Benchmarking on the requirement of Land, Water and Power for Iron Ore Beneficiation and Pellet Plants of various capacities- A case study in Odisha

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Structure of Presentation

Sl No	Description
1	Objective & Scope of Study
2	Technological Facilities
3	Supporting Auxiliary & Service Facilities
4	Assumptions
5	Requirement of Land
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7	Requirement of Power
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9	Conclusion

OBJECTIVE & SCOPE OF STUDY

To achieve optimum requirement of land, water & power for Beneficiation & Pellet Plants

Case Study for BP & PP of capacities 0.6-8 Mtpa on standalone & integrated basis

Feed iron ore (-) 10 mm size

Fe 45-55% & 55-60%

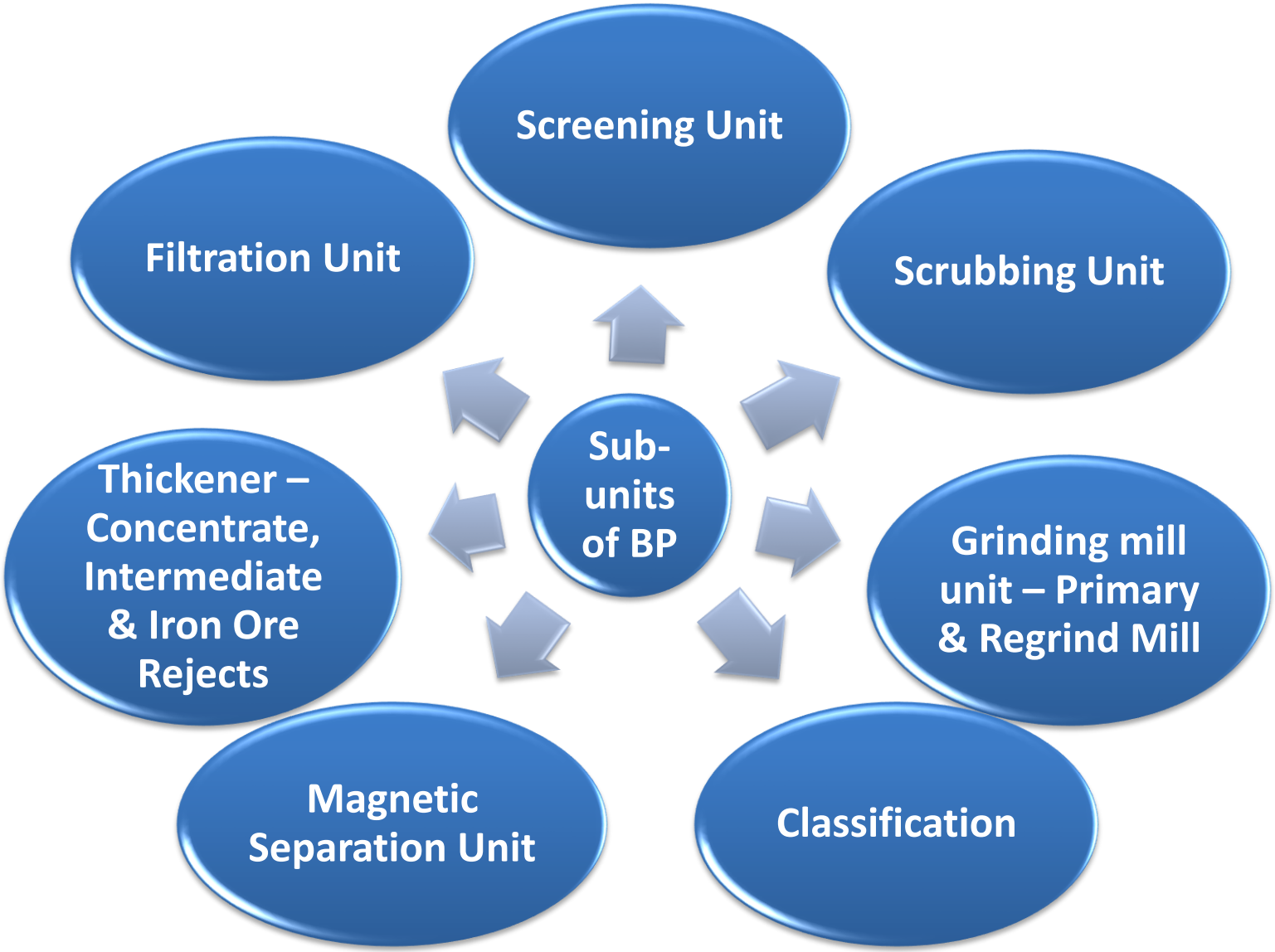
Area estimated based on consideration of technological & service facilities

