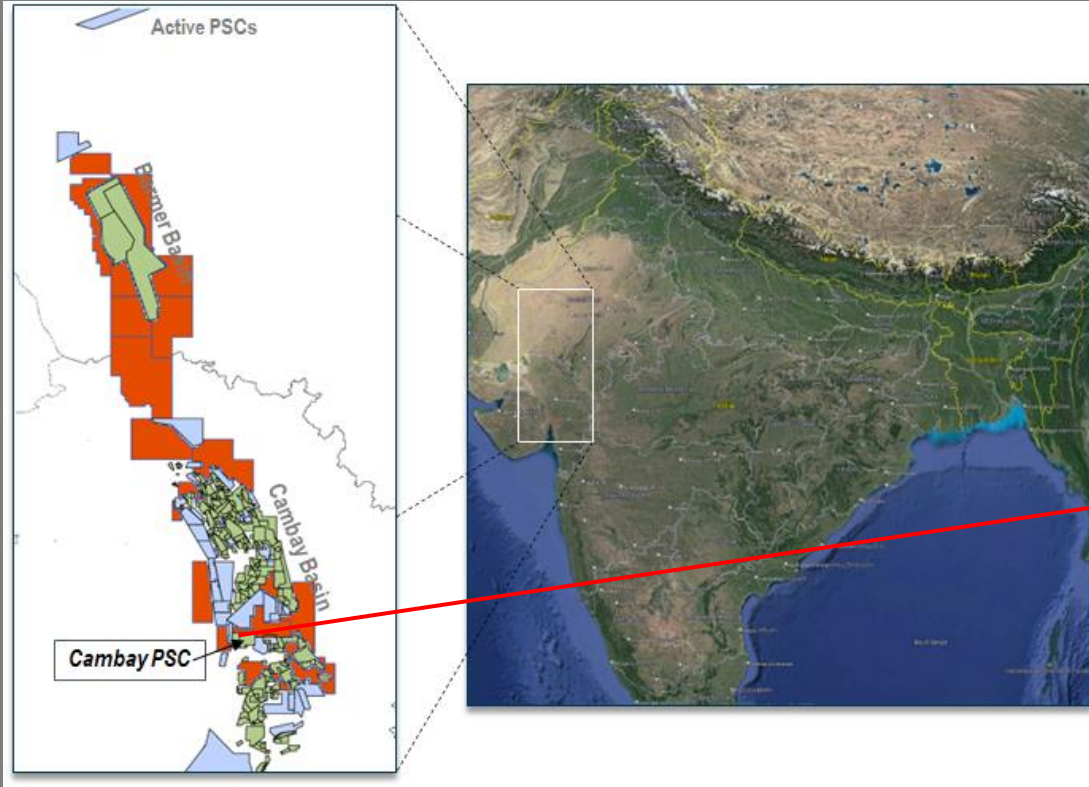
**43 MTa CO<sub>2</sub>**

Peak emissions

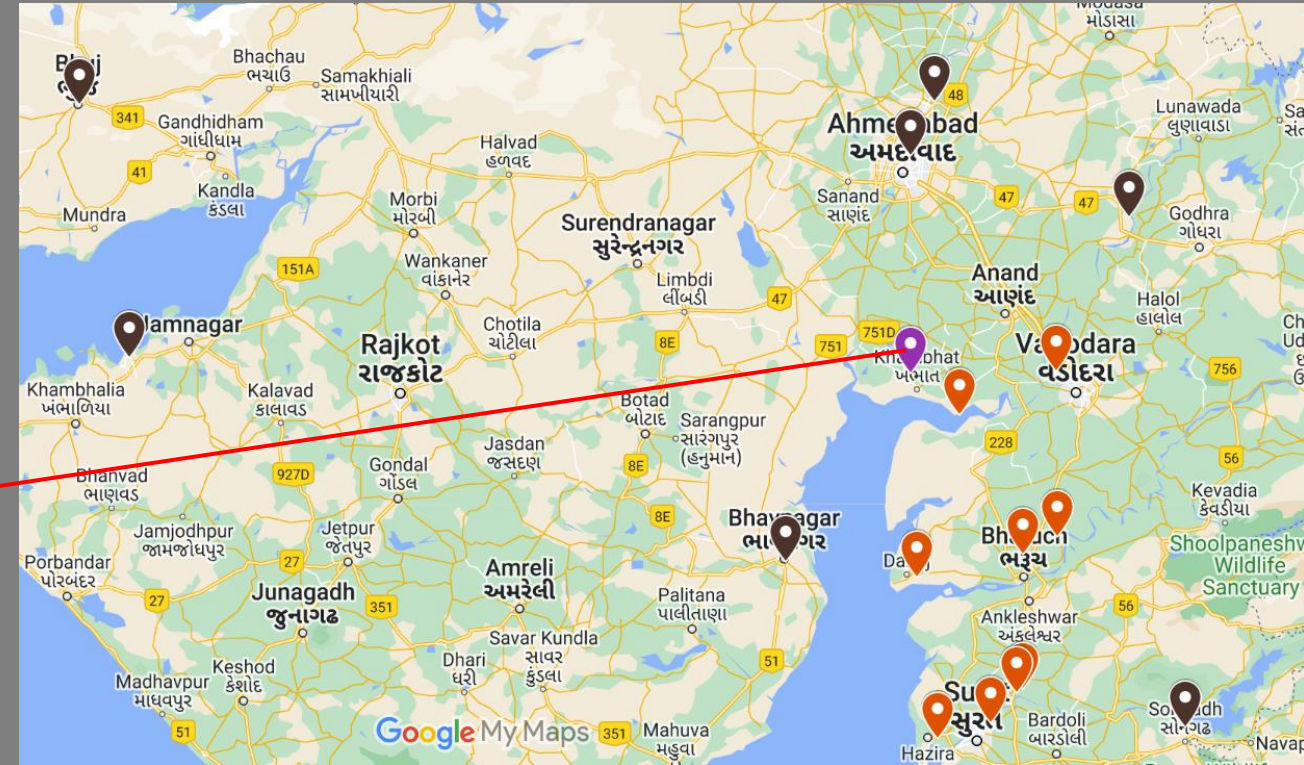
**500+ MT CO<sub>2</sub>**

Targeted  
Storage capacity

