

INDIAN SUGAR SECTOR

Ethanol: Unveiling the economies

SEPTEMBER 2022





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Government's focus towards ethanol blended petrol (EBP20) along with favourable policies and its multiple benefit have enthused large sugar mills to step up their distillery capacities (1G).

Additionally, while private entrepreneurs are also investing in grain-based distilleries (1G), OMCs are investing in 2G/3G ethanol space, though at ~6 times higher capex compared to 1G investments.



Ethanol blending targets and requirements – Ethanol requirement is projected at 988 crore litre for blending by ESY 2025, over three times higher than ESY 2021 levels with sugar and grains contributing almost equally to the requirements. For achieving the same, capacity ramp-up of grain-based distilleries along with adequacy of raw material remains a key monitorable even as sugar mills are gearing up to address the needs adequately. Further, in light of the Government's ambitious targets as well as preponement of achieving 20% blending target by 2025 (previously 2030), various players including sugar mills have announced their capex plans.



ESY 2022 target achieved – India achieved the target of 10% ethanol blending ahead of schedule in June 2022. Currently, average ethanol blending as on August 28, 2022 stood at 10.04% (13 bps lower than July 2022 levels) with 14 states pegged higher than the national average. Further, in YTD ESY 2023, the OMCs have lifted the ethanol quantity more than the full-year quantity of ESY2022. In terms of feedstock-based sourcing, syrup and B heavy molasses lead the sourcing mix, with share of sugar sourced ethanol at ~86% and grain based at ~14%



Multiple benefits of ethanol – Increasing ethanol blending with petrol lends multiple benefits to India at large including cutting down import bills, lower CO² emissions, controlling excess sugar supply in the economy, creating additional investment as well as job opportunities, product diversification for entrepreneurs, faster cane dues clearances, additional income stream to farmers among others.



Support from the Central as well as the state Government – Central Government is promoting ethanol in a big way through various policies including preponement of 20% ethanol blending to 2025, remunerative ethanol prices based on feedstock (de-linked to crude), interest subventions, capital subsidy to bio-refineries, offtake assurances in addition to tax benefits. Further, few states such as Bihar, UP and Assam has also announced ethanol production promotion policies providing capital subsidies.

While India achieved the target of 10% ethanol blending ahead of schedule in June 2022, attainment of ESY 2023 target of 12% blending would critically depend on timely launch and adoption of E-20 compliant vehicles besides pan-India ethanol availability and ramp-up of OMCs marketing infrastructure



Investments announcement – Given multiple benefits, many companies including sugar majors have announced/incurred huge investments in 1G ethanol space. Additionally, while Gol envisaged 12 bio-refineries to be set up by the OMCs in 2016-17, the first of these was commissioned by IOCL in August 2022, thus making a late start. However, HPCL expects its 2G distillery to commence its operations in FY2023 itself. Further, IOCL is also in the process of setting up a 3G ethanol plant at Panipat. The high capex requirement in 2G/3G distilleries could act as a barrier, thus restricting investments.



Project cost of distillery – The project cost to set up a sugar based (B-heavy molasses/syrup) as well as grain-based distillery for 1G-ethanol could be around Rs.1.3-1.6 crore per KLPD, of which 71%-76% is the cost of plant and machinery. While, compared to this, IOCL has set up its 2G ethanol plant at an investment of Rs. 9 crore per KLPD.

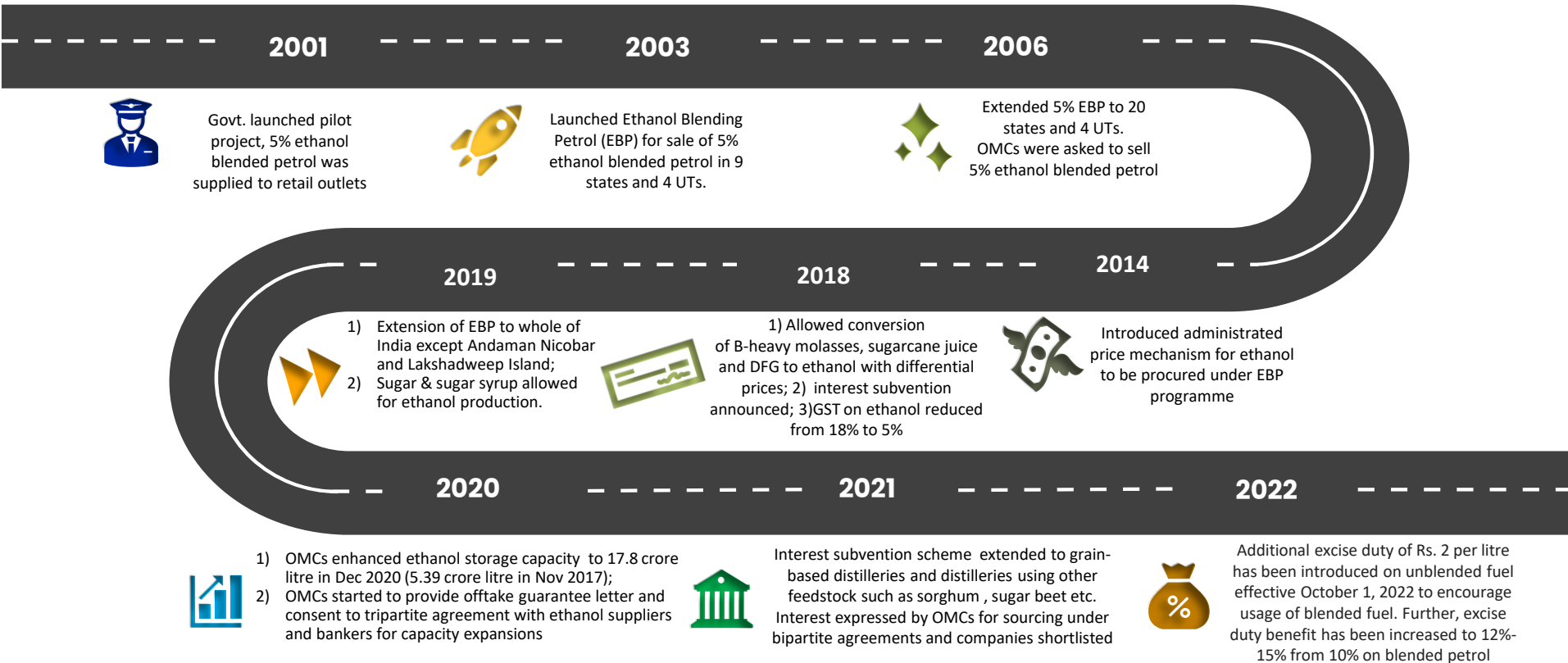


Distillery economics – A 100 KLPD grain-based distillery using broken rice as feedstock, can generate revenues of Rs. 200-210 crore at current remunerative ethanol prices as fixed by the Gol/OMCs with an operating profit margin of 16%-19%. While revenues and profitability could vary from region to region for sugar-based distilleries because of difference in agro-climatic conditions, sugar recovery rates, sugar realisations, cane cost etc., syrup-based ethanol production allows the highest revenues and profitability out of three alternatives (C-heavy molasses, B-heavy molasses and syrup) while also reducing working capital intensity for a sugar mill. Notwithstanding superior economics, syrup-based ethanol can only be produced during crushing season.



Challenges to achieve E-20 - Even as the favourable policy environment facilitates ethanol supply ramp up, few issues still remain to be addressed such as adequate ethanol capacities and feedstock availability resulting in required ethanol production, ramp up of marketing and distribution infrastructure, ensure ethanol availability pan India as well as timely launch and adoption of E-20 compliant vehicles.

