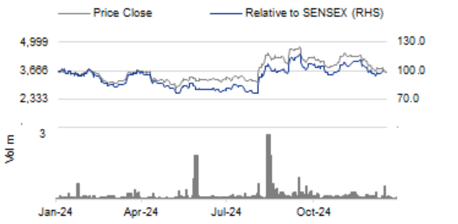
India

REDUCE *(no change)*

Consensus ratings*:	Buy 9	Hold 0	Sell 5

Current price:	Rs3,595
Target price:	Rs1,946
Previous target:	Rs1,946
Up/downside:	-45.9%
InCred Research / Consensus:	-53.1%
Reuters:	GFLL.NS
Bloomberg:	FLUOROCH IN
Market cap:	US$5,439m
	Rs394,955m
Average daily turnover:	US$12.2m
	Rs885.8m
Current shares o/s:	109.9m
Free float:	31.5%

*Source: Bloomberg



Source: Bloomberg

Price performance	1M	3M	12M
Absolute (%)	(17.4)	(13.3)	0.7
Relative (%)	(14.7)	(9.7)	(6.5)

Major shareholders	% held
Promoter & Promoter Group	68.5
HDFC Asset Management Co Ltd	2.6
Capital Group	2.0

Gujarat Fluorochemicals Ltd

Base business model at risk; REDUCE

- PFAS chemicals, including PTFE and LiPF6, face regulatory pressure and market oversupply, with demand expected to remain weak.
- GFL's battery chemical venture is struggling, and its PTFE & PVDF sales are stagnating. US President Trump's new policies to exacerbate the problems.
- The company's financial outlook is negative, with consensus earnings to decline by 40-45%, leading us to maintain our REDUCE rating.

PFAS (including PTFE & 10,000 other chemicals) facing global heat

We have written multiple reports on how PFAS are facing global headwinds.1) IN: Chemicals - Others - Are PFAS replaceable? The answer is Yes, All the chemicals manufactured by Gujarat Fluorochemicals (GFL) fall under the category of PFAs. In the recent past, The New York Times had reported that big law firms are advising their US clients to prepare class action suits for PFAS.(Link) We have also written multiple times on the ECHA inquiry that is going on in PFAS. Please see IN: Gujarat Fluorochemicals Ltd - HFC falling & PFAS face regulatory risk (REDUCE - Maintained). The battery chemical venture of GFL will be dead before its starts as global oversupply is just killing the margin and at the same time, BYD and CATL Innovation will make lithium-ion battery demand to decline. GFL's PTFE and other PFAS businesses have zero terminal value. PTFE volume sales have remained stagnant for the last five years and PVDF never really picked up.

$LiPF_6$- capex ignores changed realities, won't make any EBITDA

As shown in this report, no one would use Li-ion batteries for ESS (energy storage solution). We also believe that hybrid vehicles have a better potential in the Indian market than pure electric vehicles or EVs. In this scenario, IBEF's forecast of 60GW Li-ion battery requirement for EVs and consumer electronics appears to be a highly optimistic demand projection. However, even if we assume that 60GW battery demand will be there in 2030F. then as 1kWh of battery capacity requires around 100gm of $LiPF_6$, this means, at best, $LiPF_6$ demand in India could be around 6kt. GFL and Neogen Chemicals alone are bringing in 50kt of $LiPF_6$ capacity online. Please note that $LiPF_6$ has inferior properties compared to LiFSi, which Tesla is using in its newer vehicles. Hence, even assuming no cannibalization of $LiPF_6$ demand by LiFSi and a minimal impact on battery demand from hybrid vehicles, the best-case $LiPF_6$ demand in India could be around 6kt by 2030F. Globally, this electrolyte is hugely oversupplied (against a demand of 70kt, Chinese capacity is only ~150kt with 100kt in the pipeline) and with Trump's new policies on EVs, the future appears even more bleak.

LiPF6 has -ve RoCE; earnings inflated; PTFE to dip; retain REDUCE

In the past 12-18 months, LIPF6 prices have collapsed by 90% and it has become a zero gross profit product. At the same time, PVDF and LIPF6 sales will fall as the new Trump policies come into force. PTFE sales have peaked in FY22 and are declining since then. Consensus earnings estimates need to decline by 40-45%. GFL's businesses appear to have zero terminal value. Retain our REDUCE rating on GFL with a target price of Rs1,946.

Financial Summary	Mar-22A	Mar-23A	Mar-24F	Mar-25F	Mar-26F
Revenue (Rsm)	39,536	56,847	42,808	44,531	49,944
Operating EBITDA (Rsm)	11,976	20,472	9,548	9,638	11,974
Net Profit (Rsm)	7,748	13,231	4,350	3,958	5,292
Core EPS (Rs)	70.5	120.4	39.6	36.0	48.2
Core EPS Growth	(449.8%)	70.8%	(67.1%)	(9.0%)	33.7%
FD Core P/E (x)	50.97	29.85	90.80	99.79	74.64
DPS (Rs)	0.0	0.0	0.0	0.0	0.0
Dividend Yield	0.00%	0.00%	0.00%	0.00%	0.00%
EV/EBITDA (x)	34.11	19.93	43.25	42.40	34.38
P/FCFE (x)	394.09	224.46	232.33	82.50	(162.85)
Net Gearing	32.6%	23.9%	30.3%	21.8%	24.5%
P/BV (x)	9.28	7.15	6.65	6.24	5.76
ROE	20.0%	27.1%	7.6%	6.5%	8.0%
% Change In Core EPS Estimates			(44.14%)		
InCred Research/Consensus EPS (x)					

SOURCE: INCRED RESEARCH, COMPANY REPORTS

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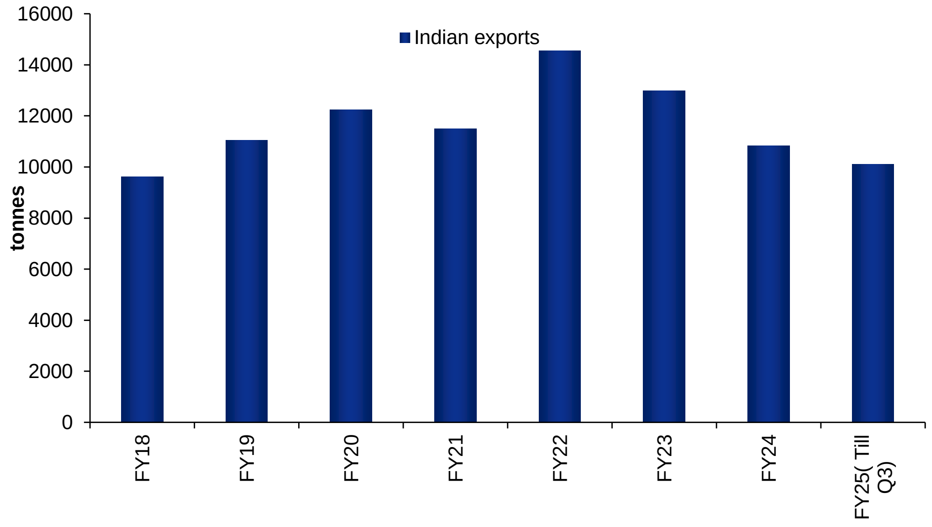
Base business model at risk; REDUCE

Fluoropolymer sales – it's end times

Fluoropolymer sales have started declining and it is showing in the near stagnant Indian exports of PTFE for the past several quarters. Europe is close to the legislation on banning all PFAS and 10 American states have also banned PFAS. Please note that Europe and the US are the biggest markets for PFAS. The stagnant sales in these markets and rising competition doesn't bode well for the sales growth of Gujarat Fluoropolymers.

PTFE exports from India have remained stagnant for the past several quarters ➤

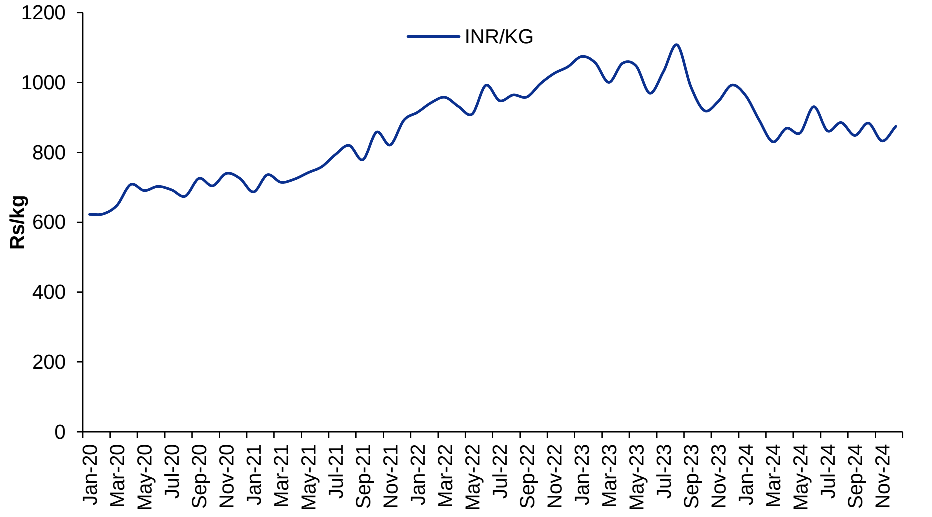
Figure 1: Indian PTFE exports have remained stagnant over the last seven years, which clearly indicate that incremental demand for the product is not growing



SOURCE: COMPANY REPORTS, INCRED RESEARCH

PTFE may be the only commodity that did not experience any price increase during the post-Covid supply chain hoarding-led rally ➤