# Cambay CCS Overview (cont.)



Synergia Energy's Cambay gas field location



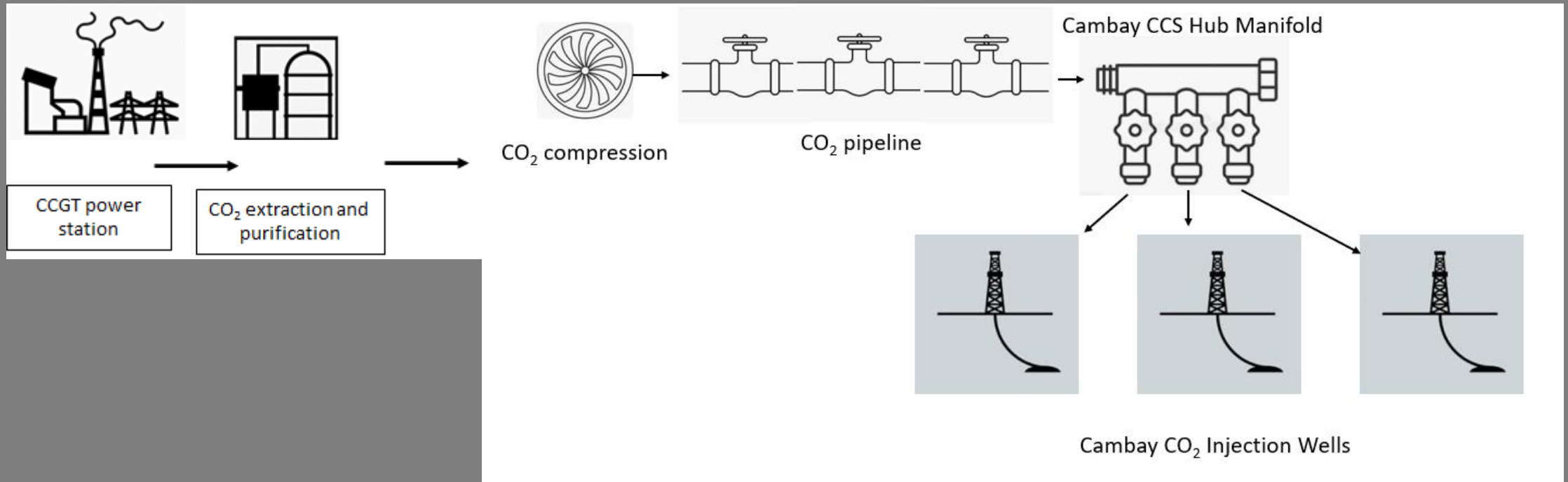
Gujarat State CCGT (red) and coal-fired (black) Power Stations locations. Location of proposed Cambay CCS hub (purple)