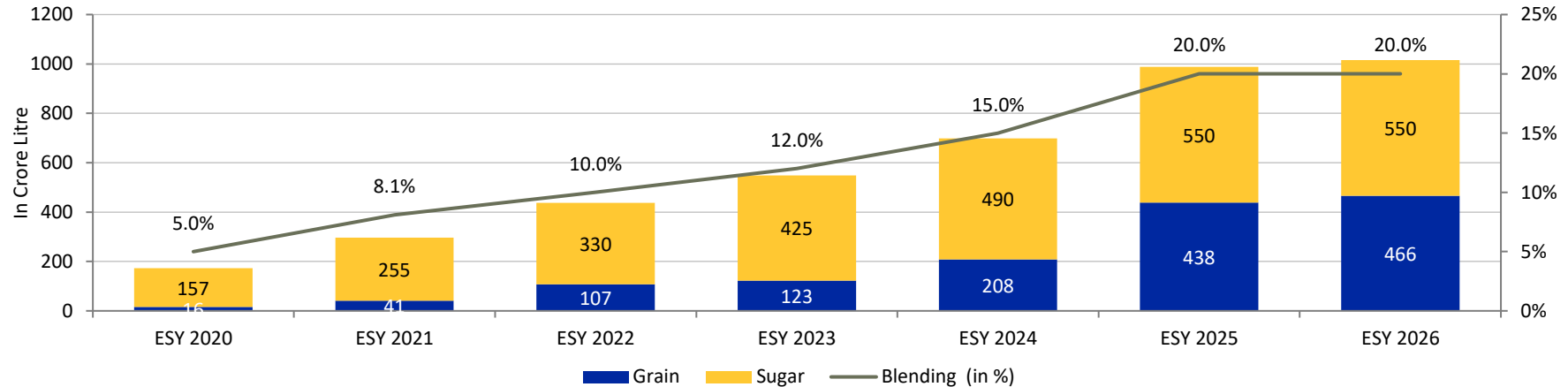
Ethanol blending programme in India – Initiatives till now



DFG: Damaged Food Grains; OMC: Oil Marketing companies

Ethanol requirement estimated at more than 3 times by ESY2025 from current levels; ramp up in grain-based needs to be steeper

Exhibit: Projected ethanol requirement (for blending only) to achieve 20% target

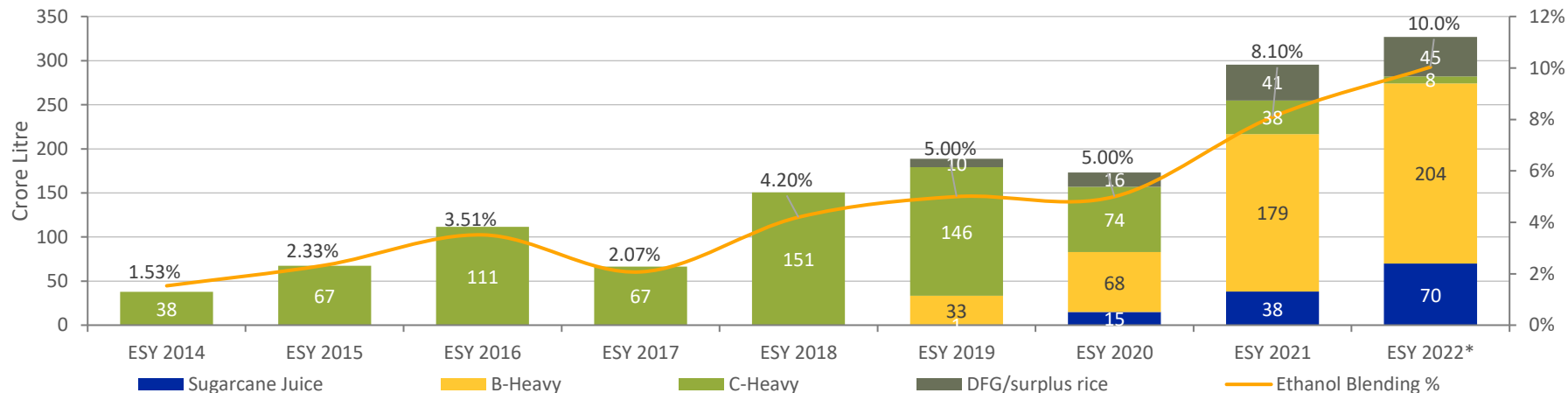


Source: Niti Ayog Report, BPCL, ISMA, ICRA Research

- Ethanol requirement is projected at 988 crore litre for blending by ESY 2025, more than three times of ESY 2021 levels with sugar and grains contributing almost equally to the requirements. For achieving the same, capacity ramp-up of grain-based distilleries along with adequacy of raw material remains a key monitorable.
- Further, in light of, government's ambitious targets as well as preponement of achieving 20% blending target by 2025 (previously 2030), various players including sugar mills have announced their capex plans

Feedstock mix evolving towards syrup/B-heavy molasses

Exhibit: Trend in ethanol blending percentage and OMCs receipt volumes (feedstock wise)

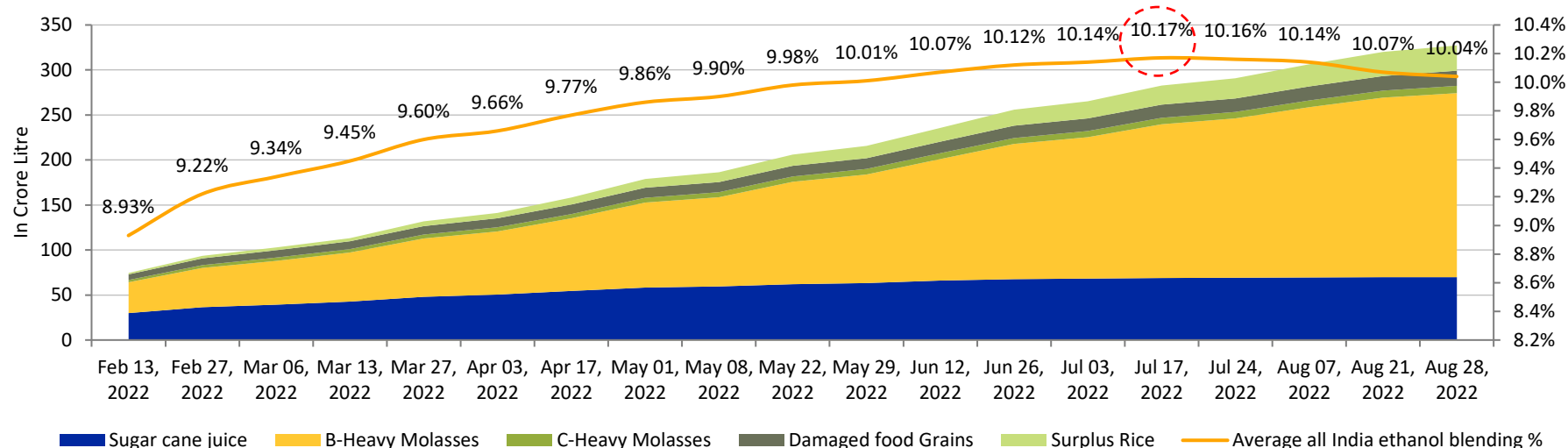


- India achieved the target of 10% ethanol blending ahead of schedule in June 2022. Currently, average ethanol blending as on August 28, 2022 stood at 10.04%, 13 bps lower than July 2022 levels (peak). While India attained ESY2022 targeted blending levels, achievement of ESY 2023 target of 12% blending would critically depend on timely launch and adoption of E-20 compliant vehicles besides pan-India ethanol availability and ramp-up of OMCs marketing infrastructure as required.
- For ESY2022 (till August 28, 2022), around 450-crore litre of ethanol has been contracted of the 452-crore-litre letter of intent (LoI) offered (i.e. almost 100% of LoI has been contracted). Considering the feedstock-wise contribution, the share of sugarcane juice and B Heavy molasses, together, stood at 78% of the contracted and 84% of the receipts during the period.
- OMCs have received ~72% of the LoI in YTD ESY 2022 compared to ~79% of LoI in ESY 2021 (full year), thus showing healthy offtakes in the current ESY.