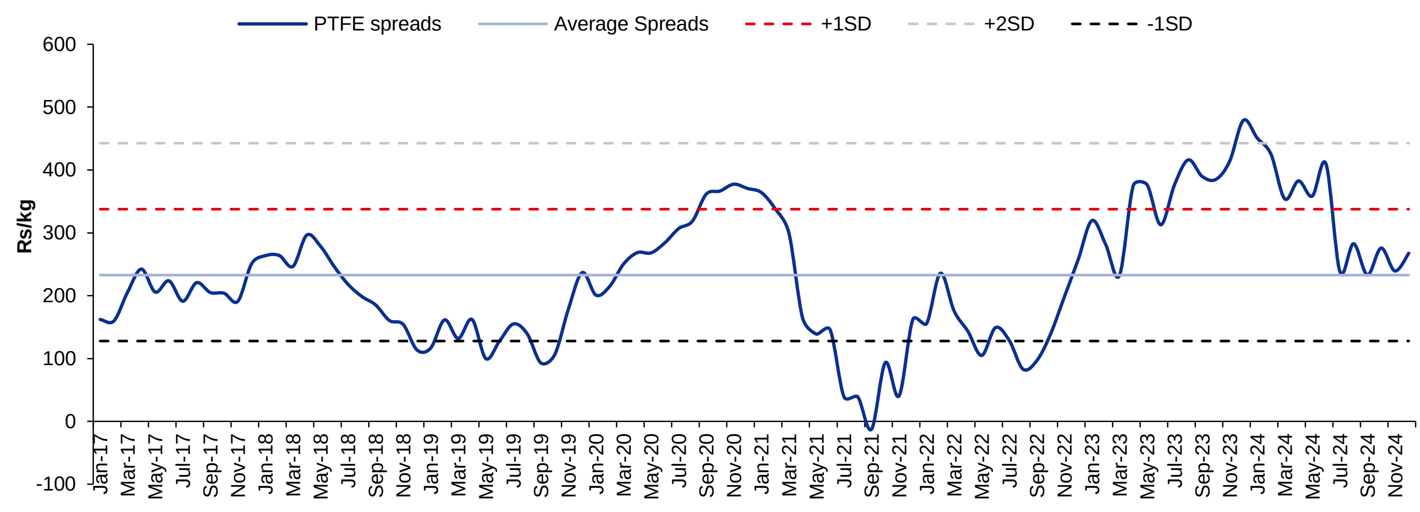
Figure 2: PTFE didn't see any big Covid-19 pandemic-led rally



SOURCE: INCRED RESEARCH, COMPANY REPORTS

PTFE spreads are falling over the last few months

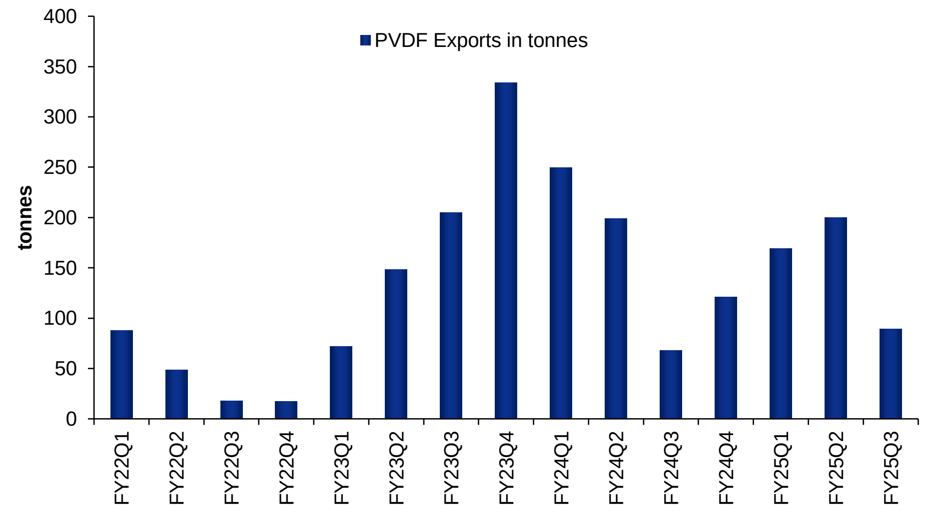
Figure 3: PTFE spreads are declining as the scope of applications for this chemical continues to shrink day by day



SOURCE: INCRED RESEARCH, COMPANY REPORTS

PVDF, another PFAS, is also not doing well

Figure 4: PVDF exports are coming down



SOURCE: INCRED RESEARCH, COMPANY REPORTS

PVDF is mainly used in EV batteries and solar panels

Polyvinylidene fluoride (PVDF) is a highly versatile and durable polymer with a wide range of applications, primarily due to its excellent chemical resistance, high-temperature stability, and electrical insulating properties. Here's a breakdown of PVDF usage across various industries:

Lithium-Ion Batteries:

Binders in electrodes: PVDF is commonly used as a binder material in the electrodes of lithium-ion batteries. Its strong chemical resistance and electrical insulating properties make it ideal for this application. It helps to hold the active materials in the battery electrodes together, ensuring stability and efficiency.

Separator coatings: PVDF is also used as a coating material for separators, helping to prevent the electrodes from coming into direct contact, which could lead to short circuits.

Solar Panels:

Back sheet material: PVDF is used in the back sheet of solar panels due to its excellent weatherability, ultraviolet or UV ray resistance, and insulating properties.

The material protects the solar cells from environmental elements like moisture and UV radiation.

Coatings: PVDF coatings are used to provide long-lasting protection to solar panels, enhancing their durability and efficiency by preventing degradation over time.

Trump's new policies, announced last Monday, are negative for both solar energy & EVs, and hence, negative for PVDF

President Donald Trump's recent executive orders have introduced significant changes to US energy policies, particularly affecting the electric vehicle (EV) and solar industries. These policy shifts are expected to have a negative impact on the demand for polyvinylidene fluoride (PVDF), a polymer widely used in EV batteries and solar panel components.

Key Policy Changes:

1. **Revocation of EV adoption targets:** President Trump signed an executive order to eliminate the previous administration's target of having 50% of all new vehicles sold in the US to be electric by 2030. This move signals a reduced federal commitment to promoting EV adoption, potentially slowing the transition to electric vehicles.
2. **Suspension of EV charging infrastructure funding:** The executive order halts the distribution of unspent funds from a US$5bn allocation intended for EV charging stations. This suspension could delay the expansion of EV charging infrastructure, a critical component for supporting widespread EV adoption.
3. **Potential elimination of EV tax credits:** The administration is considering ending federal tax credits for EV purchases, which have been a significant incentive for consumers to choose electric vehicles.
4. **Reversal of clean energy initiatives:** The executive order also seeks to revoke California's federal exemption that allowed the state to set stricter vehicle emissions standards and phase out the sale of gasoline-only vehicles by 2035. This action could undermine state-level efforts to promote clean energy and reduce greenhouse gas emissions.

These developments are neagtive for PVDF demand:

1. PVDF is a critical material in the production of EV batteries and solar panels due to its chemical resistance, thermal stability, and electrical insulating properties. The recent policy changes are likely to affect PVDF demand in the following ways:
2. Reduced EV adoption: With diminished federal support for electric vehicles, the growth of the EV market may slow, leading to decreased demand for PVDF in battery applications.
3. Delayed charging infrastructure expansion: The suspension of funding for EV charging stations could hinder the development of necessary infrastructure, potentially affecting the adoption rate of electric vehicles and, consequently, the demand for PVDF.
4. Impact on clean energy projects: Reversing clean energy initiatives may lead to a slowdown in solar energy projects, reducing the need for PVDF in solar panel manufacturing.

The European Chemicals Agency (ECHA) is against the use of this chemical, and industry consultations are underway to potentially ban the usage of PFAS (a category of 10,000 chemicals, including PTFE)

The European Chemicals Agency (ECHA) has been actively working on regulating per- and polyfluoroalkyl substances (PFAS), often referred to as "forever chemicals" due to their persistence in the environment. PFAS include a wide range of substances, such as polytetrafluoroethylene (PTFE), commonly used in non-stick coatings, waterproofing, and industrial applications.

The proposed restrictions by ECHA aim to phase out the use of PFAS due to their environmental and health risks, such as bioaccumulation and potential links to cancer, hormonal disruptions, and other health issues. Industry consultations, which are currently underway, will play a critical role in determining the final scope and timeline of any bans or regulations. Key points include:

1. **Impact on industries**: A ban on PFAS could significantly impact industries relying on these chemicals, particularly in manufacturing, automotive, electronics, and consumer goods.
2. **Replacement challenges**: Many companies are investing in research to develop safer alternatives, but finding replacements that offer similar performance is challenging.
3. **Exemptions under review**: Some PFAS applications critical for safety, medical devices, or aerospace might receive temporary exemptions due to the lack of viable alternatives.
4. **Timelines and phase-outs**: The regulatory process could take several years, but stricter rules might come into force by the late 2020s, depending on the outcome of consultations and legislative processes.

The detailed consultation paper and more details are available on the ECVH website. Please see the link to the website https://echa.europa.eu/hot-topics/perfluoroalkyl-chemicals-pfas

Nine US states have already banned PFAS including PTFE

Several US states have already taken the lead in regulating or banning PFAS, including PTFE, to address the environmental and health concerns associated with these substances. Currently, nine US states have enacted laws or introduced regulations to restrict the use of PFAS in various applications. Here are some highlights:

Following states have banned PFAS:

1. **California**: Bans PFAS in food packaging (effective from 2023). Mandates notification of PFAS content in cosmetics, textiles, and other products.
2. **New York**: Prohibits PFAS in food packaging and firefighting foam. Implements stringent drinking water standards for PFAS.
3. **Washington**: First state to implement a phase-out of PFAS in firefighting foam and food packaging. Conducts evaluations for broader product categories like textiles and carpets.
4. **Maine**: Bans PFAS in all products unless it is "currently unavoidable," effective by 2030.
5. **Vermont**: Restricts PFAS in food packaging, firefighting foam, and rugs/carpets.
6. **Maryland**: Prohibits the use of PFAS in firefighting foam and food packaging.
7. **Connecticut**: Enacts restrictions on PFAS-containing firefighting foam and consumer goods.
8. **Minnesota**: Limits PFAS in firefighting foam, food packaging, and textiles.
9. **Colorado**: Bans PFAS in certain consumer products, including carpets, food packaging, and cosmetics.

Key areas of restriction:

1. **Food packaging:** Many states have focused on eliminating PFAS in food-contact materials to reduce direct exposure.
2. **Firefighting foam**: The restrictions aim to minimize the contamination caused by firefighting foam, a significant source of environmental PFAS pollution.
3. **Textiles and consumer goods**: States are broadening bans to include carpets, outdoor apparel, and other products treated with PFAS for water or stain resistance.