Comparison as Case Study with a few plants in Odisha

PANORAMIC VIEW OF BENEFICIATION PLANT

PANORAMIC VIEW OF PELLET PLANT

MAJOR SUB-UNITS OF BENEFICIATION PLANT



SCREENING HOUSE

SCRUBBER UNIT

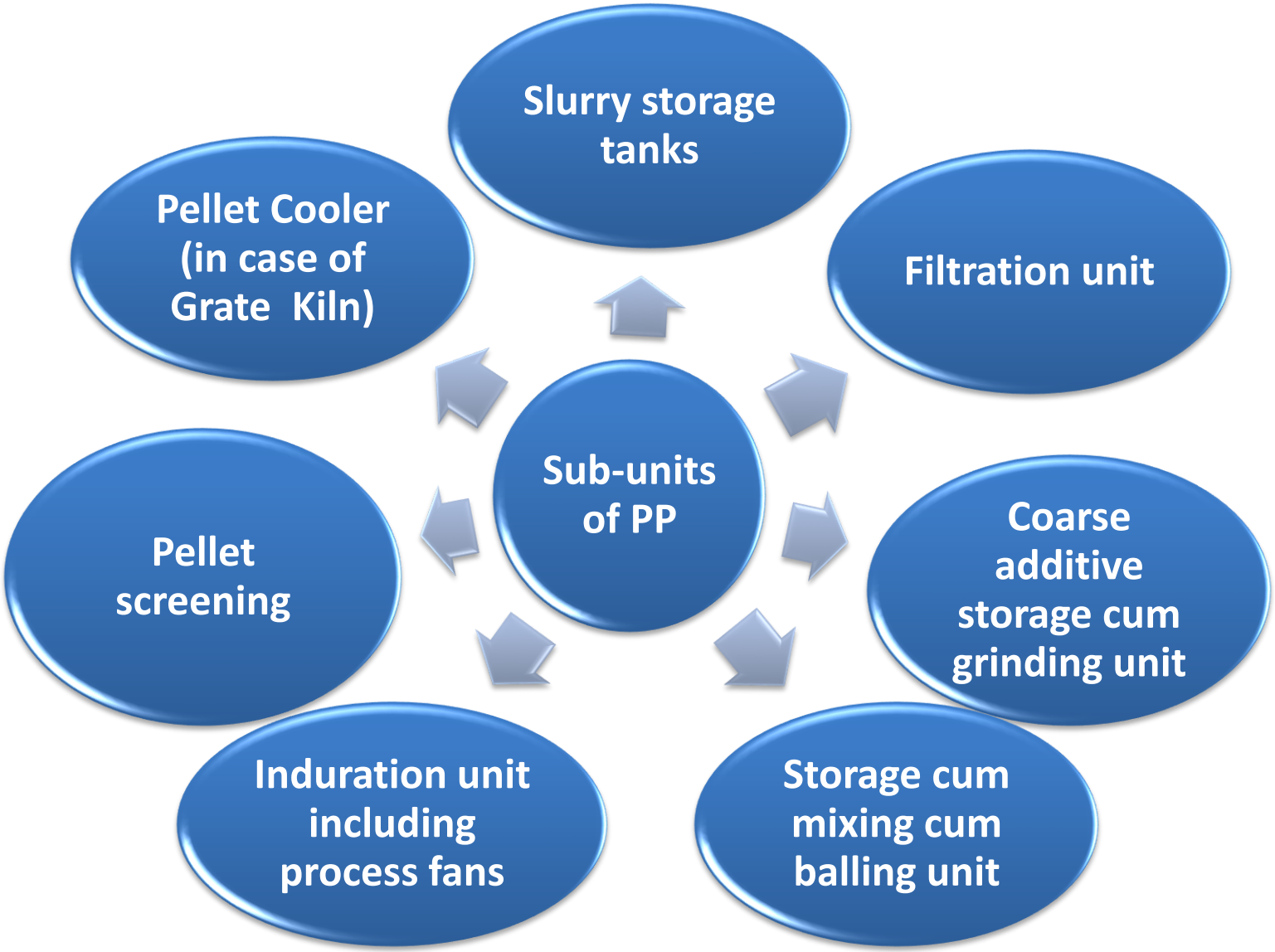
GRINDING MILL

CLASSIFICATION UNIT

THICKENERS

FILTRATION UNIT

MAJOR SUB-UNITS OF PELLET PLANT



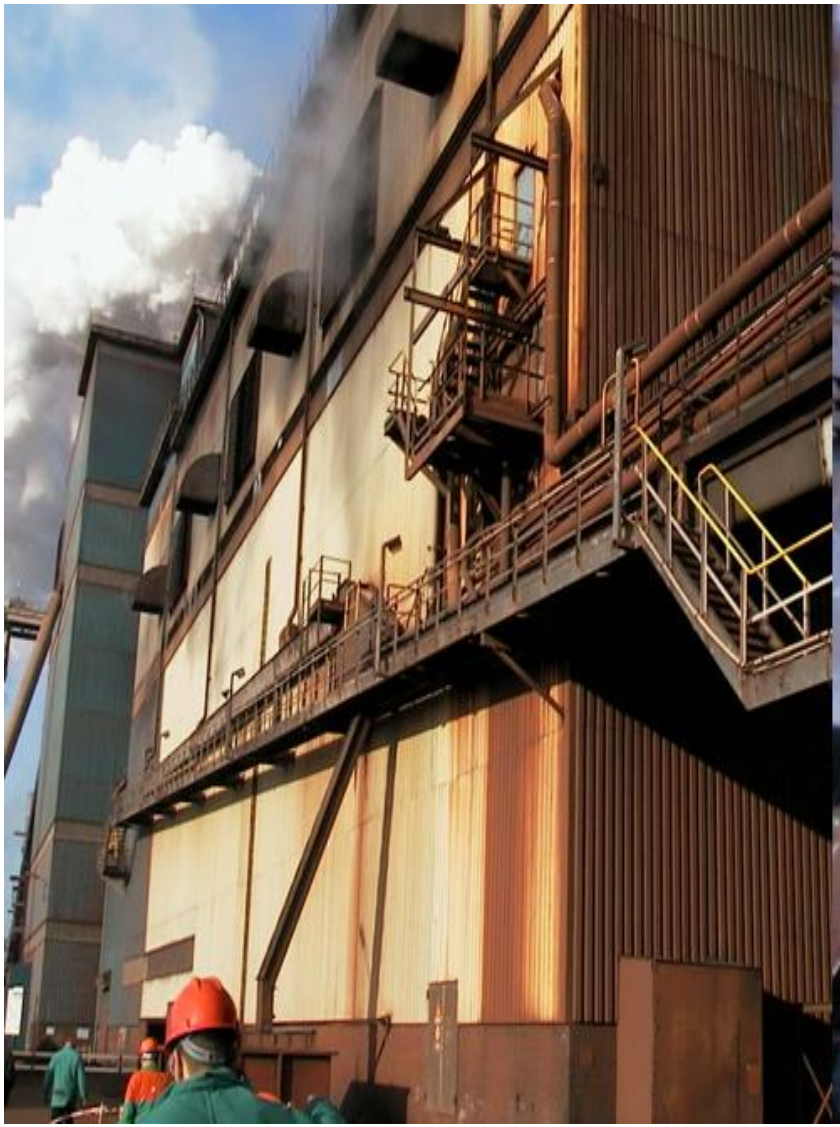
SLURRY STORAGE TANKS

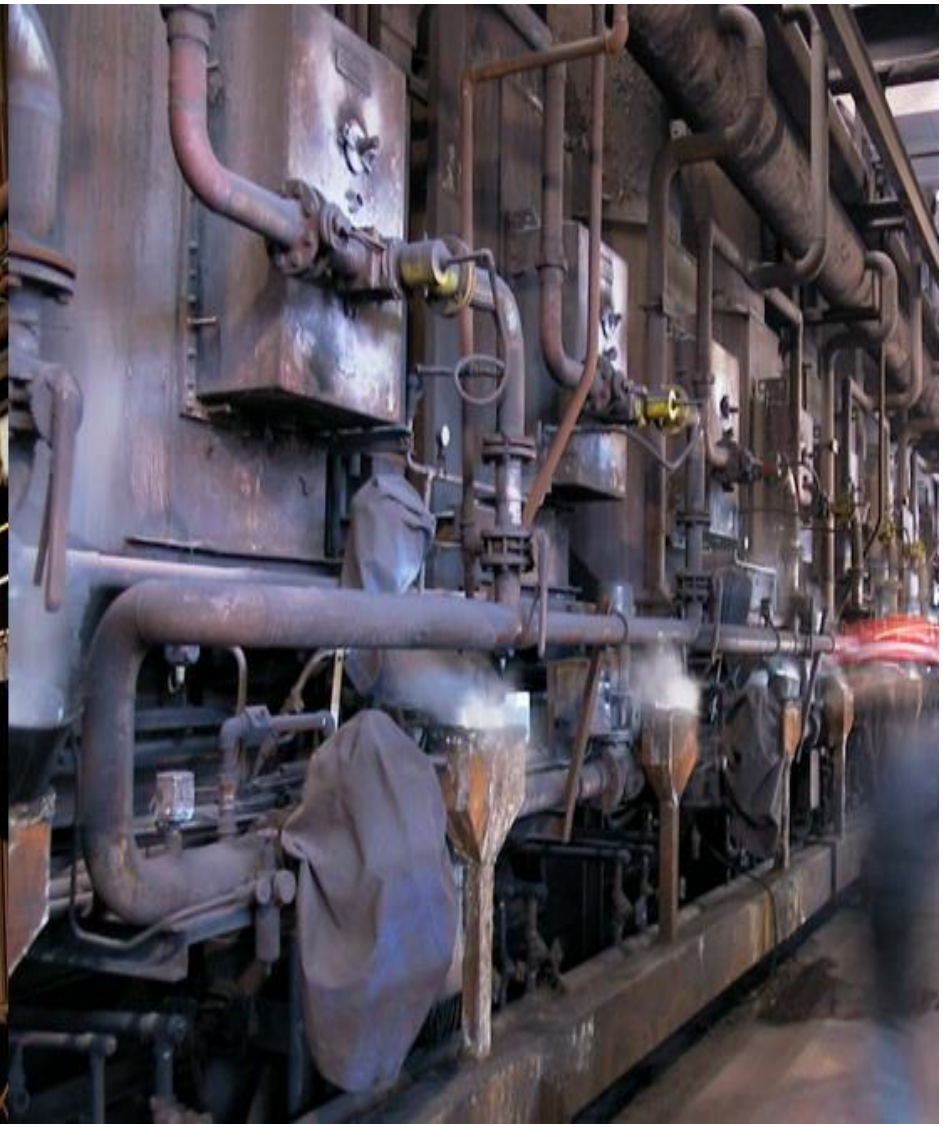
FILTRATION UNIT

ADDITIVE STORAGE-CUM-GRINDING UNIT

MIXING & BALLING UNIT

INDURATION UNIT





PELLET SCREENING

ANNULAR COOLER (In GRATE-KILN)

SUPPORTING AUXILIARY & SERVICE FACILITIES

RMHS Yard	Raw Water Reservoir	Pump House & Cooling Towers
Compressed Air Station	Electrical Sub-station & Control Room	DG Station
Repair & Maintenance Shop	Fire fighting PH incl. Hydrant sys, automatic fire detection, water spray system etc.	Road & rails
Administrative Building	Welfare canteen, medical care faclities etc.	Security post other service buildings

ASSUMPTIONS

- ✓ Rectangular shape land in 2 : 3 ratio (approx.)
- ✓ More or less flat contour of land
- ✓ Storage of raw materials - fifteen (15) days
- ✓ Storage of finished pellets - fifteen (15) days
- ✓ Storage of raw water - fifteen (15) days
- ✓ Green belt as per statutory norms of MOEFCC
- ✓ Smooth and uninterrupted flow of materials
- ✓ Provision of adequate area for dumping of ore rejects