*Till August 28, 2022; DFG: Damaged Food Grains; OMCs: Oil Marketing Companies; Source: ISMA, MoPNG, Niti Ayog, ICRA Research

Blending levels moderated in recent months; nevertheless, remained above the target

Exhibit: Feedstock wise ethanol receipt quantity by OMCs and average all India ethanol blending percentage trend



While India achieved the ethanol blending of 10.17% as on July 17, 2022, ethanol blending reduced to 10.04% as on August 28, 2022, though still remained higher than targeted levels of 10%. Decline in blending percentage reduced more than 25 bps in following states – Kerela, Gujarat, Odisha, Chhattisgarh, Punjab, Himachal Pradesh, Tamil Nadu and Rajasthan.

14 states at higher than all-India average in ethanol blending

Exhibit: Ethanol blending as on Nov 14, 2021 (All India average = 7.52%)

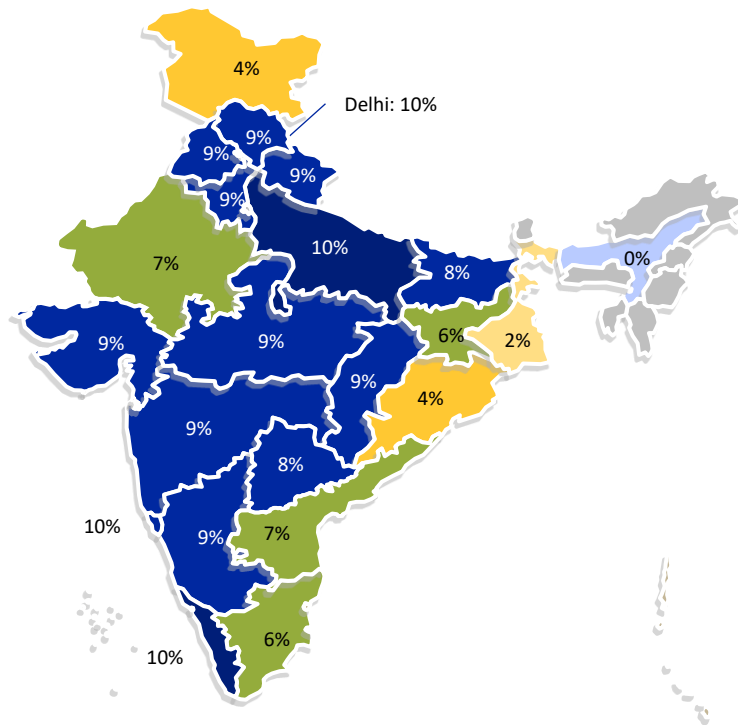
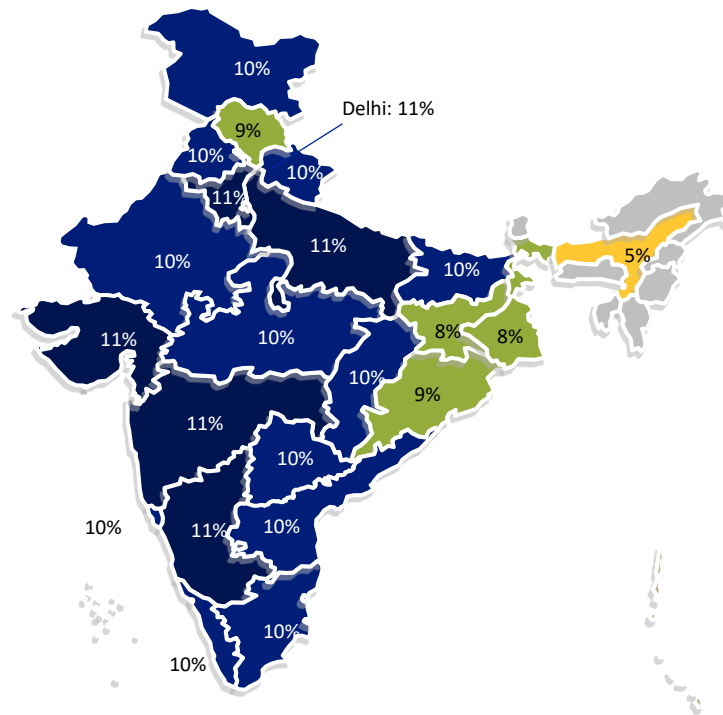


Exhibit: Ethanol blending as on August 28, 2022 (All India average = 10.04%)

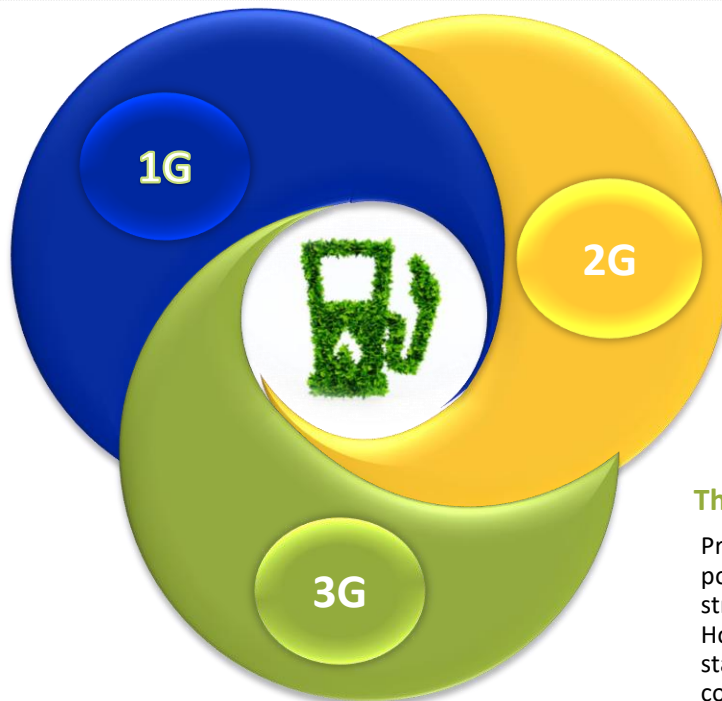


Technologies to produce ethanol; sizeable investments committed in 1G and 2G segment

While 3G ethanol has promising potential, R&D with respect to its techno- commercial viability is required, hence National policy on biofuels- 2018 aims at enhancing capacities of 1G ethanol as well as development and commercialization of 2G ethanol technologies. Currently, while private sector is investing in 1G ethanol, few PSUs have announced capex plans for 2G ethanol as well.

First Generation (1G) Ethanol

Produced from food crop containing sugar or starch through conventional methods like fermentation. As per National policy on Biofuels following feedstock can be used to produce 1G ethanol – sugar beet, sweet sorghum, corn, cassava, rotten potatoes, damaged foodgrains like wheat, broken rice and surplus food grains.



Second Generation (2G) Ethanol

Produced from non-food crop such as organic waste, food crop waste, biomass and agricultural waste which has cellulosic and lignocellulosic content. Here, the ethanol so produced is more environment-friendly.

Third Generation (3G) Ethanol

Producing ethanol from algae – has promising potential in terms of high oil content, limited waste streams and minimal land/fertilizer requirements. However, presently, 3G ethanol is at its nascent stages and need further examination with respect to commercial viability



- Ethanol blending provides sustainable solution for sugar over-supply which would also support the domestic sugar prices.
- Moreover, remunerative ethanol price announcements would enable the sugar mills to improve their profitability as well as liquidity while reducing its exposure to inherit cyclicity of the sugar industry with improved product diversification.

**Sugar
Mills**



**Cane/
Grain
Growers**



- Prompt payments from the OMCs for ethanol supplies would improve liquidity of companies and thus would allow them to clear cane dues faster than ever, especially for sugarcane growers.