India currently lacks the regulations to control PFAS usage; however, it's a matter of time when regulations are imposed

India currently lacks specific regulations governing per- and polyfluoroalkyl substances (PFAS), including polytetrafluoroethylene (PTFE). Despite the absence of formal policies, there is a growing recognition of the environmental and health risks associated with PFAS. Studies have detected PFAS contamination in various environmental matrices across India, including groundwater, surface water, and even in the Sundarbans mangrove area. These findings underscore the need for comprehensive monitoring and regulatory frameworks to manage PFAS pollution effectively.

In 2020, the Bureau of Indian Standards (BIS) adopted the International Organization for Standardization's criteria for sampling and testing perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS). However, further initiatives are urgently needed to address the unregulated and widespread use of PFAS in consumer products, such as single-use plastics, personal care items, cosmetics, processed foods, and packaging materials. These products are major sources of human exposure to PFAS, which have been linked to adverse health effects, including endocrine and immune system disruptions, reproductive and developmental disorders, and an increased risk of chronic diseases like thyroid dysfunction, obesity, diabetes, and cancer.

LiPF6 – too aggressive capex plan, Li-ion won't be used for stationary applications

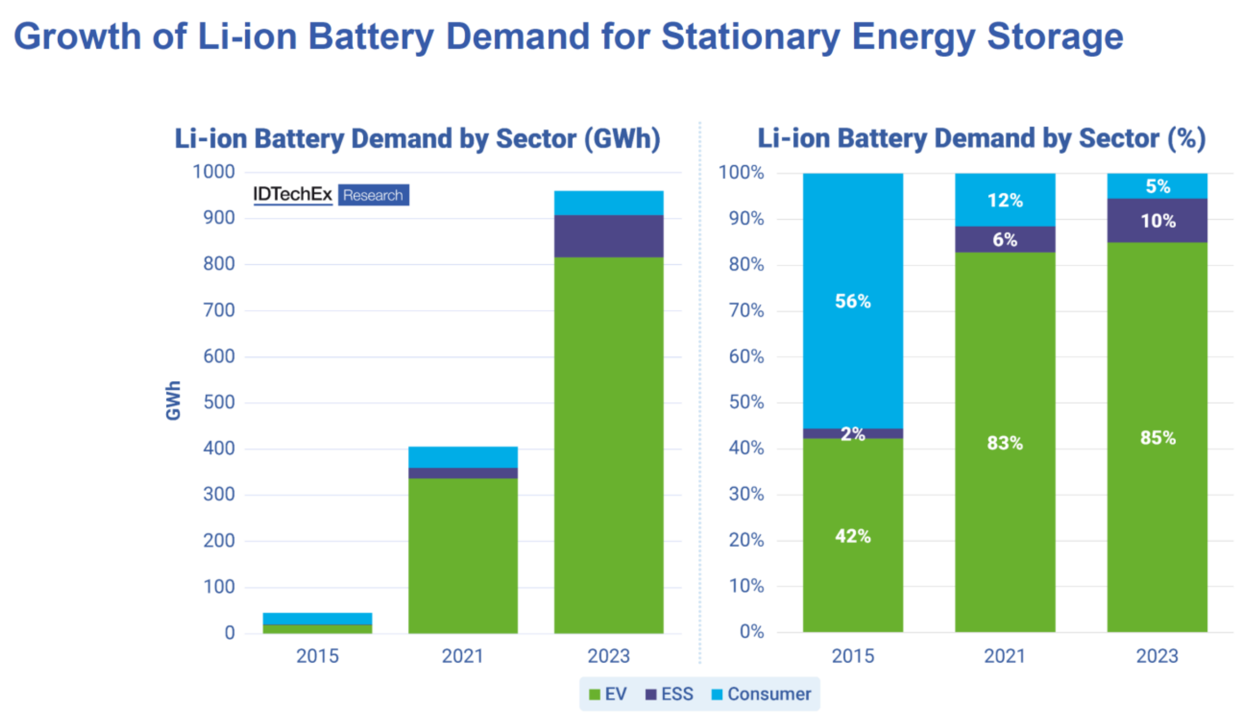
Gujarat Fluorochemicals (GFL) has announced a Rs60bn capex plan. The company has already raised Rs10bn from promoters, family offices, and other investors. GFL plans to produce 200kt of $LiPF_6$ and binders like PTFE and PVDF to cater to both domestic and global demand for Li-ion batteries. However, we have serious concerns about the viability of this capex for two reasons: 1) $LiPF_6$ is increasingly being replaced by LiFSi in the global market, and 2) Indian Li-ion demand is unlikely to exceed 60GW, as Li-ion is a poor choice for stationary grid storage applications.

Global Li-ion battery demand has primarily been led by electric vehicles or EVs. The stationary grid and energy storage applications are a minuscule part of the overall demand. Given the high lifecycle cost of Li-ion batteries, redox and flow batteries are better suited for stationary applications.

Historically, most of the Li-ion battery demand has been led by EVs

The Li-ion battery demand for ESS (energy storage solutions) stood at 10% in 2023.

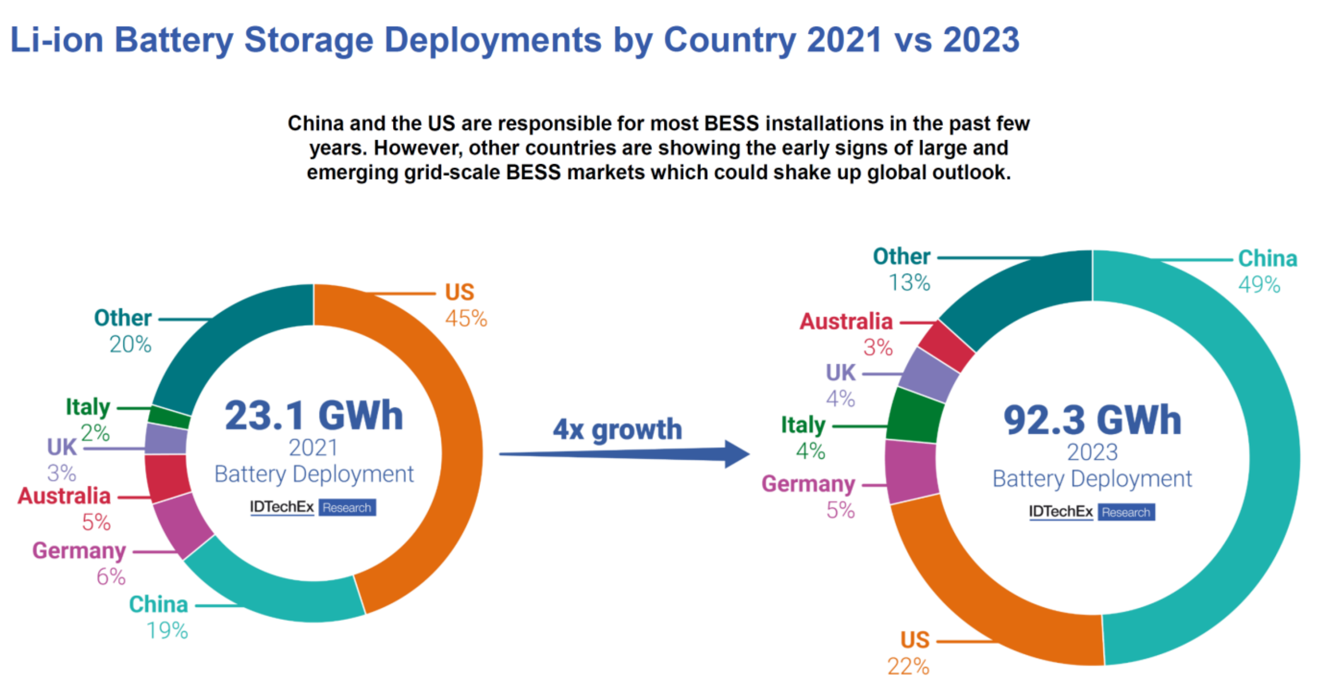
Figure 5: Globally, 90% of Li-ion battery demand has come from EVs and consumer appliance applications



SOURCE: INCRED RESEARCH, HTTPS://WWW.IDTECHEX.COM

ESS usage has primarily been led by wealthy countries like the US, but China has recently installed a huge Li-ion battery capacity for ESS

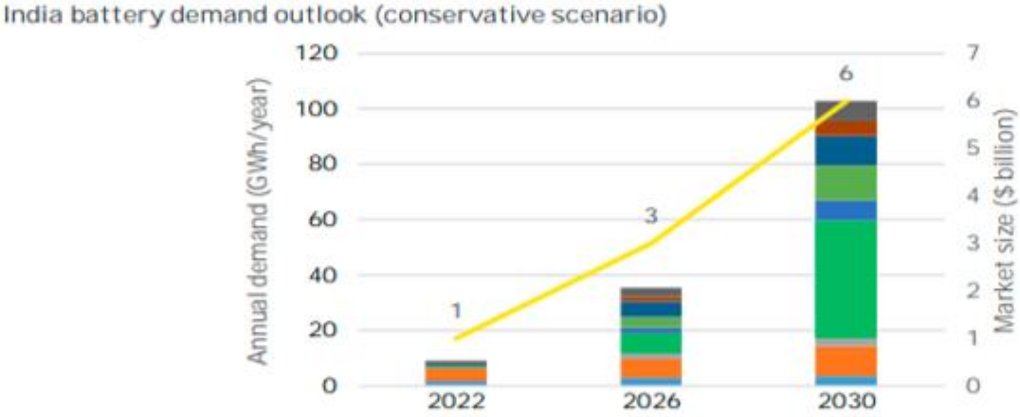
Figure 6: In the recent past, China has installed a huge Li-ion battery capacity for ESS



SOURCE: INCRED RESEARCH, HTTPS://WWW.IDTECHEX.COM

Indian government sounds quite bullish on the usage of Li-ion batteries for ESS ➤

Figure 7: IBEF predicts that India needs around 43GW of Li-ion battery capacity for stationary storage solutions



