

India

Neutral (no change)**Highlighted Companies****Thermax Ltd****ADD, TP Rs3275, Rs2895 close**

Thermax is one of the high-quality EPC & industrial solutions companies with a strong focus on the biogas space.

Summary Valuation Metrics

P/E (x)	Mar22-A	Mar23-A	Mar24-F
Thermax Ltd	104.46	68.34	52.19
P/BV (x)	Mar22-A	Mar23-A	Mar24-F
Thermax Ltd	9.34	8.43	7.44
Dividend Yield	Mar22-A	Mar23-A	Mar24-F
Thermax Ltd	0.24%	0.31%	0.33%

Renewable Energy

India can be major gas producer via biogas

- India can be one of the world's top producers and exporters of gas via proper tapping of its biogas potential. Resultant carbon credits can boost farm income.
- Thermax is focusing on understanding biogas to become a leading EPC player. Time Technoplast, a key cylinder maker, may benefit from biogas logistics.
- Large investments in the gas grid are required to make the biogas economy and gas exports a reality.

India can produce more gas than the US through biogas utilization

India can feasibly generate 1,918bcm of compressed biogas (CBG). This is 14.4x the 2030F consumption of 133bcm. The US, largest producer of gas in the world, produced 1,030bcm in 2022. This production can be managed using waste materials like straw, press mud, municipal solid waste and energy crops like Napier grass. These biogas plants can be decentralized and thereby help boost rural incomes. Carbon credits from the biogas plants if passed on to farmers can boost their incomes by 12.5%

Thermax is working hard to understand biogas technology

Thermax has set up two 10tpd CBG plants in Uttar Pradesh and is looking at producing biogas from paddy straw. It is a more technologically demanding feedstock for biogas production. Thermax's investments in biogas technology are larger than what other major Indian corporates have made in the biogas space.

Time Technoplast to benefit from cylinderized gas logistics

Time Technoplast is the key listed company in India which manufactures composite gas cylinders. These cylinders can reduce the cost and enable more efficient gas logistics. Most of the biogas production would have to be transported through these cylinders because it is not cost-efficient to lay pipelines from biogas plants to the gas sub-stations.

Large grid & liquefaction terminal needed for boosting gas exports

The decentralized nature of the biogas industry requires a large gas grid to be built to allow offtake from biogas plants and make them viable. Most of the 1,918bcm CBG production would have to be exported as the International Energy Agency or IEA estimates gas demand to be around 130bcm in 2030F. This requires the setting up of liquefaction terminals to enable gas exports by sea.

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Biogas offers a huge opportunity to make India energy-independent

Among EPC companies, Thermax has been focusing the most on biogas ➤

Thermax has set up two 10tpd CBG plants in Uttar Pradesh. These plants use rice straw as a feedstock to produce compressed biogas (CBG). Technologically, this is a tough feedstock to work with due to its low moisture content.

The feedstock choice and investment in CBG plants reflects Thermax's high focus on the biogas space.

Biogas is synergistic with Thermax's green solutions business ➤

Within the green solutions segment, Thermax's group company Thermax Onsite Energy Solutions is the most synergistic fit with CBG plants.

Thermax Onsite Energy Solutions (TOESL)

TOESL provides green utilities such as steam, heat, treated water, chilled water, and co-generation power, along with other utilities on a long-term basis (build-own-operate model). Currently, it is executing 42 projects. Revenue is likely to touch ~Rs4bn in FY24F vs. Rs0.8bn three years ago.

TOESL invests, installs and operates a utility plant at a customer's premises and undertakes its comprehensive operation & maintenance along with supply chain management of all consumables, including biomass fuels. The customer is relieved from the burden of owning and running this plant and hence, is able to focus more on core manufacturing processes.

The equity internal rate of return or IRR stands at 19-20%. The company targets to expand into international geographies (South East Asia). There are plans for backward integration to control the supply of biomass.