Limited supply of fossil
fuel

Volatility in crude oil
prices

Stringent environmental
regulations



Blending ethanol with fuel is one of the most suitable alternative



Two-wheelers



Four-wheelers

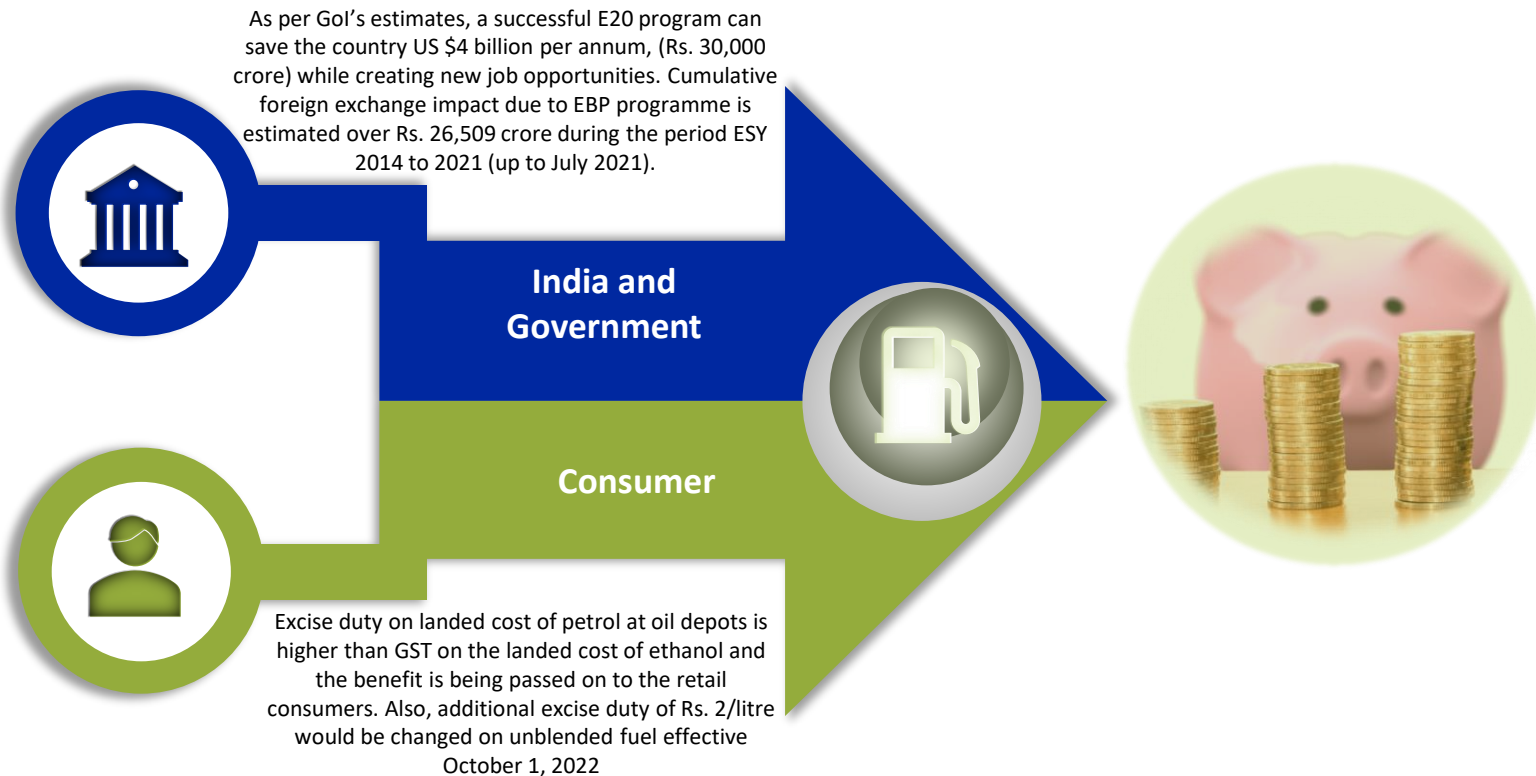
Emissions	E-10*	E-20 *	E-10*	E-20*
Carbon Monoxide	20% lower	50% lower	20% lower	30% lower
Hydrocarbons	20% lower	20% lower	20% lower	20% lower
Oxides of Nitrogen	No significant trend	10% higher	No significant trend	Similar

*E-10: 90% Petrol + 10% Ethanol; E-20: 80% Petrol + 20% Ethanol; Source: Niti Ayog Report (June 2021); Comparisons are done considering gasoline emissions as baseline

CO₂

One crore litre of ethanol blended petrol can save around 20,000 tonne of carbon-dioxide (CO₂) emission. Greenhouse gas emissions due to the EBP Programme lowered by 192 lakh tonne from 2014 to 2021 (up to July 2021).

Ethanol to reduce bills for the country as well as consumers



Source: Niti Ayog Report, (June 2021), MoPNG Report (July 2021)



2G ethanol plants would create an end-use for the agri-crop residue



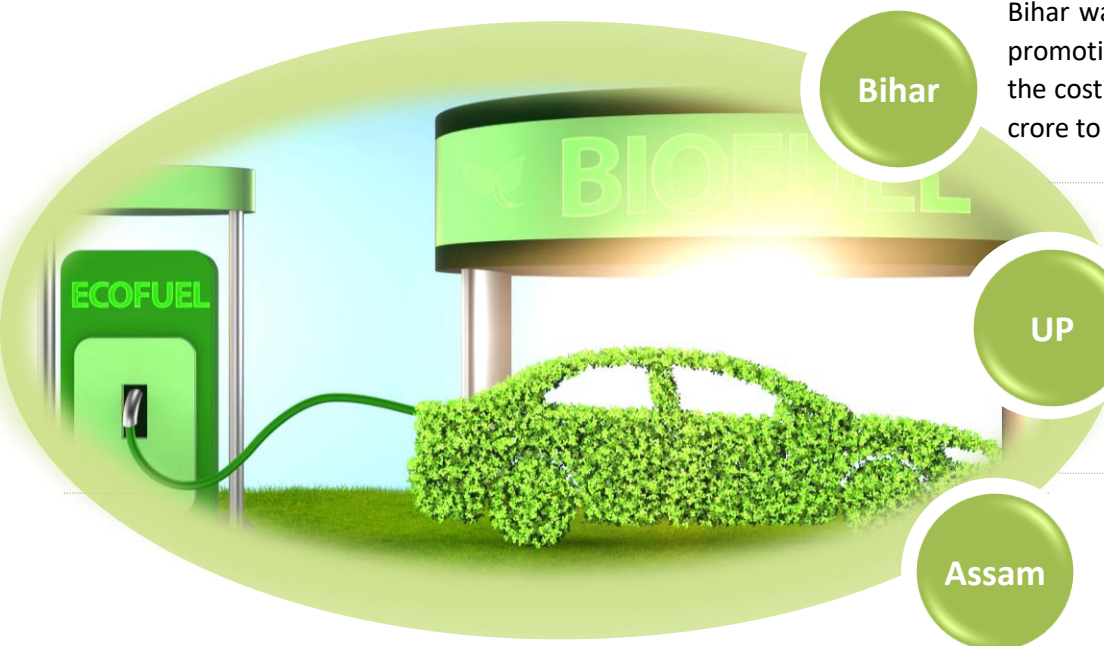
Additional income stream for farmers by selling of stubble at bio-fuel plants



Reduction of air-pollution by reducing burning of the agri-waste

Select states have announced specific policies to promote ethanol production

Exhibit: State wise ethanol production promotion policies in addition to state industrial investment policy



Bihar

Bihar was the first state to announce ethanol production promotion policies. Additional capital subsidy at 15% of the cost of plant and machinery up to a maximum of Rs. 5 crore to new standalone ethanol manufacturing units.

UP

Capital subsidy@ 25% for units investing up to Rs. 10 crore, @20% for units investing Rs. 10 – 100 crore and case to case incentives for units investing more than Rs. 100 crore of 15% for project cost or Rs. 150 crore whichever is lesser.