	2022	2026	2030
Passenger EVs	1	3	7
Commercial EVs	0	2	5
E 2-wheeler/3-wheeler	0	6	11
E-buses	1	4	12
Freight	0	2	7
Stationary storage (grid scale)	0	8	43
Behind the meter (Residential + Commercial)	0	2	3
Consumer electronics	4	7	11
Rail + Defense	2	3	4
Market size	1	3	6

SOURCE: INCRED RESEARCH, COMPANY REPORTS

A Li-ion battery cannot be used for grid-scale energy storage solution

Li-ion batteries are not ideal for grid-scale energy storage due to several limitations:

1. **High costs**: Li-ion batteries are relatively expensive, primarily due to raw materials like lithium, cobalt, and nickel. Although costs have decreased, they still remain high compared to other energy storage technologies such as pumped hydro storage and sodium-based batteries.
2. **Limited lifespan and degradation**: Li-ion batteries face degradation issues with repeated charge-discharge cycles. Their lifespan decreases with deep cycling, and the efficiency reduces over time, increasing maintenance and replacement costs.
3. **Safety concerns**: Li-ion batteries are prone to thermal runaway, which can lead to fires or explosions. For large-scale installations, this poses significant risks and requires extensive safety protocols, which add to costs.
4. **Resource constraints**: Scaling Li-ion battery production for grid applications may strain the supply of critical materials like lithium, cobalt, and nickel, leading to supply chain vulnerabilities and increasing geopolitical risks.
5. **Energy density vs. power requirements**: While Li-ion batteries have high energy density, grid-scale storage often requires high power for quick responses, which can cause thermal stress in Li-ion cells. This makes them less efficient for certain grid services like frequency regulation and peak shaving.
6. **Alternatives** like flow batteries (e.g., vanadium redox), sodium-sulphur batteries, or even non-battery technologies like pumped hydro and compressed air energy storage are better suited for grid-scale applications due to their longer lifespan, better scalability, and lower costs per kWh stored. These alternatives are more reliable for applications requiring long-duration

storage and deep discharge cycles, such as renewable energy storage and grid stabilization.

Li-ion battery life degrades fast if it is fully discharged- something which is a prime requirement for a grid-scale solution

The lifespan of Li-ion batteries and their performance are significantly influenced by the depth of discharge (DoD). DoD refers to the percentage of a battery's capacity that has been discharged relative to its total capacity. For example, if a battery has a capacity of 100kWh and 30kWh has been used, the DoD is 30%. A cycle is defined as a complete discharge and recharge of the battery. However, partial discharges can also contribute to cycles.

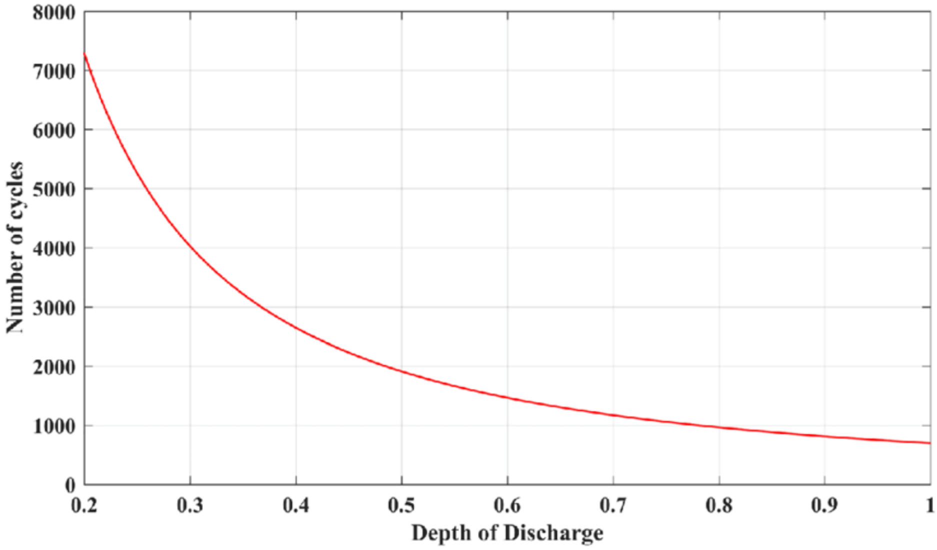
Higher DoD: Frequently discharging to a high DoD (e.g., above 80%) can lead to faster degradation of battery cells, reducing the overall cycle life. This is due to increased stress on battery materials and more pronounced chemical reactions that degrade the electrodes.

Lower DoD: Limiting the DoD to lower percentages (e.g., 20-50%) can significantly extend the cycle life of a battery. For instance, discharging only to 50% might allow for several thousand cycles, whereas discharging to 80% might reduce that number significantly.

1. Li-ion batteries tend to lose capacity over time and with use. A higher DoD can accelerate this process. For example, a battery regularly cycled to 80% DoD might retain only 70% of its original capacity after 1,000 cycles, while one cycled to 50% DoD might retain closer to 90%.
2. Operating at high DoD can generate more heat, which can further contribute to capacity loss and degradation. Keeping batteries cooler and at lower DoD can help mitigate these effects.

For applications requiring longevity, it's advisable to limit the DoD to around 20-50%.

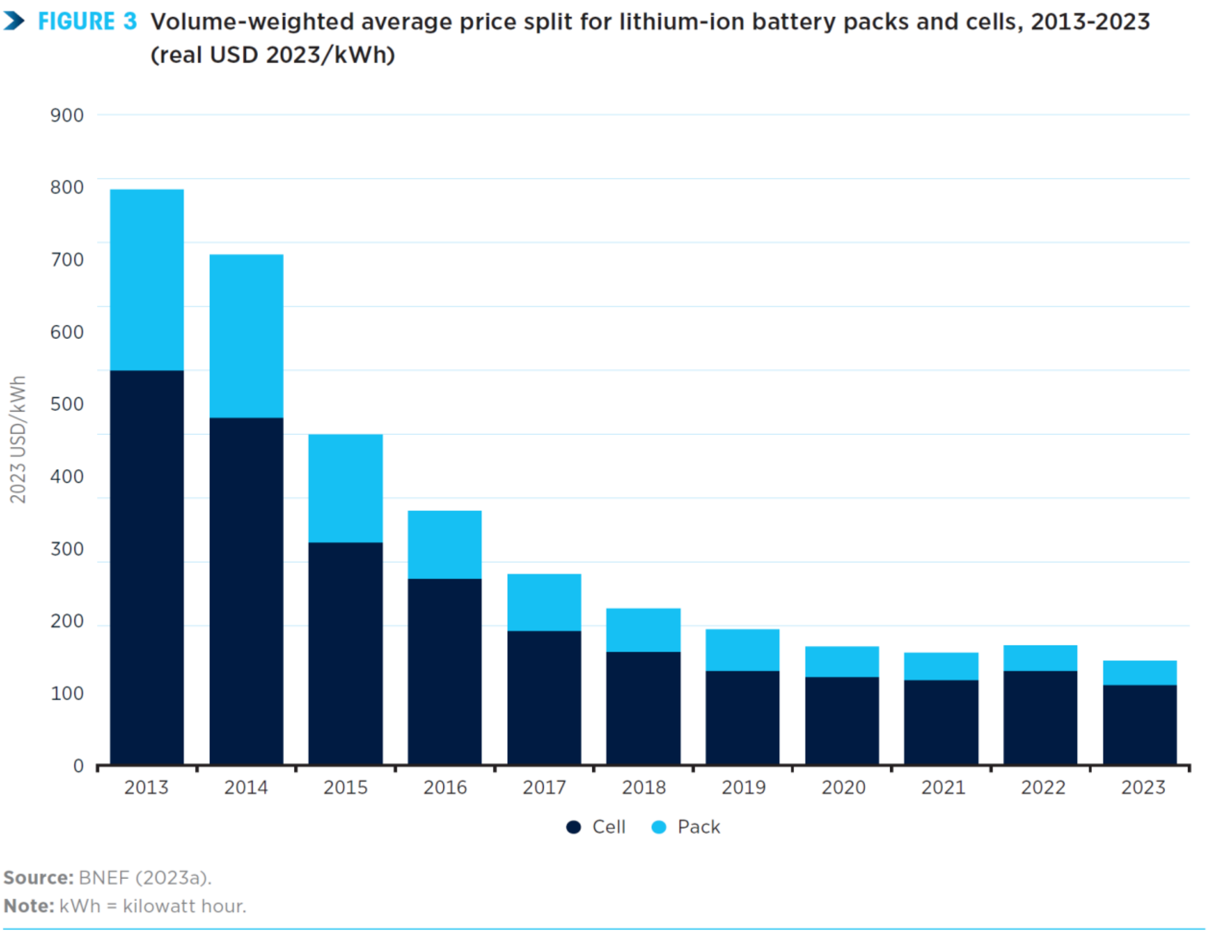
Figure 8: The life cycle curve of Li-ion batteries and different levels of depth of discharge are shown below; assuming an 80% discharge level, grid-level Li-ion batteries will have a life of 1,000 cycles



SOURCE: INCRED RESEARCH, HTTPS://WWW.RESEARCHGATE.NET/FIGURE/LIFECYCLE-CURVE-OF-THE-LI-ION-BATTERY-FOR-DIFFERENT-DEPTHS-OF-DISCHARGES_FIG3_330973403

Hence, the lifecycle cost of Li-ion batteries, even at US$100/kWhr (40% below current price), will be ~ Rs6/unit

Figure 9: The current Li-ion battery pack cost is approximately US$160–165/ kWh, or around Rs13,400 per unit; assuming battery prices fall to US$100/kWh by 2030F, the real storage cost will be around Rs6/unit in 2030F



SOURCE: INCRED RESEARCH, WWW. IRENA.COM

We don't believe Indian consumer businesses can pay a levelized storage cost of Rs6/ unit. That's why the assumption that India can have 43GW of storage capacity is just misplaced.

