

Pulses Mill Modernization Challenges and Opportunities

Automation
Efficiency
Across Milling
Stages

Forward
Integration
Pea Protein
Extraction

Lateral
Opportunities
Solar Power
Usage

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Mill Modernization Background

India Pulses Milling Scenario

- Indian pulses availability : Estimated 26Mn Tonne in 2023 : Includes sowing + consumption (24Mn Tonnes)
- Pulses milling stands as 4th largest Food processing industry –After rice, wheat, Edible oil
- Relatively semi organized - concentrated in small / medium scale dal mills across India
 - Average size of small mill is ~30 T to 50 T/day dal intake for production.
 - Medium / Large scale mills have intake capacity of 100-150TPD
- Fragmentation: There are over 7500 Dal Processing units which operate at least 4 months in the year counting : 90% of these mills have FSSAI registration certificate
- Standalone Filter / sieving / Cleaning units are over and above this count

S. No.	Region	State	Number. Of Dal mills Estimated as per regional association
1	West	Maharashtra & Gujarat, Rajasthan	2025
2	North	UP, Delhi, Bihar,	1625
3	Central	MP, Chhattisgarh	825
4	South	Kerala, Tamil Nādu, Andhra, Karnataka	1250
5	ROI	Eastern part	350



Mill Modernization Background:

Current challenges and issues faced

1. Seasonality of pulses: **Regional millers operate cyclically**- spike in Supply and Demand situation
2. Lot of **Yield related losses** Often caused by quality Variability in Raw Material and limitation of equipment
3. Lack of **skilled and technically equipped manpower** resources : for efficiency and product quality
4. Often **Poor quality of Finished Products** / Dals eventually reaches market
5. Inability to provide **better Value added products within Pulses** as basic infrastructure itself is weaker.

Key factors for consideration

- **Best practice from food processing industry to make pulses processing more efficient.**
 - Efficiencies would help reduce: price volatility provide a stable revenue stream to millers.
 - Ensure continuous delivery of high quality product even with variability of input raw material.
- **Pulses milling becoming profitable**, sustainable industry for millers
 - Facilitate the consumption of throughput coming from harvest Benefitting farmers.
 - Improving the margin and profitability of millers, better bulk price advantage for Miller and Consumer
- **Better facility at premise for storage and for cargo handling** : Minimize the damage caused to RM and FG
- **Milling operations Skill building**: local manpower resources- improving their employability with in and beyond pulses sector.
- **Automation**: Superior design of equipment, lesser space and low power consumption, lower dependency on Miller skills
- **Facilitate down stream opportunities** Food processing value added product offering , Protein extraction / application / derivatives / Use of Solar Power

Pulses Milling Unit Process / Equipment Modernization opportunities

Material Inward handling & storage

- Objectively **checking material quality** for specific quality parameters.
- Benchmarking at crop level
- **Defining the storage conditions** based on input quality conditions like moisture /damage/infestation/ FM
- Proper **fumigation facility** at inward stage.
- **Silo based storage** : reducing storage space, improved handling and hygiene, longer shelf life, avoiding any risk of grain damage
- **Automate Grain handling** from Silo

Operation /Processing & Multistage Storage

- **Integrated SCADA based system** for monitoring whole plant from single desk.
- All process **parameters can be controlled and monitored** from integrated system. E.g. Hulling Pass Stone angle and Roll pressure etc..
- **Advanced design huller** for improving throughput and yield.
- Multiple intermediate bin storage for WIP, **Conveyor diversions** : complete online processing
- **Solar Power deployment**

Drying

- Small dal mills have **open drying beds**: Very low to negligible production during rainy season
- Low production -> price rise
- **RM deterioration** during rainy season
- Dal mills can be equipped with Stack/ **vertical dryers**
- **Uninterrupted functioning** of dal mill irrespective of Monsoon.
- Many contractual labors connected with local dal mills will have continuous work if small dal **mills remain functional during rainy season**

F.G. Storage and Forward Integration

- Development of **cold store shared facility in mills clusters**
 - Minimize FG damage during lean season
 - proper supply during peak demand
 - Better price realization through the year.
- FG specs check through **Halogen moisture meters, digital grain analyzer**
- Traceability of FG for back-end analysis and correction.
- Usage of **handling and loading automation equipment** like conveyers, forklift with pellets for speed and reduction in storage space
- Down stream retail / Consumer pack
- **Protein extraction**