Assam

Capital subsidy at 20% of the cost of plant and machinery, with maximum INR 5 crore + 5% interest subsidy on working capital loan for 5 years subject to an overall ceiling of Rs. 50 lakh per annum

Source: The above stated policies are only representative and not exhaustive

Maharashtra leads the ethanol capacity creation through sugar feedstock route, followed by UP

Exhibit: Estimated state-wise molasses-based ethanol capacity (in KLPD) as on September 30, 2021

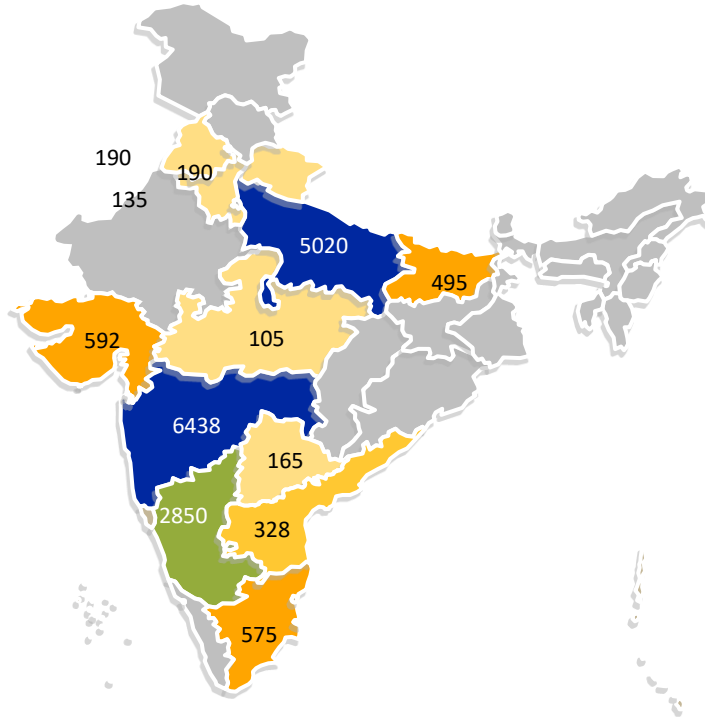
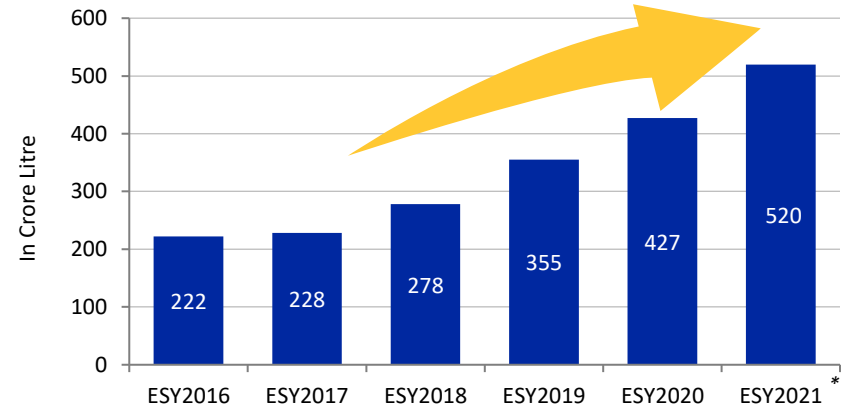


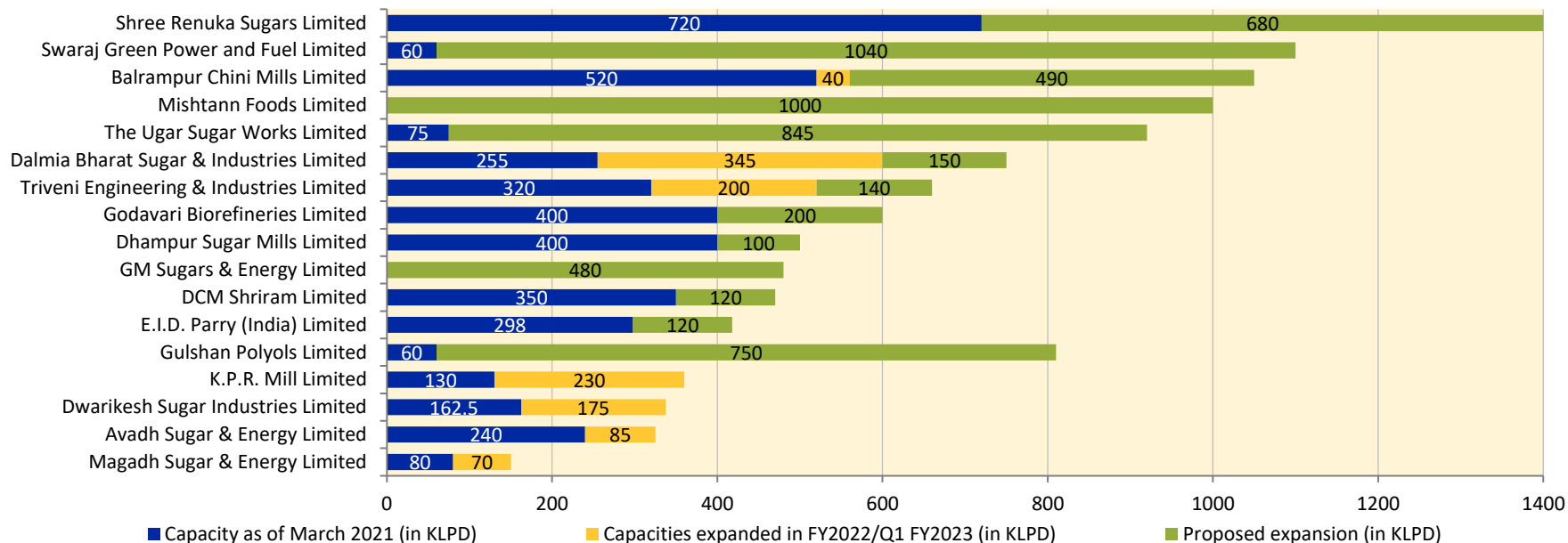
Exhibit: Ethanol Capacities (molasses based)



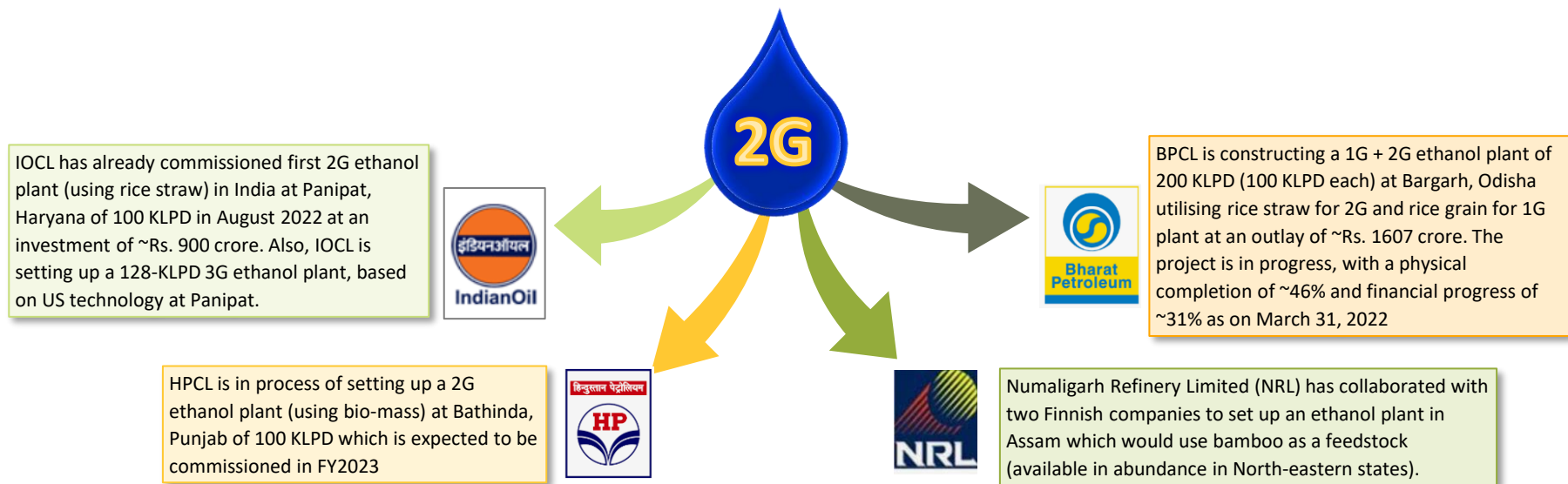
Source: ISMA, ICRA Research, * As on September 30, 2021

Government's focus towards Ethanol Blended Petrol (EBP20) along with favourable policies and its multiple benefits have enthused large sugar mills to step up their distillery capacities.