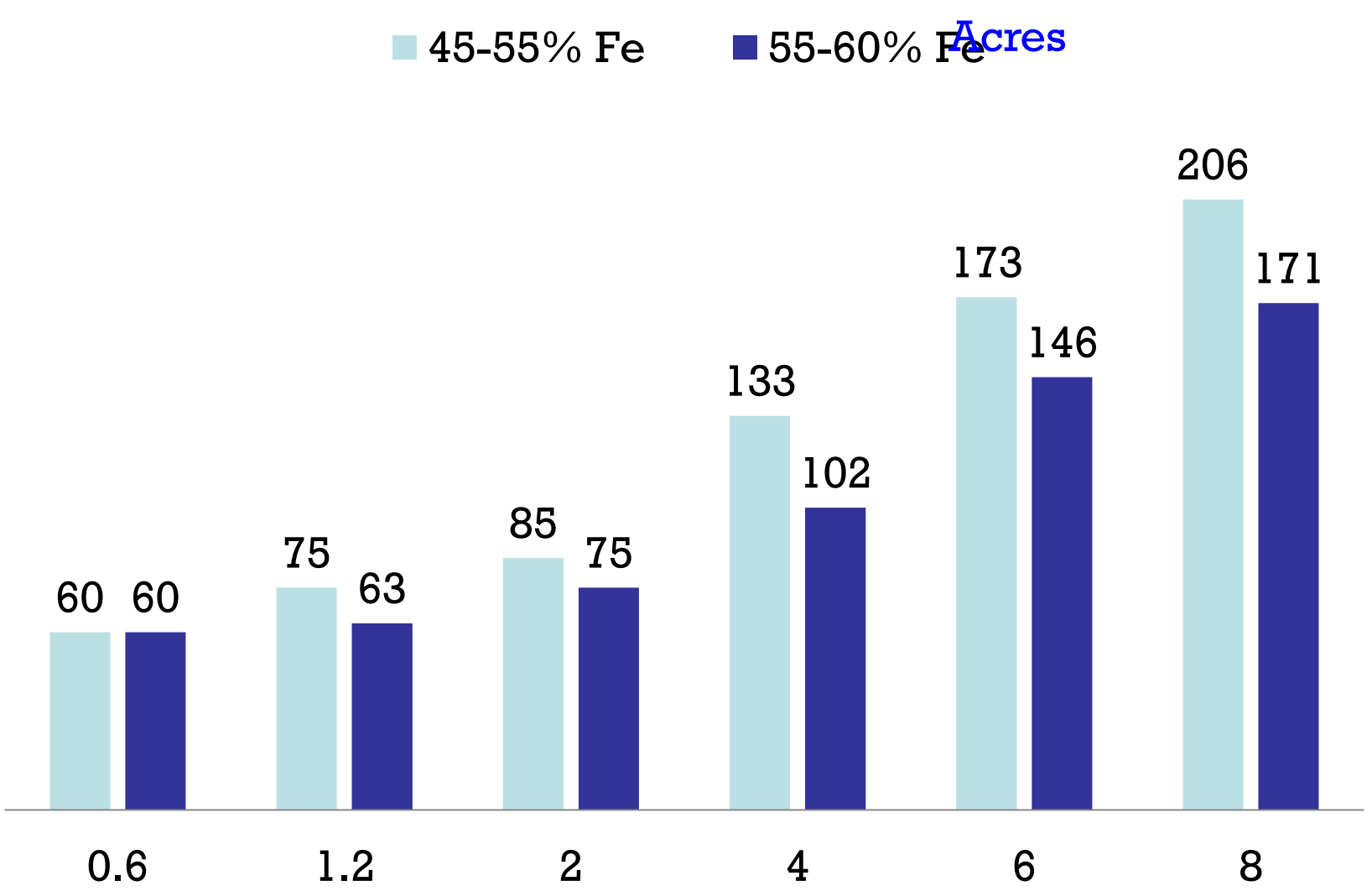
(8.0 years to 10 years) considering 20-30 m stack height

REQUIREMENT OF LAND

Sl. No.	Capacity of the plant (in Mt/yr)	0.6	1.2	2.0	4.0	6.0	8.0
	Description	Area (in Acres)					
1.	Standalone beneficiation plant (45-55% Fe)	60	75	85	133	173	206
2.	Standalone beneficiation plant (55-60% Fe)	60	63	75	102	146	171
3.	Standalone pellet plant	45	50	62	116	140	150
4.	Integrated beneficiation plant (45-55% Fe) and pellet plant	97	119	136	215	266	306
5.	Integrated beneficiation plant (55-60% Fe) and pellet plant	97	105	128	189	239	272