Mill Modernization ESTIMATED INVESTMENT FOR 100TPD MILL UPGRADATION

S.No	Heads	Resource/ Equipment Required	Equipment Image	Estd Cost INR	Estd Cost USD
1	Material Inward and Q.A. Testing	Digital Moisture Meter		25,000	313
		Oven		150,000	1,875
		Muffle Furnace		150,000	1,875
		Protein Tester		80,000	1,000

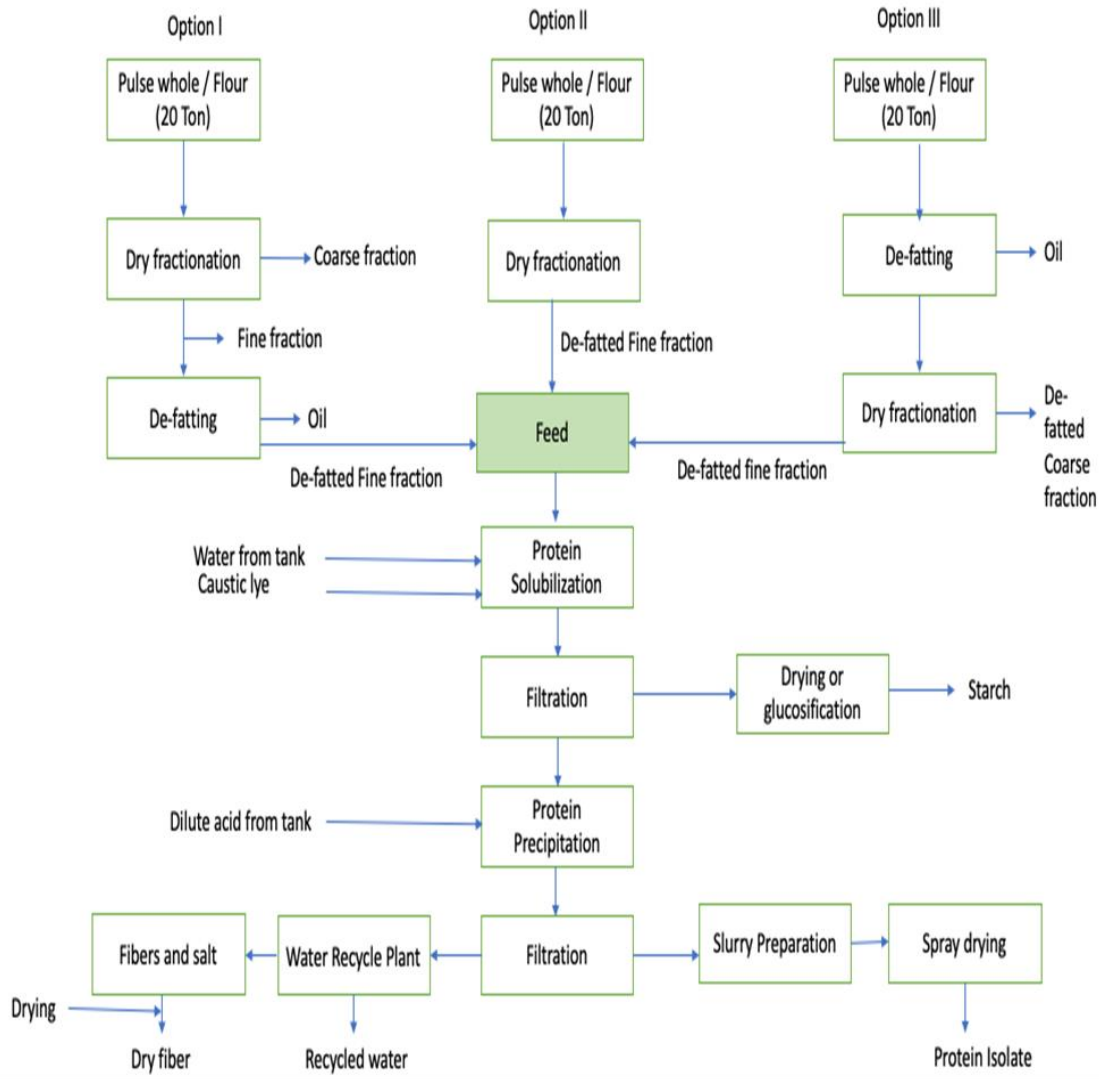
S.No	Heads	Resource/ Equipment Required	Equipment Image	Estd Cost INR	Estd Cost USD
2	Operations	SCADA System		5,000,000	62,500
		Silo		10,000,000	125,000
		Huller (Advanced Design)		4,200,000	52,500
3	Drying Process	Dryers		5,000,000	62,500