Distillery capacity expansion plans announced in 1G space



Preonement on blending target of 20% from 2030 to 2025, enabling financing, assured offtake (bipartite/ tripartite schemes of OMCs), favourable working capital cycle benefits for sugar and grain-based distilleries are triggering sizeable investments.



Public Sector OMCs, under the administrative control of MoPNG, are in the process of setting up 12, 2G bio-refineries with an investment of Rs.14,000 crore. To encourage the same, Govt has launched a scheme, namely 'Pradhan Mantri JI-VAN Yojana' for providing financial support to integrated bio-ethanol projects. The total financial outlay for the scheme is Rs. 1,969.50 crore during 2018-19 to 2023-24. Financial assistance of Rs. 150 crore each to the abovesaid four 2G bio-ethanol projects and Rs. 15 crore to one demonstration project at Panipat has been approved under the scheme. These projects are in advanced stage of construction and are expected to be commissioned from 2022-23. So far, Rs. 151.50 crore has been released based on the milestones achieved as per the scheme.

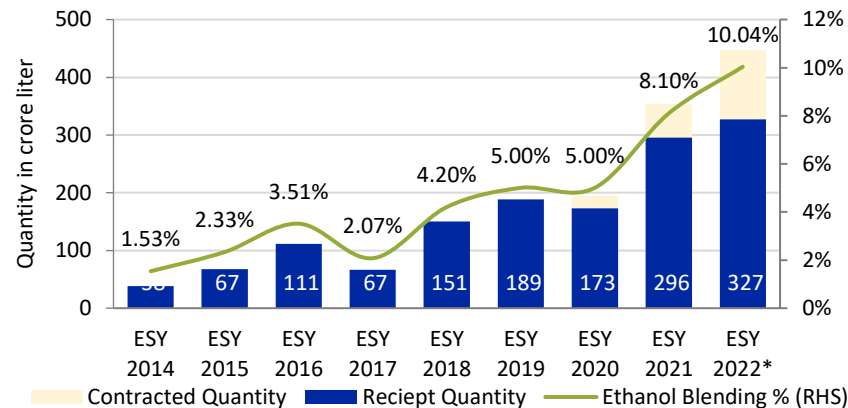
Remunerative ethanol pricing supports distillery investments

Exhibit: Ethanol prices excluding taxes and transportation cost (Rs./litre)

Feedstock	ESY2020	ESY2021	H1 ESY2022	H2 ESY2022*
Sugarcane Juice	59.48	62.65	63.45	65.05
B-Heavy molasses	54.27	57.61	59.08	60.57
C-Heavy molasses	43.75	45.69	46.66	47.84
Damaged Food Grain	50.36	51.55	52.92	55.26
Surplus Rice	NA	56.87	56.87	58.31

Source: ISMA, MoPNG, ICRA Research, *including relief amount (effective during Jun 1, 2022-Nov 30, 2022)

Exhibit: Trend in contracted and receipt quantity of ethanol

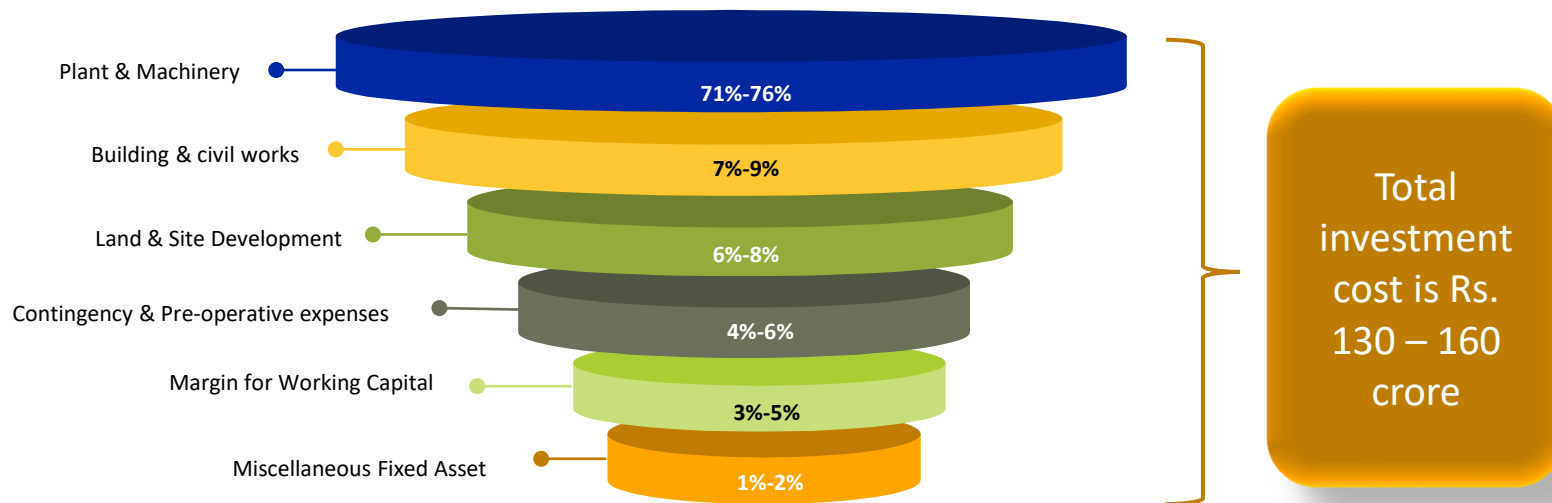


Source: ISMA, ICRA Research, * As on September 30, 2021

- Recently the OMCs have announced the relief amount for ethanol based on various feedstock as shown in the above exhibit, effective from June 1, 2022 to November 30, 2022, which would continue to encourage the industry for increased ethanol supplies.
- The Government's focus on ethanol blending in addition to remunerative ethanol prices would allow the mills to increase diversion of molasses/ sugarcane juice towards ethanol production. This would in turn control sugar supply in the domestic market while improving the profitability metrics and liquidity position and reduce the country's reliance on exports.