Quantifying the opportunity for Thermax

Key usable feedstocks ➤

Biogas can be made from any organic material. The list of key feedstocks includes:

- Straw: Using straw as a feedstock is a good solution to stubble burning but considering the limited number of harvesting seasons, there may be low supply.
- Press mud: This is waste from sugar mills and sugarcane-to-ethanol plants. Currently, it's sold as a fertilizer but can be turned into a value-added product by using it as a feedstock for biogas plants.
- Municipal solid waste (MSW): This is a very common feedstock for biogas plants. The Indore Municipal Corporation has a 19tpd biogas plant that processes 550t of wet waste.
- Industrial effluents: Wastewater from sugar mills, distilleries, milk processing units and starch plants is a good feedstock for biogas plants. Often small-scale biogas plants are used as waste management units by food processing plants.
- Super Napier grass: This grass (also known as elephant grass) is a fast-growing and hardy tropical grass, which is quite drought-resistant. Super Napier grass is a high-yield hybrid of Napier grass.

Straw ➤

Figure 1: Biogas production from straw

	Units	Remarks
India gross straw production in 2030F	693 mmt	https://doi.org/10.1016/j.renene.2019.03.133
Dry fodder demand	413.6 mmt	
Available for biogas	279.4 mmt	
Collection efficiency	35%	
Feedstock for biogas	97.79 mmt	
CBG yield (95% methane)	210 nm3/t	
Methane density	0.7 kg/m3	
Net CBG production potential	14.38 mmt	
CBG production in BCM	20.54 bcm	
CBG capacity	57,500.52 tpd	
Annual capacity addition	3,833.37 tpd	15 years re required to build this much capacity.
Revenue per TPD	45.00 Rs m	
Thermax market share	30%	
Revenue from straw biogas	51.75 Rs bn	

SOURCE: INCRED RESEARCH, COMPANY REPORTS

India has a large excess straw production, leading to stubble burning, especially in the states like Punjab, Haryana and some parts of Uttar Pradesh. Straw, especially paddy straw, has a high biogas yield and can be used as a feedstock to make a large amount of biogas, as seen in the table above.

The seasonal availability of paddy straw poses some challenges, which requires the biogas plant operator to buy it in large quantities during the harvest season and subsequently store it for use throughout the year. This can reduce the usage of straw as a feedstock. Hence, we have assumed only 35% of available straw would be used to produce CBG.

We can expect Thermax to be the market leader in this segment as its CBG plants use rice straw as a feedstock. It is a more technologically challenging feedstock as compared to others.

Recently, Punjab Energy Development Agency (PEDA) signed a Memorandum of Understanding or MoU with Hindustan Petroleum Corporation (HPCL) to set up 10 paddy straw-fed plants to produce over 35,000t of CBG and about 8,700t of organic manure annually.

Paddy straw carbon credits are passed on to the farmers ➤

As stubble burning is a serious problem in North India, additional carbon credits can be accrued for using straw/stubble as a feedstock for biogas plants.

Figure 2: Carbon credit potential of paddy straw

Carbon credit potential:	Units	Remarks
Carbon credits/t of paddy straw	3.02	tCO2eq Unnat Bharat Abhiyaan – IIT Delhi
Total carbon credits produced	295.33	MMTCO2eq
Carbon credit price in US\$	20.00	
Gross value of carbon credits	5.91	US\$ bn
USD-INR	83.00	Rs
Gross carbon credit benefit/kg of straw feedstock	5.01	Rs/kg
Carbon credit benefit passed on to the farmer	50%	
Paddy straw production per kg of rice production	1.5	kg
Revenue for the rice farmer per kg of rice grain	30.00	Rs/kg
Additional income from paddy straw carbon credits	12.5%	

SOURCES: INCRED RESEARCH, COMPANY REPORTS

The above table indicates how much additional income the rice farmer can generate from the paddy straw-based carbon credits alone. It should be noted that carbon credit prices often depend on the social benefits they generate. Thus, it's possible to have significantly higher prices for carbon credits.

Press mud ➤

Figure 3: Using press mud to produce biogas

		Units	Remarks
India press mud production in 2022	13	mmt	
India's press mud production in 2030F	15.84	mmt	StatisticsAPY.pdf (dac.gov.in)
Press mud availability	90%		
Biogas yield from press mud	100	m3/t	
Methane content	55%		
Methane density	0.70	kg/m3	
Net CBG production	548.83	mmt	
CBG capacity needed	16,63,119.96	tpd	
Annual capacity addition	1,10,874.66	tpd	15 years are required to build this much capacity.
Revenue/tpd	45.00	Rs m	
Thermax's market share	30%		
Revenue from press mud biogas	1,496.81	Rs bn	

SOURCE: INCRED RESEARCH, COMPANY REPORTS

Press mud is the waste product of a sugar mill. Currently, it is sold as a fertilizer. It can, instead, be used as a CBG feedstock. As sugar mill operators would have deep pockets, we can assume all sugar mills would be able to set up a biogas plant to consume their waste products.