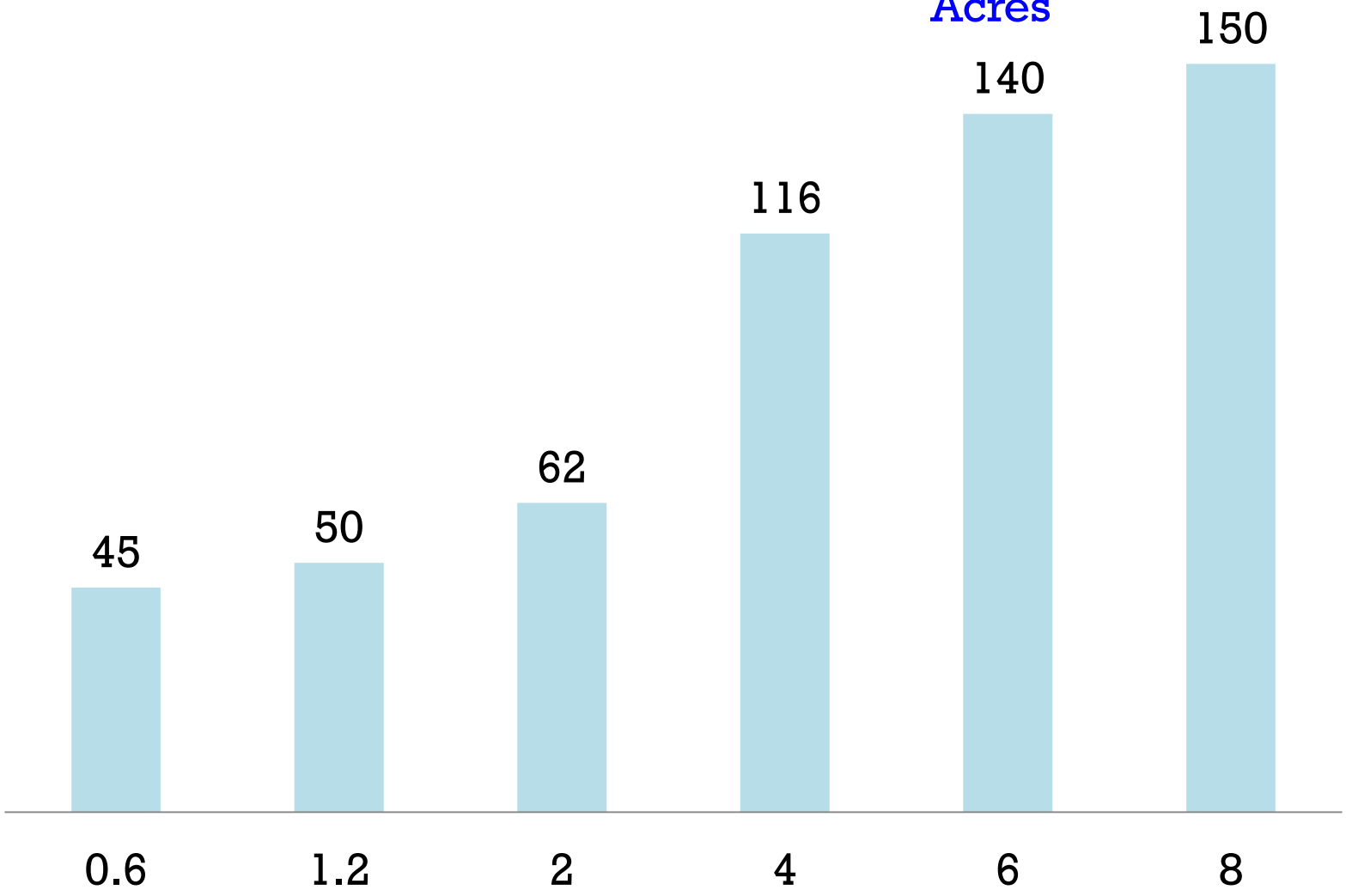
AREA : STAND-ALONE BENEFICIATION PLANT

all figures are in Acres



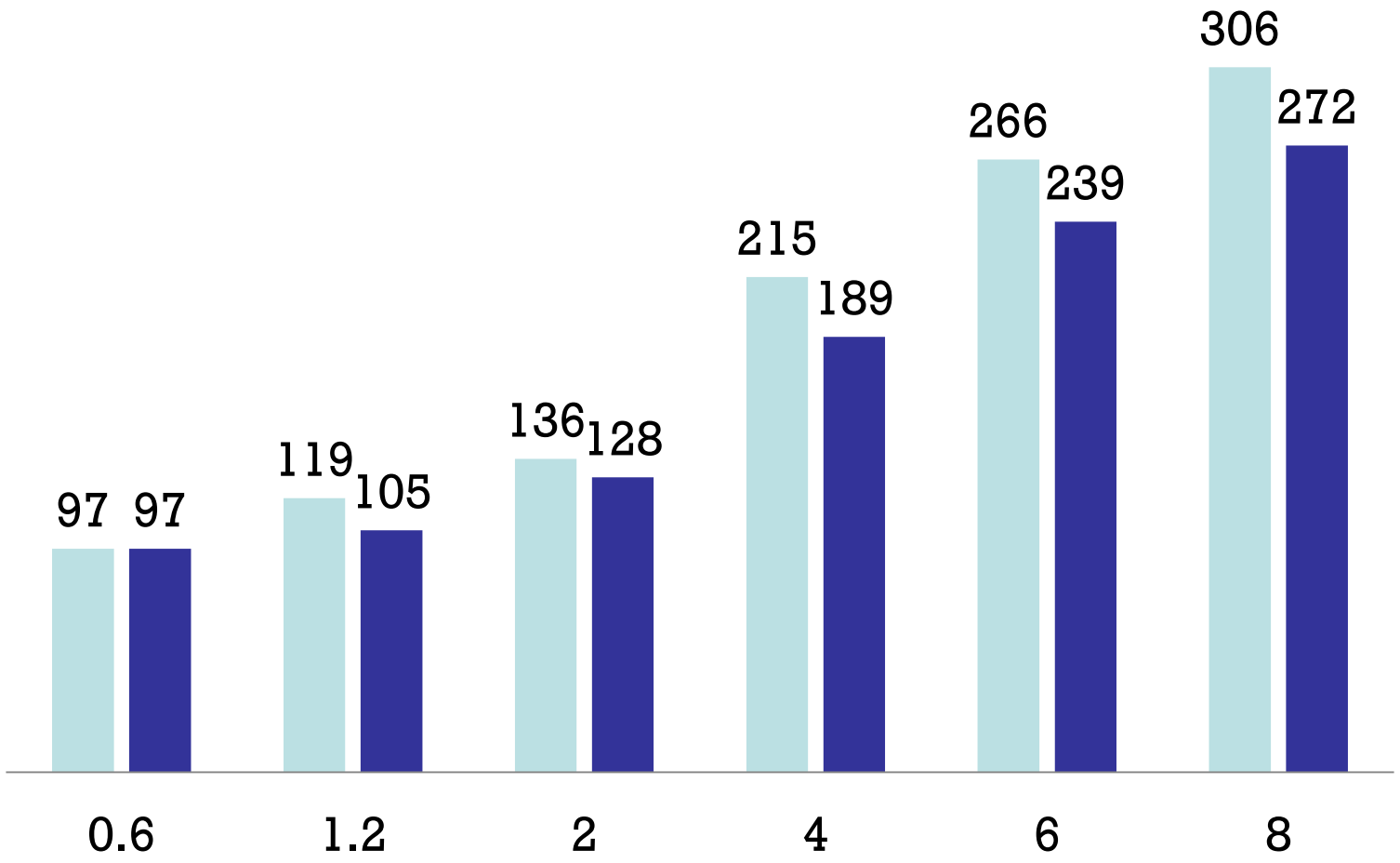
AREA : STAND-ALONE PELLET PLANT

all figures are in Acres



AREA : INTEGRATED BENEFICIATION & PELLET PLANT

all figures are in Acres



REQUIREMENT OF DUMP AREA

Sl. No.	Capacity of the plant (in Mt/yr)	0.6	1.2	2.0	4.0	6.0	8.0
	Time period for storage (in Years)	10	10	10	7.5	7.5	7.5
	Dump area – Beneficiation plant	Area (in Acres)					
1.	45% to 55% Fe	25	50	83	124	186	248
2.	55% to 60% Fe	13	25	42	62	93	124

Tailing Pond (Wet) :

- **30% additional area requirement over the above area required for Iron Ore Rejects (Dry)**