The solution is flow batteries, and there are multiple types of such batteries

Flow batteries are a promising technology for large-scale energy storage, particularly suitable for grid applications due to their scalability, long cycle life, and ability to decouple energy and power. The following are the main types of flow batteries available in the market:

1. **Vanadium Redox Flow Battery (VRFB)**
   a. Chemistry: Uses vanadium ions in different oxidation states in both the positive and negative electrolytes.
   b. Advantages: High cycle stability, long lifespan (up to 20 years), and reduced cross-contamination risk as both electrolytes use the same active material.
   c. Applications: Suitable for grid energy storage, renewable energy integration, and back-up power systems.
2. **Zinc-Bromine Flow Battery**
   a. Chemistry: Utilizes zinc as the anode and bromine as the cathode, with an electrolyte that contains zinc bromide.
   b. Advantages: High energy density and relatively lower costs compared to some other flow batteries.

   c. Applications: Effective for commercial and industrial applications and for renewable energy storage.

3. **All-Vanadium Flow Battery (AVFB)**
   a. Chemistry: Similar to VRFB but focuses on using only vanadium for both electrodes, which helps reduce potential issues with cross-contamination.
   b. Advantages: Long cycle life and good efficiency, with an emphasis on safety and environmental sustainability.
   c. Applications: Ideal for renewable energy integration and grid-scale energy storage.
4. **Iron-Chromium Flow Battery**
   a. Chemistry: Uses iron and chromium in the electrolytes.
   b. Advantages: Cost-effective due to the abundance of iron and chromium. Good cycle stability and can operate in varying temperatures.
   c. Applications: Suitable for large-scale energy storage applications, though not as widely adopted as vanadium-based systems.
5. **Organic Flow Battery**
   a. Chemistry: Utilizes organic compounds as active materials in the electrolytes.
   b. Advantages: Potential for low-cost materials and environmental sustainability. Research is ongoing to improve efficiency and lifespan.
   c. Applications: Still in development and research phases, but has potential for renewable energy integration.
6. **Manganese Flow Battery**
   a. Chemistry: Employs manganese-based compounds in the electrolyte.
   b. Advantages: Lower costs and environmental impact due to the use of abundant materials.
   c. Applications: Primarily in research and development; potential for grid-scale applications in the future.
7. **Hybrid Flow Battery**
   a. Chemistry: Combines different types of active materials, such as lithium and flow chemistry, to optimize performance.
   b. Advantages: Can leverage the strengths of different materials to improve efficiency, energy density, and cost-effectiveness.
   c. Applications: Emerging technology with potential in various energy storage applications.

Vanadium flow batteries are already here and are being installed for energy storage ›

There are multiple such plants which have been ordered and are operational. India's NTPC has also ordered such plants.

1. https://etn.news/energy-storage/h2-vanadium-flow-battery-project-spain-details
2. https://www.pv-magazine-india.com/2022/11/02/tdafoq-energy-partners-indias-delectrik-systems-for-gwh-scale-vanadium-flow-battery-plant-in-saudi-arabia/
3. https://www.energy-storage.news/nearly-140mwh-of-vanadium-flow-battery-sales-and-fundings-for-invinity-last-year/
4. https://balkangreenenergynews.com/vanadium-flow-megabattery-comes-online-in-china/
5. https://www.energy-storage.news/indias-biggest-power-producer-ntpc-tenders-for-3mwh-flow-battery-at-research-facility/
6. https://solarquarter.com/2024/09/24/delectrik-systems-wins-ntpc-tender-to-deploy-3-mwh-vanadium-flow-battery-at-netra-for-long-duration-energy-storage/

The Vanadium flow battery technology is already mature ➤

Figure 10: Vanadium flow battery lifecycle cost is miniscule in comparison to Li-ion battery

Lithium-ion battery vs Vanadium Flow battery

	Lithium-ion	Vanadium flow
Service life	5-15 years – far shorter than generating assets	25 years or more – matches generating assets
Raw materials supply	Global **lithium battery production required for EV** transition	No conflict minerals; vanadium more abundant than copper
Safety	**Increasing awareness of fire risk** due to real-world incidents	**No fire risk**
No. of cycles	**‹ 250 per year**	**Unlimited**
Length of cycle	**‹ 4 hours**	**4-12 hours**

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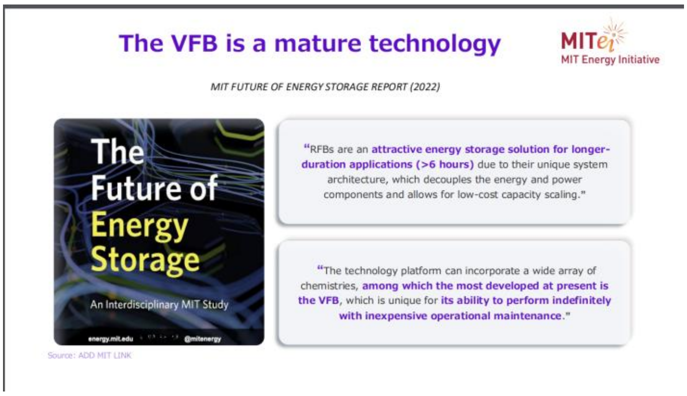
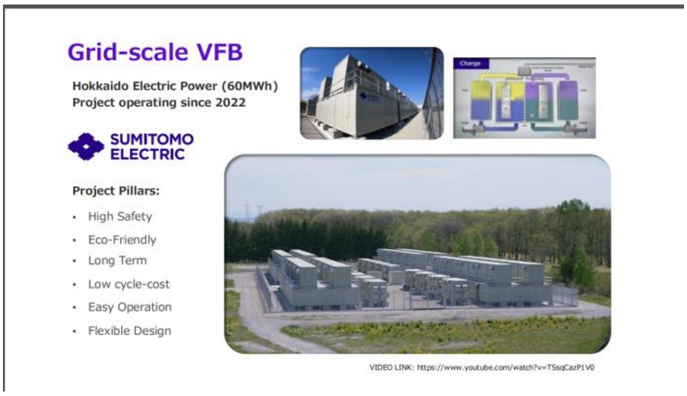
SOURCES: INCRED RESEARCH, HTTPS://S203.Q4CDN.COM/650773386/FILES/DOC_PRESENTATIONS/2024/AUG/13/VRB_PRESENTATION_AUG13.PDF

Figure 11: MIT acknowledges that VFB is mature technology



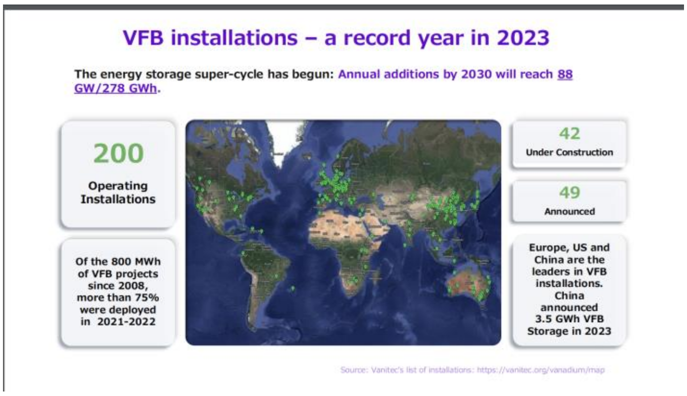
SOURCES: INCRED RESEARCH, HTTPS://S203.Q4CDN.COM/650773386/FILES/DOC_PRESENTATIONS/2024/AUG/13/VRB_PRESENTATION_AUG13.PDF

Figure 12: For grid-scale installation, VFB is the only solution



SOURCE: INCRED RESEARCH, HTTPS://S203.Q4CDN.COM/650773386/FILES/DOC_PRESENTATIONS/2024/AUG/13/VRB_PRESENTATION_AUG13.PDF

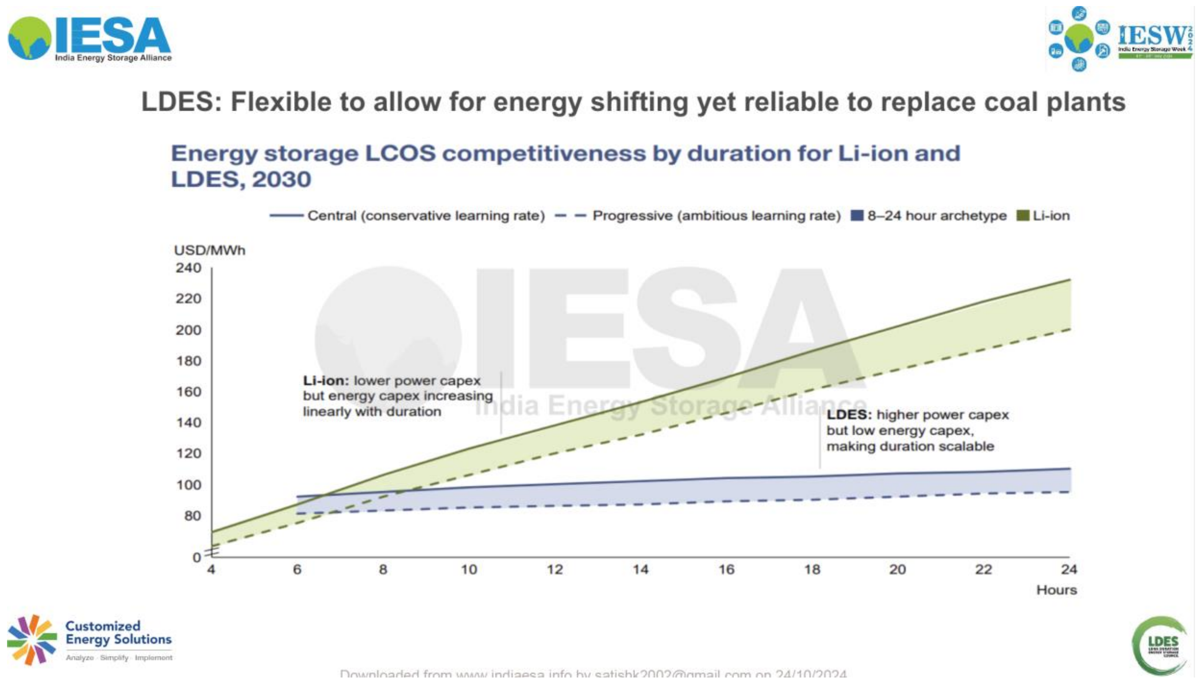
Figure 13: VFB installations are progressing rapidly