Project cost to set up a 1G ethanol plant

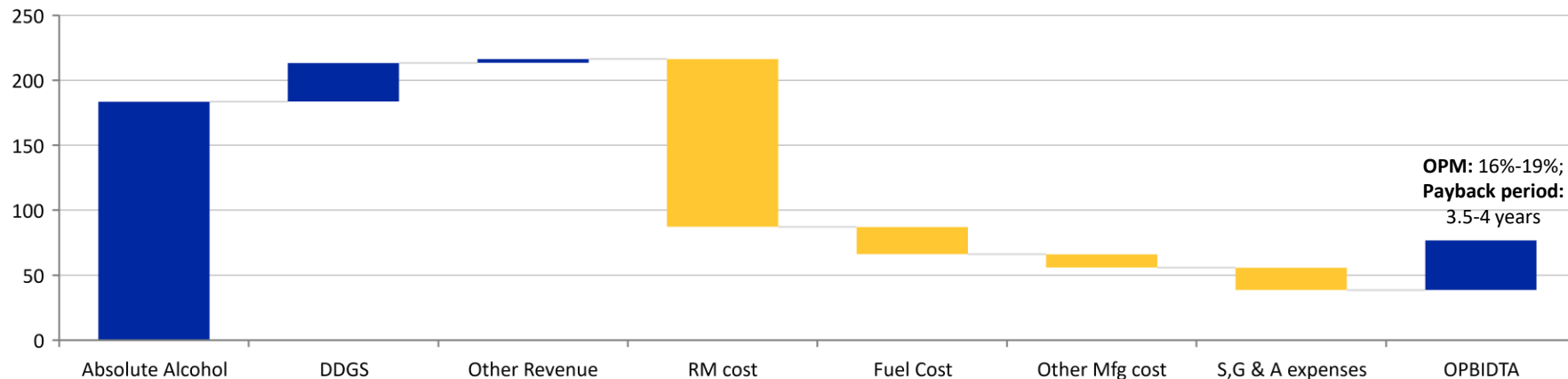
Exhibit: Investment Cost for setting up a 100 KLPD distillery



- The project cost to set up a sugar-based (B-heavy molasses/syrup) as well as grain based distillery could be around Rs.1.3-1.6 crore per KLPD, of which 71%-76% is the cost of plant and machinery. While, compared to this, IOCL has set up its 2G ethanol plant at an investment of Rs. 9 crore per KLPD.
- Major machineries for 1G distillery include: incineration boiler, multiple effect evaporation section, fermentation section, multi pressure vacuum distillation, cooling towers, yard piping, turbine, bag filter etc. Further, in grain based distilleries DDGS driers (5%-7% of plant and machinery cost) are also required.

Grain-based distillery could earn healthy OPM of 16%-19%

Exhibit: Operating profitability of 100 KLPD grain based distillery (broken rice)

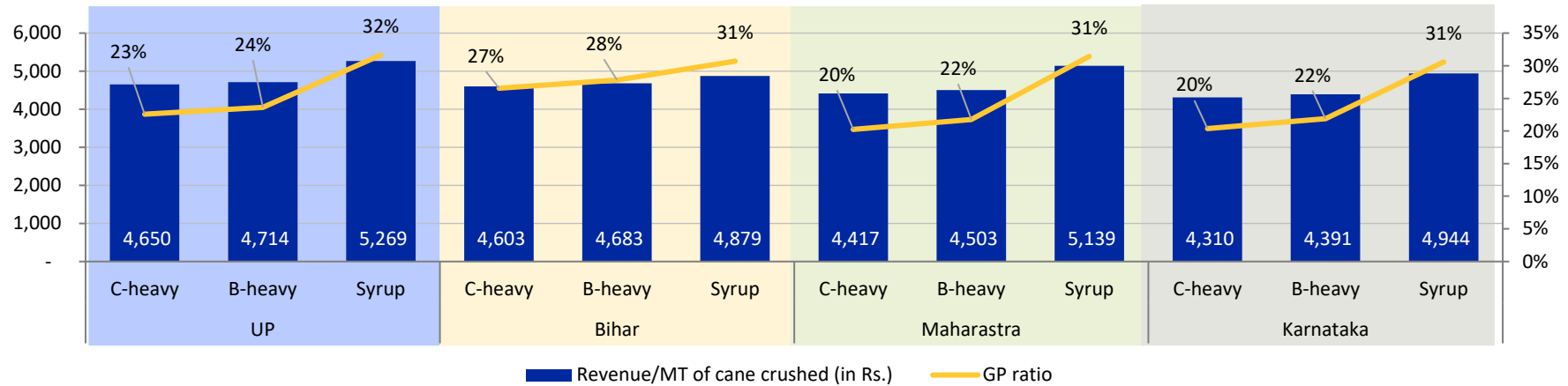


Source: ICRA Research; Note: Capacity utilisation is assumed at 90% and operational days assumed at 330 days; Calculations factor in current announced prices

- A 100 KLPD grain-based distillery using broken rice as feedstock, which can operate for 330-340 days a year, can earn revenues of Rs. 200-210 crore at current remunerative ethanol prices as fixed by the GoI/OMCs with an operating profitability of 16%-19%.
- With an average capex of ~Rs. 135 crore, the payback period is estimated at 3.5-4 years.

With prices being remunerative, syrup-based ethanol looks lucrative but only could be produced during crushing season

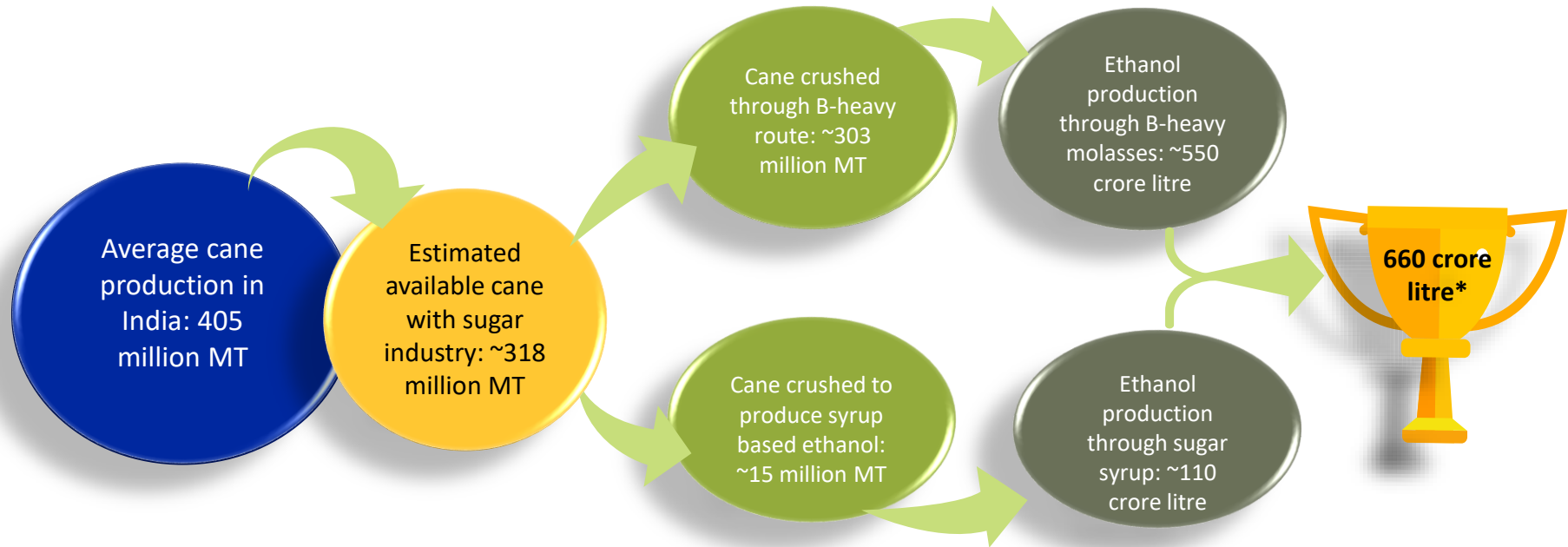
Exhibit: Route-wise indicative revenues and profitability for various states



Source: ICRA Research; Note: The above calculations takes into account revenues from only sugar and ethanol division basis current ethanol prices. GP ratio is calculated by considering only cane cost (other costs and related revenues have been ignored)