Praj Industries has set up one of the first press mud-to-CBG plants in India. The technology is still being understood by the plant developer. Thus, we believe Praj Industries doesn't necessarily have a large first-mover advantage and Thermax could go on to gain a 30% market share.

Municipal solid waste or MSW ➤

Figure 4: Using MSW to produce biogas

		Units	Remarks
India's MSW generation in 2030F	210	mmt	
Organic portion (dry weight)	19.11	mmt	
Gas yield/t feedstock	400	m3/t	
Gas generation potential	7,644	mm3/year	
Methane content	45%		
Methane density	0.7	kg/m3	
Net CBG production	2.41	mmt	
CBG capacity needed	7,296.55	tpd	
Annual capacity addition	486.44	tpd	15 years are required to set up this much capacity
Revenue/tpd	45.00	Rs m	
Thermax market share	30%		
Revenue from MSW biogas	6.57	Rs bn	

SOURCE: INCRED RESEARCH, COMPANY REPORTS

MSW is toxic and must be treated at a sewage treatment plant (STP). The organic portion of MSW is also a cheap source of biogas. The key concern with this feedstock is that a municipal corporation would have to maintain effective waste segregation into dry and wet, or else plastics could find their way into the biogas digester. This would not only be toxic to the bacteria but also cause blockages within the biogas plant, thereby compromising its operations.

As MSW is available round the year and is a cheap feedstock for CBG plants, we expect all available MSW to be used by CBG plants, assuming it meets the waste segregation requirement that is becoming a norm across India.

The Indore Municipal Corporation has one of the largest MSW-to-CBG plants in India. We can easily expect Thermax to garner a good market share, given the company's prowess in large-scale environmental waste handling.

Industrial effluents >

Figure 5: Industrial wastewater

	Sugar	Distilleries	Milk processing	Tapioca-Starch	Maize-Starch	Total	Remarks
Wastewater generation in 2030F (mm3/day)	1.8	0.2	0.15	0.31	0.1	2.56	
Biogas potential in 2030F (mm3/year)	620.5	1971	36.5	635.1	204.4	3467.5	
Utilized potential	90%	90%	70%	80%	80%	87%	
Methane content in biogas	55%	55%	50%	55%	45%		
Methane density in kg/m3	0.7	0.7	0.7	0.7	0.7		
CBG production (in mmt)	0.22	0.68	0.01	0.20	0.05	1.15	
CBG capacity needed (in tpd)	1,194.46	3,794.18	27.10	592.76	156.09	5,764.58	
Annual capacity addition	79.63	252.95	5.42	39.52	10.41	387.92	
Revenue/tpd	45.00	45.00	45.00	45.00	45.00		
Thermax's market share	30%	30%	5%	30%	30%		Higher market share for industries where individual plant can be larger
Revenue from wastewater biogas	1.08	3.41	0.01	0.53	0.14	5.18	Rs Bn

SOURCES: INCRED RESEARCH, COMPANY REPORTS

Industrial wastewater, especially from the food & beverage processing industry, can be a rich feedstock for CBG plants. Zero liquid discharge (ZLD) norms incentivize the factories to handle their wastewater well.

As TOESL has expertise in the wastewater space, it can capture a good market share, at least among large companies.

Super Napier grass >

Napier grass is already used as a cover crop and as cattle fodder. Napier grass has been cultivated in Thailand for at least 30 years.

Unlike the previous feedstocks, which are waste materials, Super Napier grass is an energy crop. It is farmed for its high biomass yield per acre. This grass also has a 50% higher biogas yield as compared to regular Napier grass.

The hardy nature of Napier grass allows it to grow in wastelands, degraded lands, etc. The waste slurry from biogas plants is a very good manure. So, if it's put on a Super Napier grass plantation, soil fertility will improve by raising the organic carbon content. This can cause greenification of these marginal fertility lands and thus lead to carbon sequestration.