SOURCE: INCRED RESEARCH, HTTPS://S203.Q4CDN.COM/650773386/FILES/DOC_PRESENTATIONS/2024/AUG/13/VRB_PRESENTATION_AUG13.PDF

The lifecycle costs of vanadium flow batteries are miniscule compared to Li-ion batteries ➤

Figure 14: For long-duration storage, Li-io batteries are prohibitively costly while VFB batteries are much cheaper



SOURCE: COMPANY REPORTS, INCRED RESEARCH

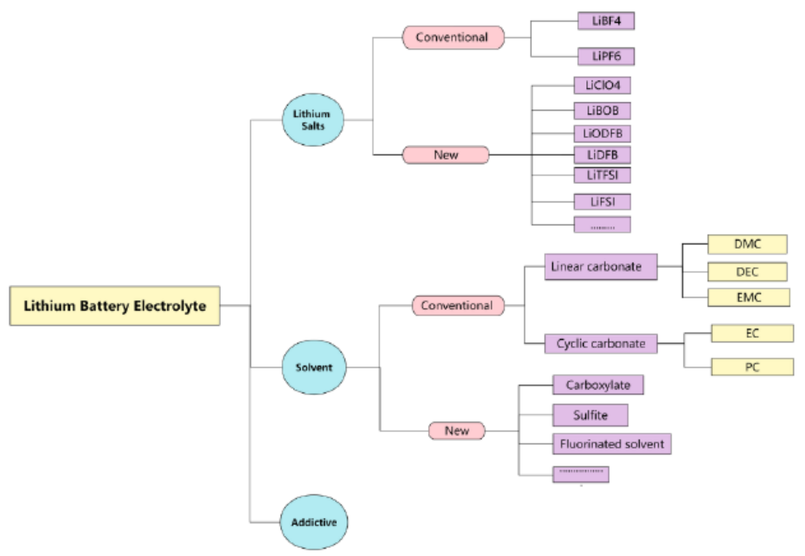
Electrolytes and solvents of lithium-ion batteries, there are much better salts than LiPF6

There are seven kinds of lithium salts which are listed below:

1) LiBF4 - lithium tetrafluoroborate
2) LiPF6 - lithium hexafluoro phosphate
3) LiClO4 - lithium perchlorate
4) LiBOB - lithium bis(oxalato)borate
5) LiODFB - lithium difluoro(oxalato)borate
6) LiDFB - lithium difluoro(oxalate)borate. LiDFB, also known as lithium difluoro(oxalato)borate, is the same compound as LiODFB (lithium difluoro(oxalate)borate). They both have the same chemical formula, Li (ODFB), and share the same properties and applications. The difference in notation (DFB vs. ODFB) likely arises from different ways of representing the same chemical structure.
7) LiFSi-: lithium bis(fluorosulfonyl)imide.

Out of these, LiPF6 is the most widely used salt commercially. BYD's Blade Battery also uses LiPF6 as an electrolyte**.** LiPF6 stands for lithium hexafluorophosphate, made up of a lithium cation and hexafluorophosphate anion. It accounts for 43% of the total electrolyte cost and is manufactured by reacting phosphorus pentachloride with hydrogen fluoride and lithium fluoride. In comparison to the older electrolyte salts like LiBF4, LiAsF6 and LiClO4, LiPF6 has a better performance with respect to solubility, conductivity, safety, and environmental friendliness in organic solvents. Hence, it became widely popular among battery electrolytes, even though some of the newer salts like LiFSi have better properties.

Figure 15: Different lithium salts used as an electrolyte



SOURCE: INCRED RESEARCH, COMPANY REPORTS

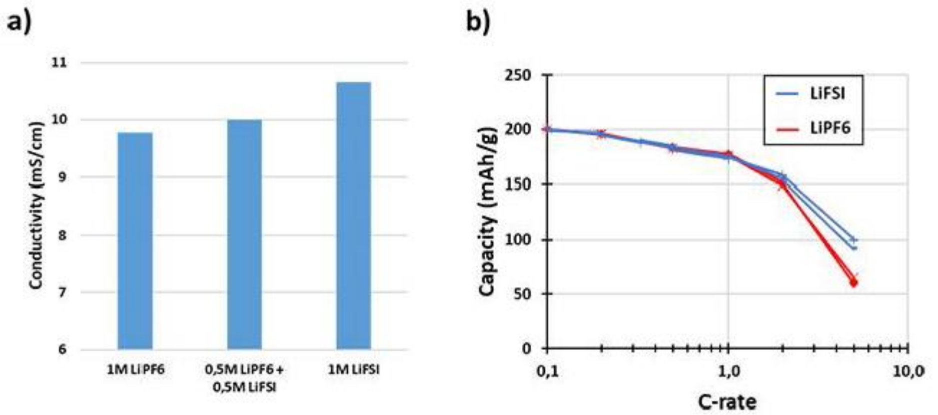
Electrolytes for lithium-ion batteries: LiFSi vs. LiPF6 - LiFSi is a better salt but the world is still taking baby steps in its adoption ➤

1. LiPF6 still dominates the market because standardized processes exist for it, enabling the refinement of the manufacturing process, thus lowering the cost. However, the trend is likely to change in the future.
2. Currently, the global demand for LiPF6 stands at 67kt and Chinese capacity now is 2x of this, with another 100kt capacity in the pipeline.
3. Meanwhile, a new contender for LiPF6 is around the block: lithium bis(fluorosulfonyl)imide (LiFSI).

4. LiPF6 has limitations such as poor performance in both low & high temperatures, a harsh preparation process, and inadequate thermal stability.
5. LiFSI has the potential to address most of these bottlenecks, not just due to its better physical & chemical properties but also due to the continuous investments from Chinese companies in its research & development.
6. Currently, LiFSI is mainly used in small quantity as an electrolyte additive mixed with LiPF6.
7. Several major Chinese players are investing in new supply of LiFSI besides LiPF6 plants. The primary hindrance to widespread adoption of LiFSI is its high application cost.
8. The price disparity between the two is gradually narrowing. Notably, EV giant Tesla is already deploying LiFSI salt into its 4680 batteries. Companies like Contemporary Amperex Technology (CATL), Panasonic, and LG Chem are actively involved in the production of these batteries, having inked sourcing agreements with domestic LiFSI manufacturers in China.
9. LiPF6 decomposes easily in heat, has hydrolysis resistance, and crystalizes easily at low temperatures.
10. LiPF6 electrolyte's performance is not optimal at high and low temperatures, and humidity because it is unstable and sensitive to humidity and temperature. It is susceptible to decomposition when the temperature and humidity are high. Hydrogen fluoride is produced under these conditions, and it severely affects battery life.
11. LiPF6 also crystalizes under low temperature, thereby decreasing the electrical conductivity of the electrolyte.
12. As a result, LiFSI could potentially be the answer. It is a hydrophyphic lithium salt that is used to make electrolytes for lithium-ion batteries as a safer alternative to the conventionally used LiPF6. It is made up of one li cation and a bistriflimide anion. The fluorine atom in LiFSi has strong electron absorption ability, because of which it has high conductivity. FSI- anion in LiFSi has better hydrolysis resistance. LiFSi has a lower crystallization point than LiPF6 and hence, it is more stable at lower temperatures.

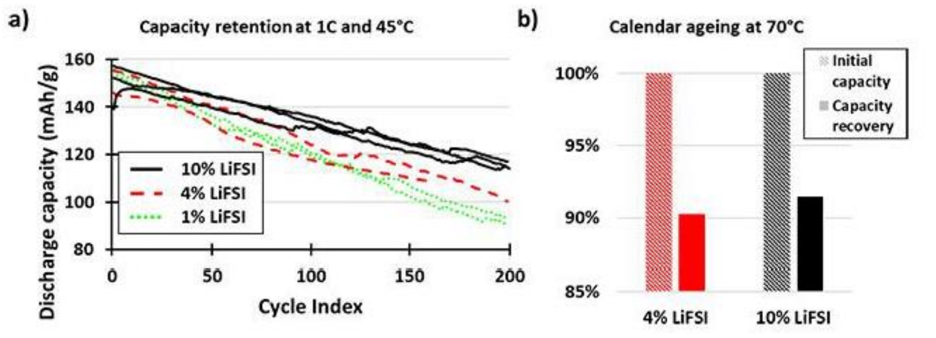
Overall, in comparison to LiPF6, LiFSi has the plus side of better thermal stability, strong hydrolysis resistance, and high conductivity. Owing to its superior properties, LiFSi can significantly improve a battery's life, its range, and charge & discharge power in the summer and winter seasons. Due to these reasons, it is expected to become the next-generation mainstream lithium salt. China is rapidly expanding its LiFSi capacity. A lot of downstream players like LG, Tesla, Volkswagen, etc. are beginning to use LiFSi. Even though LiPF6 dominates the market now, with the mass production of 4680 batteries and Qilin batteries, the trend is likely to change.

Figure 16: a) LiFSI batteries have improved fast charging and high-power delivery; b) batteries with LiFSI have higher capacity compared to LiPF6



SOURCE: INCRED RESEARCH, COMPANY REPORTS

Figure 17: Capacity retention of NMC532/graphite cells cycled at 1C (charge & discharge) at 45°C; b) initial capacity and capacity recovery at C/10 after two weeks of calendar ageing at 100% SOC at 70°C



SOURCE: INCRED RESEARCH, COMPANY REPORTS

LiPF6 venture may not be able to recover even the cost of debt ➤

1. Multiple Indian companies are incurring capex to make LiPF6 electrolyte and its additive, cinylene carbonate. They hope that India will become a big powerhouse of lithium-ion battery manufacturing and hence, there will be huge demand for electrolytes.
2. GFL is incurring a capex of Rs10bn to make LiPF6 while Neogen Chemicals has also committed capex for the same. Even a small company like Ami Organics is incurring a capex of Rs2bn to make vinylene carbonate (an additive for LiPF6). Please note that current global demand for LiPF6 is ~67,000t against which the top 10 Chinese companies' capacity alone is 1,00,000t and 1,50,000t capacity is in the pipeline.
3. As of now, the spreads of $LiPF_6$ over the raw material is -Rs100/kg. Normally, 12 units of electricity are needed to make 1kg of $LiPF_6$, which means that present EBITDA/kg will be nearly -Rs300 or an **overall EBITDA loss for a 1,800t plant will be ~Rs540m**. Given the capex of Rs10bn for a 1,800t plant, at present even the interest costs (assuming 2:1 debt-equity ratio) won't be recovered.
4. Assuming the last 36 months' average spread EBITDA/kg is around Rs500 (removing the abnormally high spreads of the post-Covid supply chain crisis period between Sep 2021 to Mar 2022), EBITDA for a 1,800t plant should be ~Rs900m. Adjusting for working capital requirement and necessary sustenance capex, it will be barely sufficient to recover 9-10% interest costs on debt taken for capex.