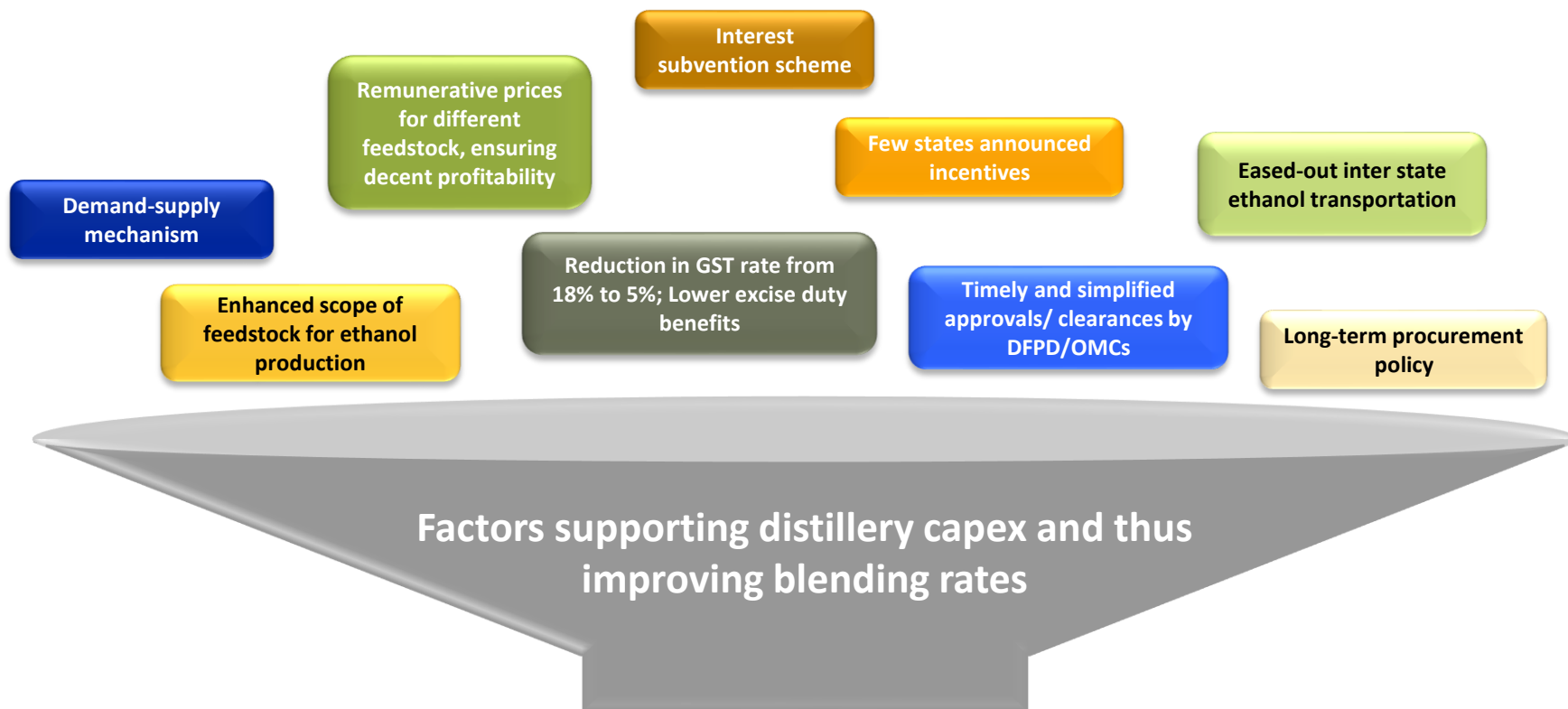
- Revenues and profitability could differ from region to region because of difference in agro-climatic conditions, sugar recovery rates, sugar realisations, cane cost etc.
- While the syrup-based ethanol production allows the highest revenues and profitability among all three alternatives given the remunerative prices, syrup can only be used during crushing season for ethanol production. Hence, most mills plan to produce syrup-based ethanol during season and crush balance cane through B-heavy route to produce B-heavy molasses during crushing season which is stored and utilised during off-season to produce ethanol.

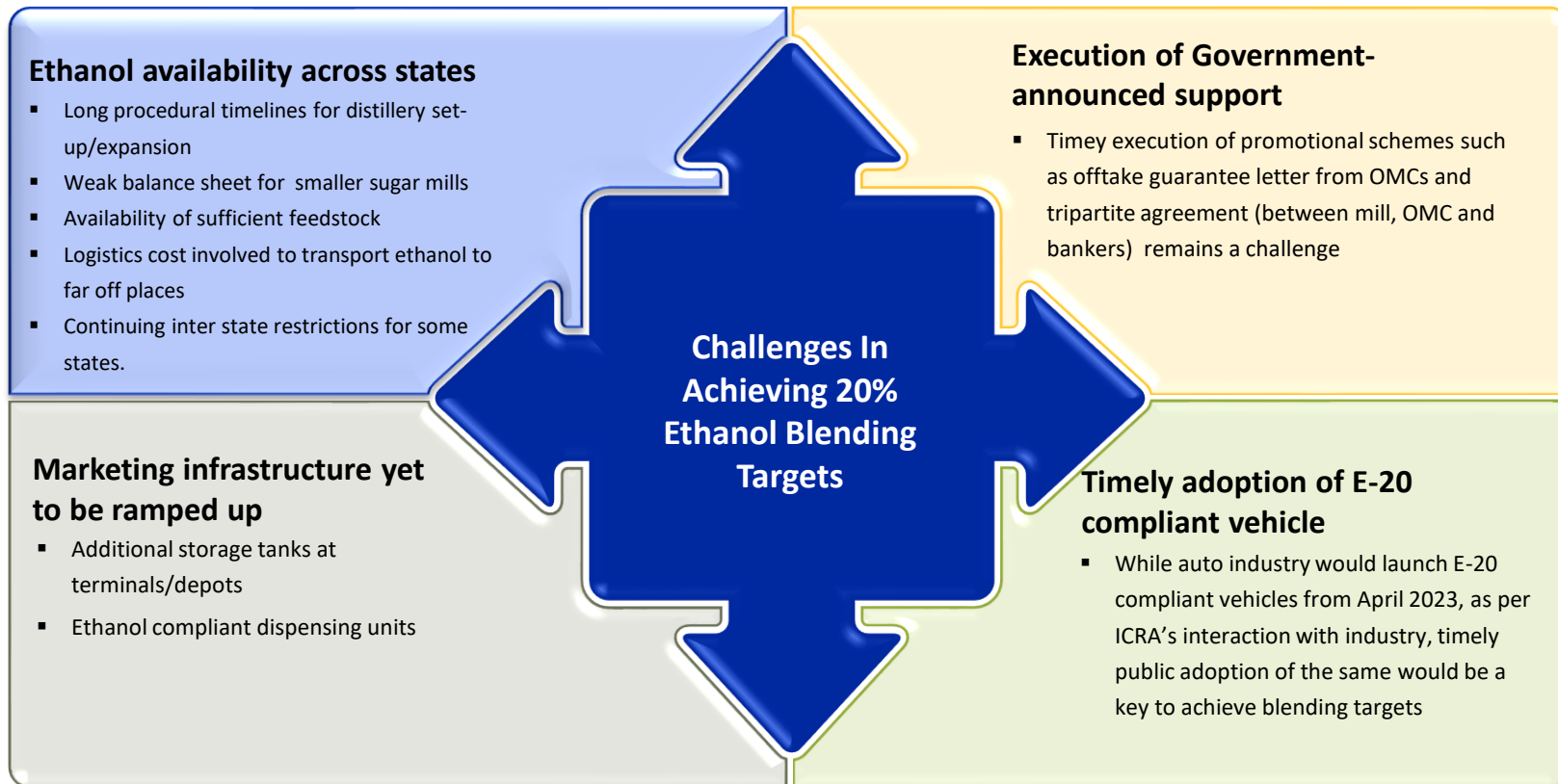
Adequate sugarcane is available to produce the required ethanol for achieving 20% blending target



Considering sugar annual consumption at 28.5 million MT**, ICRA estimates that enough sugarcane-based feedstock would be available to produce the required ethanol volumes for achieving 20% blending targets in case of normal agro-climatic conditions.

Source: ICRA research, Niti Ayog report; *As per Niti Ayog report 660 crore litre of ethanol is required to be supplied through sugarcane to achieve 20% blending targets.; ** Current consumption is estimated at 27.5 million MT, slight increase in sugar consumption is expected by 2025.







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