Figure 6: Super Napier grass for making biogas

		Units	Remarks
India fallow farmland	5,83,21,640.00	acre	
Fallow land used	20%		
Super Napier grass yield on fallow land	175	t/acre/year	
India's degraded land	24,16,89,500.00	acre	
Degraded land used	40%		
Super Napier grass yield on degraded land	100.00	t/acre/year	
Total annual super Napier grass production	11,708.84	mmt	
Gas yield	150	m3/t	
Methane content	60%		
Methane density	0.70	kg/m3	
Annual CBG production	737.66	mmt	
CBG capacity	22,35,323.50	tpd	
Annual capacity addition	74,510.78	tpd	30 years are required to set up this much capacity.
Revenue/tpd	45.00	Rs m	
Thermax's market share	15%		
Revenue from super Napier grass-fed biogas	502.95	Rs bn	

SOURCE: INCRED RESEARCH, COMPANY REPORTS

In our calculations, we assume that fallow land as well as degraded land will be used to farm super Napier grass and there is a considerable difference in grass yields for the same.

Net benefits for key Indian listed companies

Thermax ➤

Figure 7: Total CBG EPC business of Thermax

		Units
CBG production	1,304.42	mmt
CBG production	1,918.27	bcm
CBG capacity needed	39,69,005.11	tpd
Annual capacity addition	1,90,093.17	tpd
Revenue/tpd	45	Rs m
Thermax's market share	24%	
Revenue from biogas in 2030F	2,063.25	Rs bn
EV/sales	2	
EV in 2030F	4,126.50	Rs bn
Back-discounted at 12%	2,090.61	Rs bn
Net debt	-8.89	Rs bn
Market capitalization	2,099.50	Rs bn
Number of shares outstanding	0.11	Rs bn
Option value per share	18,634.14	
Probability of achieving this business	15%	
Probability adjusted value	2,795.12	

SOURCE: INCRED RESEARCH, COMPANY REPORTS

All these calculations have been focused on exploiting as much feedstock as possible for CBG production. Thus, these numbers are bound to be quite optimistic. We assign a 15% probability to this quantum of business being achieved by Thermax's biogas segment. Our probability-adjusted option value comes to Rs2,795/share.

Time Technoplast ➤

Time Technoplast manufactures type-IV compressed natural gas or CNG cylinders. These are composite cylinders and weigh 80% less than all-metal cylinders. They are also corrosion-proof, both to the air and the gas they carry. This makes them ideally suited for transporting CBG.

Figure 8: Total CBG cascade business for Time Technoplast

		Units	Remarks
CNG density at 250 bar	215	kg/m3	
Usable cascade volume	7488	L	
CNG weight in cylinder	1,609.92	kg	
Cylinder price	₹ 9	Rs m	
Biogas plant capacity addition in 2030F	1,95,469.83	tpd	
%age of output transported by composite cylinder cascade	70%		
Cylinderized gas carrying capacity needed	1,36,828.88	t	Assume cylinders are only used to send gas to CGD station
No. of cylinders needed	84,991.11		
Time Technoplast's market share	10%		
Revenue of Time Technoplast	₹ 68.84	Rs bn	Assume 10% discount on bulk orders
EV/sales multiple	2		
EV value in 2030F	₹ 137.69	Rs bn	
Back-discounted EV at 12%	₹ 69.76	Rs bn	
Net debt	₹ 7.10	Rs bn	
No. of shares outstanding	22,60,14,760.00		
Option value per share	₹ 277.22		
Probability of achieving this business	15%		
Probability-adjusted value	₹ 41.58		

SOURCE: INCRED RESEARCH, COMPANY REPORTS

Based on our calculations, Time Technoplast can have an option value of Rs 30.60/share at a 15% probability.

Constraints to effective resource utilization

Decentralized network of CBG plants raises logistics costs ➤

Given the dispersed availability of feedstock, CBG plants must be quite small and should be set up in a decentralized manner. This raises logistics costs, as the gas must be transported to a sub-station and from there it can be put on to the grid. As the Indian gas grid is still being built, several biogas plants are unviable today owing to the lack of gas-offtake infrastructure.

Lack of gas liquefaction terminal ▶

As the higher utilization of India's biogas resources would lead gas production to outstrip demand by at least two-to-three times, this gas needs to be exported. This necessitates the setting up of the gas liquefaction infrastructure.

Carbon credits ▶

As the cost of production of CBG is higher than the administered pricing mechanism or APM natural gas price, carbon credits are needed to bring down the net cost of production. In the absence of carbon credits, fewer CBG projects would be viable, leading to reduced CBG production and a relatively inefficient market for it.

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