S.No	Heads	Resource/ Equipment Required	Equipment Image	Estd Cost INR	Estd Cost USD
4	FG Storage Forward Integration	Pellets		2,500,000	31,250
		Forklift		1,500,000	18,750
		Augur Steel Conveyers		1,000,000	12,500
		Digital Moisture Meter		25,000	313
TOTAL			29,630,000	370,375	

Estimated \$400K Investment for Mid size plant

Mill Modernization : Forward Integration : Plant based/ Pea protein Extraction

**Pilot Plant for Protein output of 500kg per/day
with starch drying and glucosification**



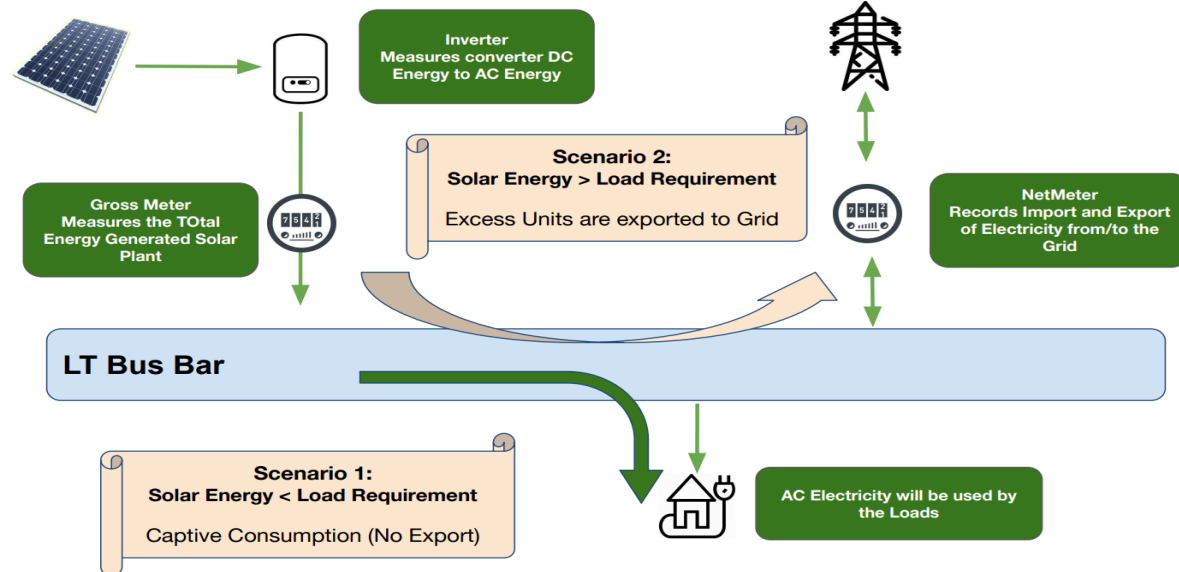
Equipment	Capacity (MT/Hr)	No of Units	Unit Cost (INR mio.)	Total Cost (\$ '000)
Dry-Fractionation				
Ory Fractionation Unit		1.0	22.5	310.3
Wet-Extraction				
SS 316 Tank Precipitator	2,000.0	1.0	1.5	20.7
Centrifuge Feed Tank	6,000.0	1.0	0.7	9.7
Centrifuge for protein/ ANFO if possible	600.0	1.0	2.0	27.6
Kneader/Protein Solubilisation		1.0	1.5	20.7
Membrane Filtration Feed Tank	6,000.0	1.0	0.7	9.7
Membrane Filtration	4,200.0	1.0	1.0	13.8
Centrifuge Feed Tank	6,000.0	1.0	0.7	9.7
Centrifuge for Starch	1,200.0	1.0	2.5	34.5
SS 316 Extractor	6,000.0	1.0	2.5	34.5
Homogeniser		1.0	2.0	27.6
SS 316 Extractor	3,000.0	2.0	1.0	27.6
Teflon Coated Precipitator	2,000.0	2.0	1.0	27.6
Drying and Packing				
Ring Dryer or Glucosification in ROS		1.0	0.8	11.0
Mechanical Vapor Recompressor	4,000.0	1.0	5.0	69.0
Spray Dryer		1.0	12.0	165.5
Steam Boiler		1.0	1.5	20.7
Modified Starch (Food Grade) Drying		1.0	2.4	33.1
Salt Crystalliser Unit		1.0	2.0	27.6
Miscellaneous Equipment				
ANFD 3000 Litre;	3,000.0	1.0	3.0	41.4
Solvent Intermediate Tanks	2,000.0	3.0	0.5	20.7
Solvent Recovery Vessel / R-02	5,000.0	1.0	1.0	13.8
Solvent Storage	10,000.0	1.0	1.0	13.8
Water Tank	10,000.0	1.0	0.3	4.1
Flour Charging (Conveyor)		1.0	1.0	13.8
Misc. Equipment				
Laboratory				
Water-activity		1.0		-
Moisture analyzer		1.0		-
Viscosity measurement		1.0		-
Texture Analyzer		1.0		100.0
Spectrophotometer , Calorimeter, pH and Brix,Rapid Protein Testing, Fat Analysis, Hibart Mixer, Oven, Bench fryer, Proofers, Chillers, Pasterusizer ++		1.0		30.0
Total Cost - Equipment			99.24	1,368.9
Other Expenses			15.4	212.4
Civil Work			9.9	136.6
Erection and Commissioning			5.5	75.9
Total Cost			114.6	1,581.3