# Cambay CCS Proposed Scheme Methodology

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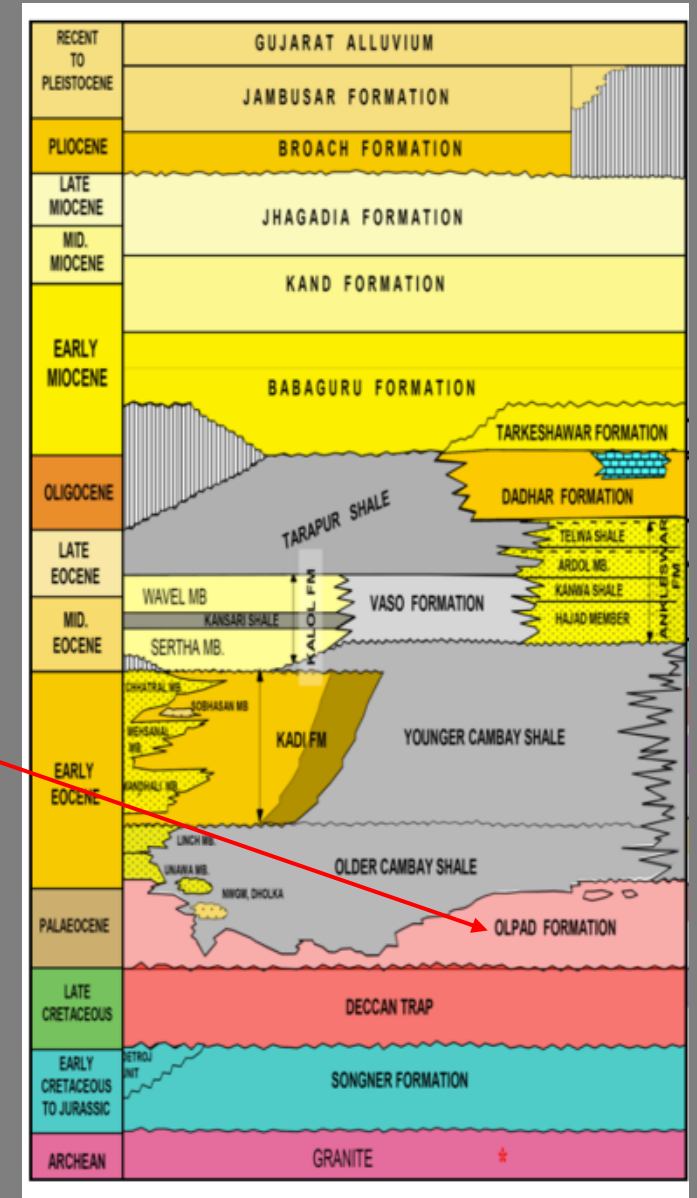
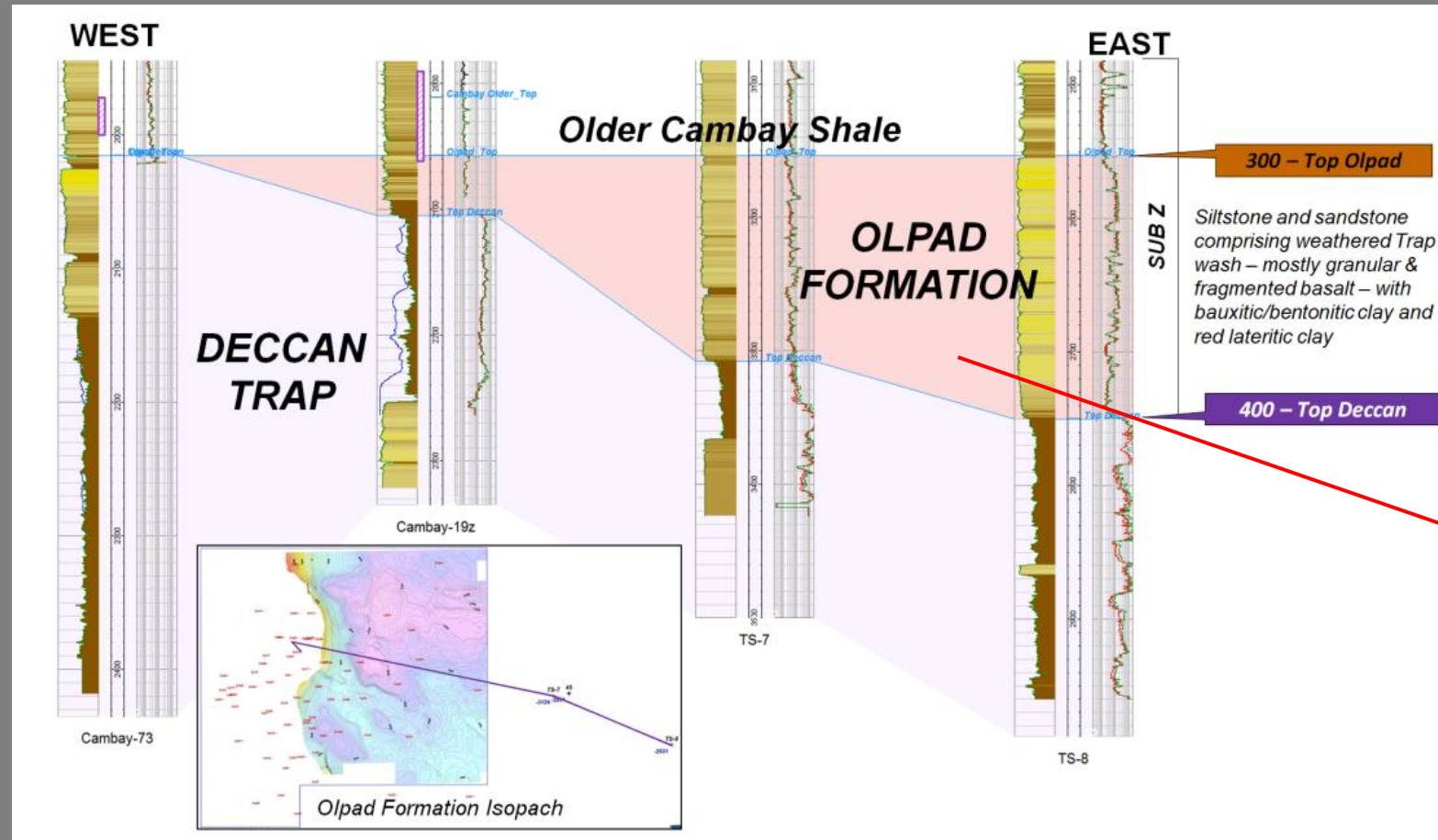
- The project is a simple carbon capture and storage scheme and involves:
  - Separation of CO<sub>2</sub> from power station exhaust streams in situ
  - Transportation of separated CO<sub>2</sub> to Cambay CCS hub via CO<sub>2</sub> pipeline
  - CO<sub>2</sub> at Cambay is distributed to CO<sub>2</sub> injection wells for permanent storage in Olpad underground formation

# Cambay CCS Schematic





# Cambay CO<sub>2</sub> storage – Olpad Fm



# Cambay CO<sub>2</sub> storage – Olpad Formation

- Extensive over Cambay PSC
- Palaeocene conglomerates
- 2000 – 3000 meters vertical depth
- 50-500 meters thickness increasing west to east
- Established sealing mechanism of overlying shale formations
- 10-25% porosity
- Permeability (and hence CO<sub>2</sub> injectivity) to be determined via appraisal well
- Potential for 500+ MT CO<sub>2</sub> storage