LiPF6 is the most hyped electrolyte in Indian equity markets ➤

Investors are assigning a premium valuation to any company that makes $LiPF_6$ (none are making it on a commercial scale though) or has an intention to make it or in the process of installing a pilot plant. Contrary to market hype, 1) $LiPF_6$ is being replaced by a better electrolyte known as LiFSi, 2) $LiPF_6$ margins have collapsed, is hugely oversupplied and, in fact, the current and upcoming capacity in China alone can keep the product oversupplied beyond 2030F, and 3) the slew of $LiPF_6$ manufacturing capacities and little investment in Li (lithium) mining have resulted in skyrocketing lithium carbonate (LiC) prices. $LiPF_6$ margins have collapsed by 75% in the last six months and are expected to decline further in the coming months. Even $LiPF_6$ prices have collapsed by 60%. In this context, we are unable to understand as to why investors are assigning a premium valuation to Indian companies who have no indigenous source of LiC and are coming into oversupplied $LiPF_6$.

Leading electric vehicle or EV makers are replacing $LiPF_6$ with LiFSi

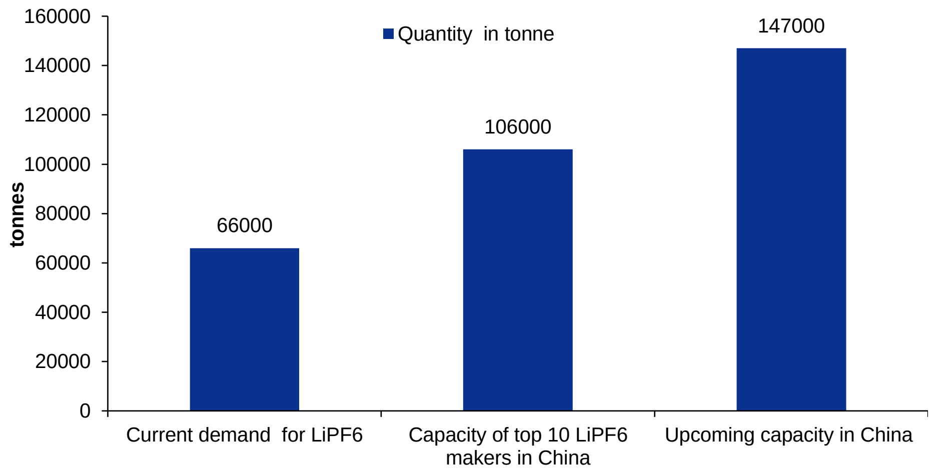
The trend is quite certain that LiFSi is becoming one of the mainstream lithium salts for the next-generation electrolytes. However, it is also true that due to severe technical problems in mass production and high costs, LiFSi has not been directly used as a solute lithium salt but as an additive mixed with lithium hexafluorophosphate ($LiPF_6$) for use in electrolytes of lithium-ion-powered batteries especially. To cite an example, LG Chem has been using LiFSi as an additive in its electrolytes for quite some time. Tesla's '4680' battery has commenced mass production, and the upgrade of the new battery technology has enabled LiFSi to be rapidly introduced into the industry chain.

Indian companies' foray into LiPF6 and its additives is ill-timed

We can say that Indian companies' foray into LiPF6 and its additives is ill-timed. Gujarat Fluorochemicals as well as Neogen Chemicals are talking about putting up commercial plants of LiPF6, and Ami Organics is venturing into LiPF6 additives (vinylene carbonate or VC, and fluoroethylene carbonate or FEC). As we have stated in our report, VC prices have fallen by 80% over the last eight months and a greater decline is on the cards till they reach the production cost of US$4/kg (current price of VC is US$12/kg). We retain our REDUCE rating on Gujarat Fluorochemicals. Ami Organics & Neogen Chemicals are UNRATED stocks.

LiPF6 is hugely oversupplied in global market

Figure 18: $LiPF_6$ is hugely oversupplied, and it is being substituted by LiFSi



SOURCE: INCRED RESEARCH, COMPANY REPORTS

What is the use of solvent in batteries? Solvents play a critical role in the electrochemistry of electrolytes

1. Solvents are used in batteries to dissolve lithium salt and other active materials. They also provide a medium for ion transport and can affect the diffusion coefficient of lithium ions and the dissociation of lithium salts. Small solvent molecules can enable a previously unknown ion-transport mechanism in battery electrolytes. This can speed up charging and increase the performance at low temperatures.
2. The choice of solvent and salt is the main descriptor of the electrolyte in lithium-ion batteries (LIBs). Different solvents and salts can have varying effects on the performance of LIBs. For example, the use of isoxazole as the main solvent in the electrolyte has been found to significantly increase the ionic conductivity at low temperatures.

Some commonly used solvents include: 1)N-methyl-2-pyrrolidone, 2) dimethyl carbonate , and 3) ethylene carbonate

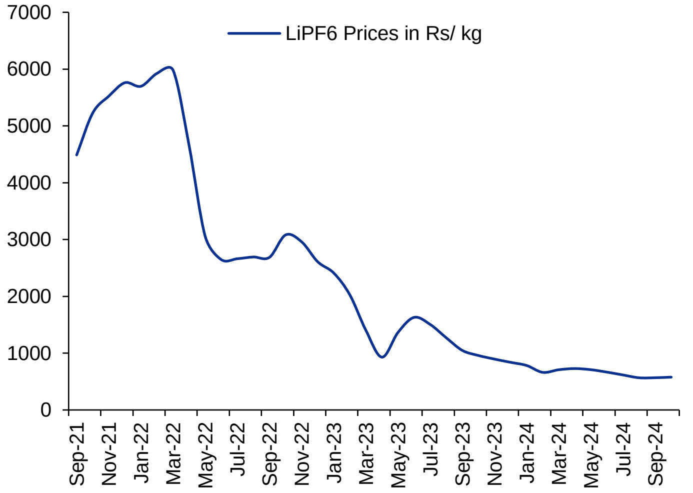
Solvent mixtures are used because a high relative permittivity and low viscosity commonly cannot be integrated into a single molecule

Is making ethylene carbonate, N-methyl-2-pyrrolidone or dimethyl carbonate a specialized skill which cannot be mastered by all? The answer is an emphatic NO

All these chemicals are manufactured by multiple companies in India. For example- N-methyl-2-pyrrolidone is exported by at least 150 different companies from India. Ethylene carbonate and dimethyl carbonate are simple chemicals.

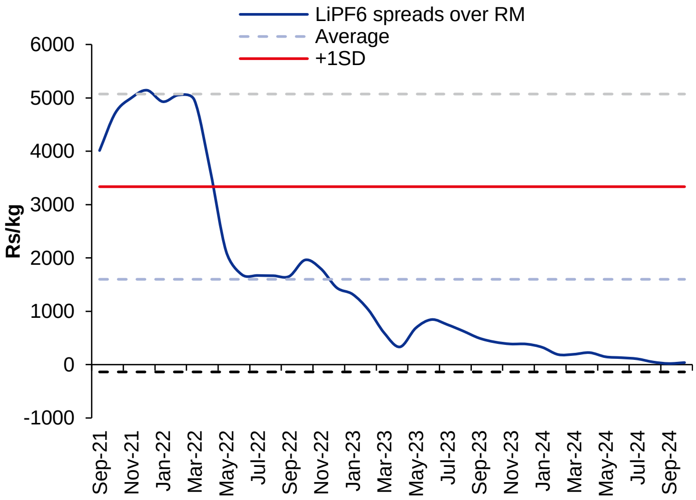
Is $LiPF_6$ making money now? No, it will be EBITDA negative

Figure 19: Prices of $LiPF_6$ have collapsed by ~90%...



SOURCE: COMPANY REPORTS, INCRED RESEARCH

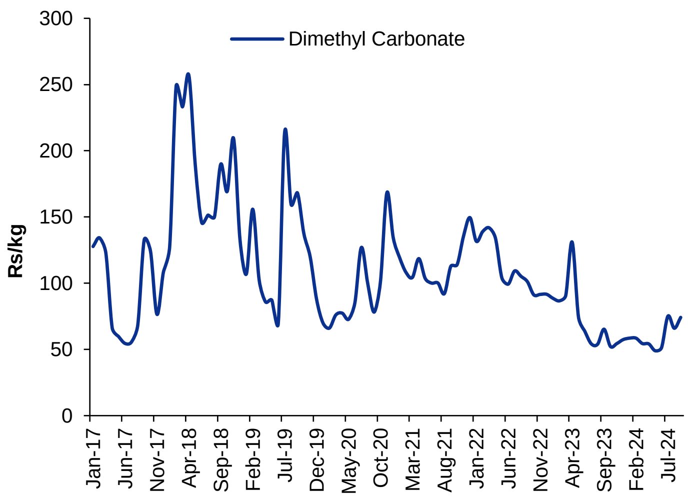
Figure 20: …and even gross spread is zero