Capex Investment of INR 12 CR : \$1.6Mio

Mill Modernization : Solar Paneling for electricity Net Metering: Specimen Model



- Total plant capacity is approx. 1MW,; 2200 solar panels
- Approx. 150,000 unit power generation per month.
- @ 4,45 per unit cost and Net metering option There would be Estd \$1.2Mn savings in electricity bill over period of 15year PPA with power producer.
- First year annualized saving is \$80K
- It will reduce approx. 1258Ton/Years carbon footprints of a plant.



- PPA where the Capex absorbed by the Power Producer Company
- Onetime Opex for the Miller is Margin money/ Bank Guarantee of INR 30L (\$37500)

Solar Panel Installation	Mono PERC HC with Gen 2 String Inverter
Capacity (kWp)	1210 kWp/975KW
Timeline (Days)	180 Days
Module Make	Jinko
Module Specs (min)	Mono PERC HC 535 Wp
Inverter Make	XYZ Solar
Inverter Specs	Gen-2 String Inverter
MMS Specs	Al short rail structure
DC Cable	4 mm2 EN 50618 Polycab/Siechem/Reputed
Balance of System	Standard BoS
Module (Years)	10 /25 Years
Inverter (Years)	07 Years
Balance System (Years)	1 Year As per OEM Standards
Expected Performance # (Sp. Yield & PR%) Based on GHI 1823	Sp. Yield: 1391 kWh/ kWp
	1681900 kWh/ Y1
	PR: 70.00 %
YoY Degradation (%)	2 % in 1st year and 0.7% from 2nd year

Mill Modernization : Solar Paneling for electricity Net Metering: Specimen Implementation



Mill Modernization Opportunities : Bringing to Fruition: Proposal stage

Proposed Formation of Governing Body / Institute to facilitate Modernization /training/audits / certification

Anchored by IPGA comprising of

- IPGA + Processor + Dal mill association Representation + Competent Lab
- Under supervision of Central Ministry: Food processing or DOCA

This Institute Certifies and recommends the Mills for Government subsidy for Mill Modernization Initiatives

Key Deliverables

- **Guide the Local / Regional mills for Modernization investments**
- **Work with Government for Loan / Subsidies** for Mill modernization and investments thereof
- **Training /auditing/skill imparting/ Certifying:** processing, quality & operations: Have panel of domain experts
- **Train Millers** on compliances, FSSAI, EHS, SCADA system and other automation training, yield improvement / productivity
 - **Certify Millers** as class 1, class 2, class 3, based on their performance in practical examinations.
 - Develop SOP consisting best industry GMP practice, Upskill current manpower,
 - ISO 9001-2015, ISO 14001-2015, ISO 22000-2018, ISO 45001-2018, certifications can be taken as per mill requirement

Development of Star Rating system for Mills

- Based on automation, final output quality, hygiene standard, EHS practices detailed audit checklist to be developed
- This rating could have start rating ranging from 2 star to 5 star from manual to most advanced processing mill.

Thank you



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