# Key Assumptions

- Average CCGT CO<sub>2</sub> emissions of 371 metric tons per GWh
- Average coal-fired power station emissions of 846 metric tons per GWh
- In-situ CO<sub>2</sub> capture and compression into CO<sub>2</sub> pipeline network connected to Cambay CCS hub
- CO<sub>2</sub> distributed via Cambay Hub manifold to dedicated CO<sub>2</sub> injection wells to be permanently stored in Olpad formation on the Synergia Energy operated Cambay PSC at depths in excess of 2000 meters

# Cambay CCS potential emitter candidates

				Gujarat Power Stations					
Power Station Name	Location	Operator	Type	Nominal Peak Output, MW	CO2 emissions, T/day	CO2, 80% load, 95% recovery, T/day	CO2, 80% load, 95% recovery, T/year	CO2 gas emissions per day, m3	CO2 gas emissions per day, BCF
CLP Bharuch	Surat	NTPC	CCGT	655	5832	4432	1,617,830	2,464,421	0.09
Ukai	Tapi	GSECL	Coal	850	17258	13116	4,787,480	7,292,710	0.26
GIPCL Baroda	Vadodara	GIPCL	CCGT	310	2760	2098	765,691	1,166,367	0.04
Kawas Hazira	Surat	NTPC	CCGT	645	5743	4365	1,593,130	2,426,796	0.09
Utran	Surat	GSECL	CCGT	375	3339	2538	926,239	1,410,928	0.05
Amgen	Ahmedabad	Torrent	Coal	362	3223	2450	894,129	1,362,016	0.05
Unosugen	Akhakhhol	Torrent	CCGT	382	3401	2585	943,528	1,437,265	0.05
Sugen Mega	Akhakhhol	Torrent	CCGT	1147	10213	7762	2,833,055	4,315,558	0.15
Dhuvaran	Dhuvaran	GSECL	CCGT	594	5289	4020	1,467,162	2,234,910	0.08
NTPC Jhanor Gandhar	Bharuch	NTPC	CCGT	648	5770	4385	1,600,540	2,438,083	0.09
DGEN Torrent	Dahej	Torrent	CCGT	1200	10685	8120	2,963,964	4,514,969	0.16
GSECL Bhavnagar	Bhavnagar	GSECL	Coal	500	10152	7716	2,816,165	4,289,829	0.15
Gardhinagar	Ahmedabad	GSECL	Coal	630	12792	9722	3,548,368	5,405,185	0.19
Kutch	Kutch	GSECL	Coal	150	3046	2315	844,849	1,286,949	0.05
Sikka	Jamnagar	GSECL	Coal	500	10152	7716	2,816,165	4,289,829	0.15
Wanakbori	Keda	GSECL	Coal	2270	46090	35028	12,785,388	19,475,824	0.69
<b>Total</b>				<b>11218</b>	<b>155,745</b>	<b>118,366</b>	<b>43,203,683</b>	<b>65,811,638</b>	<b>2.32</b>

# Cambay CCS Commercial Framework

- Synergia Energy to offer emitters long-term CO<sub>2</sub> transportation and storage contracts
- Emitting power stations responsible for CO<sub>2</sub> extraction plant adjacent to power stations
- Synergia Energy constructs and operates CO<sub>2</sub> pipeline network
- Synergia Energy responsible for CO<sub>2</sub> from export flange at power stations through to permanent storage on Cambay field

# Cambay CCS Economic Drivers

- Emitters to be offered long-term (10-year+) CO<sub>2</sub> transportation and storage contracts
- Economics to be driven by Gol carbon credit scheme costings
- T&S contract plus CO<sub>2</sub> capture cost to be competitive with carbon credit incentives
- Result is zero-carbon power generation

# Cambay CCS Scheme next steps

- Scheme is subject, inter alia, to Government of India and DGH approvals and consents
- The scheme is conceptual and requires additional detailed engineering and sub-surface studies and potentially an appraisal well to verify the Olpad formation characteristics
- Initial discussions to be held with potential CO2 emitter customers
- Scheme is subject to funding and the establishment of a robust commercial and regulatory framework