SOURCE: COMPANY REPORTS, INCRED RESEARCH

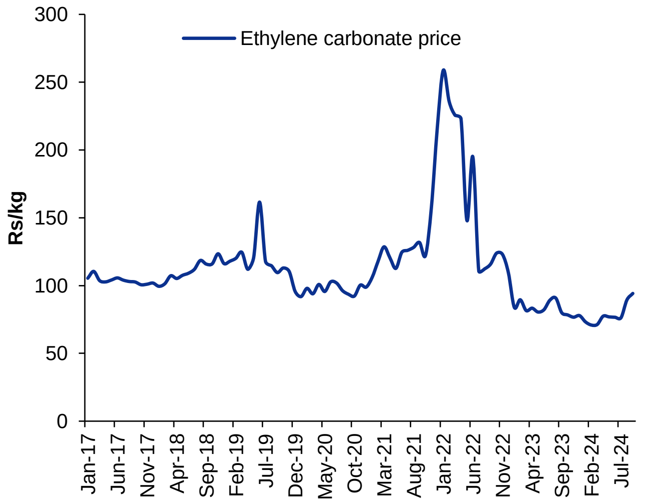
What about the prices of solvents? They too are falling rapidly

Figure 21: Carbonated dimethyl prices have recovered a bit



SOURCE: INCRED RESEARCH, COMPANY REPORTS

Figure 22: Ethylene carbonate prices have fallen below their all-time low



SOURCE: INCRED RESEARCH, COMPANY REPORTS

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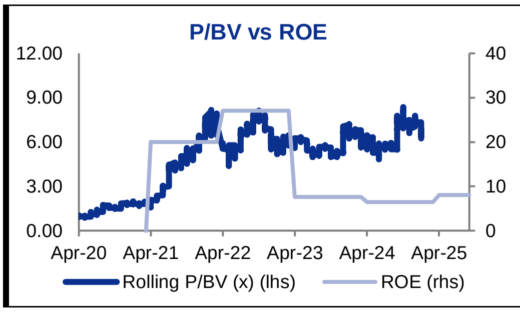

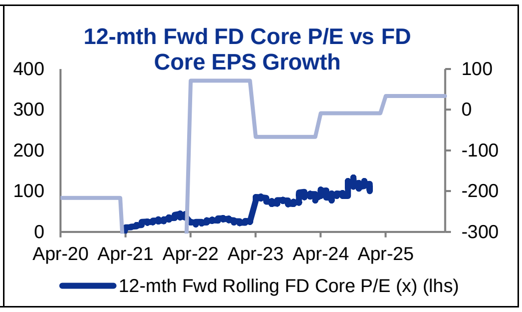

Profit & Loss

(Rs mn)	Mar-22A	Mar-23A	Mar-24F	Mar-25F	Mar-26F
Total Net Revenues	**39,536**	**56,847**	**42,808**	**44,531**	**49,944**
Gross Profit	**27,665**	**41,423**	**28,602**	**27,609**	**30,965**
Operating EBITDA	**11,976**	**20,472**	**9,548**	**9,638**	**11,974**
Depreciation And Amortisation	(2,054)	(2,361)	(2,861)	(3,413)	(3,966)
Operating EBIT	**9,922**	**18,111**	**6,687**	**6,225**	**8,008**
Financial Income/(Expense)	(784)	(1,168)	(1,331)	(1,529)	(1,529)
Pretax Income/(Loss) from Assoc.					
Non-Operating Income/(Expense)	1,314	904	595	595	595
Profit Before Tax (pre-EI)	**10,452**	**17,848**	**5,951**	**5,291**	**7,075**
Exceptional Items					
Pre-tax Profit	**10,452**	**17,848**	**5,951**	**5,291**	**7,075**
Taxation	(2,704)	(4,617)	(1,601)	(1,333)	(1,783)
Exceptional Income - post-tax					
Profit After Tax	**7,748**	**13,231**	**4,350**	**3,958**	**5,292**
Minority Interests					
Preferred Dividends					
FX Gain/(Loss) - post tax					
Other Adjustments - post-tax					
Net Profit	**7,748**	**13,231**	**4,350**	**3,958**	**5,292**
Recurring Net Profit	7,748	13,231	4,350	3,958	5,292
Fully Diluted Recurring Net Profit	**7,748**	**13,231**	**4,350**	**3,958**	**5,292**

Cash Flow

(Rs mn)	Mar-22A	Mar-23A	Mar-24F	Mar-25F	Mar-26F
EBITDA	11,976	20,472	9,548	9,638	11,974
Cash Flow from Invt. & Assoc.					
Change In Working Capital	(2,544)	(8,827)	(1,440)	7,733	(1,366)
(Incr)/Decr in Total Provisions					
Other Non-Cash (Income)/Expense	1,680	4,156	1,111		
Other Operating Cashflow	(595)	(2,545)	325	1,191	1,191
Net Interest (Paid)/Received	(784)	(1,168)	(1,331)	(1,529)	(1,529)
Tax Paid	(2,320)	(4,700)	(1,949)	(1,333)	(1,783)
Cashflow From Operations	**7,414**	**7,389**	**6,264**	**15,700**	**8,487**
Capex	(6,740)	(6,750)	(9,556)	(10,913)	(10,913)
Disposals Of FAs/subsidiaries	248	49	146		
Acq. Of Subsidiaries/investments	933	191	2		
Other Investing Cashflow	(279)	1,745	(256)		
Cash Flow From Investing	**(5,839)**	**(4,764)**	**(9,665)**	**(10,912)**	**(10,912)**
Debt Raised/(repaid)	(573)	(866)	5,101		
Proceeds From Issue Of Shares					
Shares Repurchased					
Dividends Paid		(439)	(220)		
Preferred Dividends					
Other Financing Cashflow	(862)	(1,336)	(1,406)	(595)	(595)
Cash Flow From Financing	**(1,435)**	**(2,641)**	**3,476**	**(595)**	**(595)**
Total Cash Generated	140	(16)	75	4,192	(3,021)
Free Cashflow To Equity	**1,002**	**1,760**	**1,700**	**4,787**	**(2,425)**
Free Cashflow To Firm	**2,359**	**3,793**	**(2,070)**	**6,317**	**(896)**

SOURCE: INCRED RESEARCH, COMPANY REPORTS

BY THE NUMBERS…cont'd

Balance Sheet

(Rs mn)	Mar-22A	Mar-23A	Mar-24F	Mar-25F	Mar-26F
Total Cash And Equivalents	1,718	1,612	1,985	6,177	3,156
Total Debtors	7,781	11,068	8,446	8,786	9,854
Inventories	9,473	14,854	15,713	18,717	20,992
Total Other Current Assets	5,410	8,469	7,892	7,892	7,892
Total Current Assets	**24,381**	**36,003**	**34,036**	**41,571**	**41,894**
Fixed Assets	31,738	41,051	51,458	58,957	65,904
Total Investments	73	42	42	42	42
Intangible Assets	133	314	511	511	511
Total Other Non-Current Assets	12,456	6,304	6,295	6,295	6,295
Total Non-current Assets	**44,399**	**47,711**	**58,305**	**65,804**	**72,751**
Short-term Debt	11,173	12,950	16,227	16,227	16,227
Current Portion of Long-Term Debt					
Total Creditors	5,135	6,910	5,189	16,266	18,243
Other Current Liabilities	2,756	3,529	3,612	3,612	3,612
Total Current Liabilities	**19,064**	**23,389**	**25,028**	**36,105**	**38,082**
Total Long-term Debt	4,354	1,832	3,731	3,731	3,731
Hybrid Debt - Debt Component					
Total Other Non-Current Liabilities	136	477	1,443	1,443	1,443
Total Non-current Liabilities	**4,490**	**2,309**	**5,174**	**5,174**	**5,174**
Total Provisions	2,924	2,808	2,776	2,776	2,776
Total Liabilities	**26,478**	**28,507**	**32,977**	**44,054**	**46,031**
Shareholders Equity	42,551	55,207	59,363	63,321	68,613
Minority Interests	(248)				
Total Equity	**42,303**	**55,207**	**59,363**	**63,321**	**68,613**

Key Ratios

	Mar-22A	Mar-23A	Mar-24F	Mar-25F	Mar-26F
Revenue Growth	49.2%	43.8%	(24.7%)	4.0%	12.2%
Operating EBITDA Growth	78.0%	70.9%	(53.4%)	1.0%	24.2%
Operating EBITDA Margin	30.3%	36.0%	22.3%	21.6%	24.0%
Net Cash Per Share (Rs)	(125.71)	(119.90)	(163.62)	(125.45)	(152.95)
BVPS (Rs)	387.36	502.57	540.40	576.43	624.61
Gross Interest Cover	12.65	15.51	5.02	4.07	5.24
Effective Tax Rate	25.9%	25.9%	26.9%	25.2%	25.2%
Net Dividend Payout Ratio					
Accounts Receivables Days	66.71	60.51	83.19	70.62	68.11
Inventory Days	278.44	287.83	392.68	371.33	381.84
Accounts Payables Days	131.00	142.52	155.43	231.39	331.83
ROIC (%)	14.5%	22.7%	6.8%	5.7%	7.4%
ROCE (%)	17.7%	27.3%	8.7%	7.4%	9.0%
Return On Average Assets	13.0%	18.5%	6.0%	5.1%	5.8%

SOURCE: INCRED RESEARCH, COMPANY REPORTS

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Recommendation Framework

Stock Ratings	Definition:
Add	The stock's total return is expected to exceed 10% over the next 12 months.
Hold	The stock's total return is expected to be between 0% and positive 10% over the next 12 months.
Reduce	The stock's total return is expected to fall below 0% or more over the next 12 months.

The total expected return of a stock is defined as the sum of the: (i) percentage difference between the target price and the current price and (ii) the forward net dividend yields of the stock. Stock price targets have an investment horizon of 12 months.

Sector Ratings	Definition:
Overweight	An Overweight rating means stocks in the sector have, on a market cap-weighted basis, a positive absolute recommendation.
Neutral	A Neutral rating means stocks in the sector have, on a market cap-weighted basis, a neutral absolute recommendation.
Underweight	An Underweight rating means stocks in the sector have, on a market cap-weighted basis, a negative absolute recommendation.

Country Ratings	Definition:
Overweight	An Overweight rating means investors should be positioned with an above-market weight in this country relative to benchmark.
Neutral	A Neutral rating means investors should be positioned with a neutral weight in this country relative to benchmark.
Underweight	An Underweight rating means investors should be positioned with a below-market weight in this country relative to benchmark.w