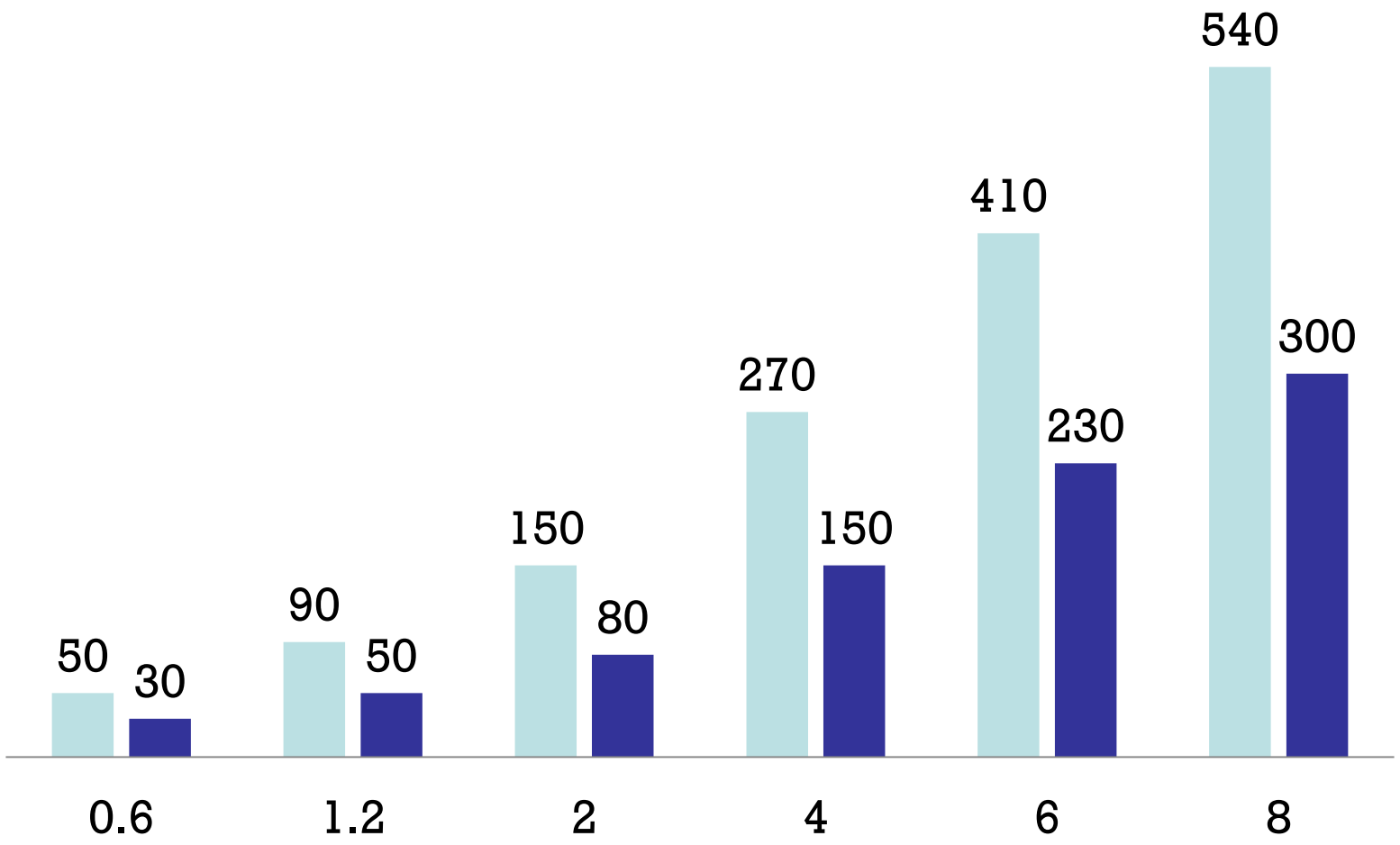
REQUIREMENT OF WATER

Sl. No.	Capacity of the plant (in Mt/yr)	0.6	1.2	2.0	4.0	6.0	8.0
	Description	Make-up water (in m^3/h)					
1.	Standalone beneficiation plant (45-55% Fe)	50	90	150	270	410	540
2.	Standalone beneficiation plant (55-60% Fe)	30	50	80	150	230	300
3.	Standalone pellet plant	30	50	75	125	170	205
4.	Integrated beneficiation plant (45-55% Fe) and pellet plant	80	140	225	395	580	745
5.	Integrated beneficiation plant (55-60% Fe) and pellet plant	60	100	155	275	400	505

Apart from process needs, the above requirement also includes drinking, fire fighting and other minor needs.

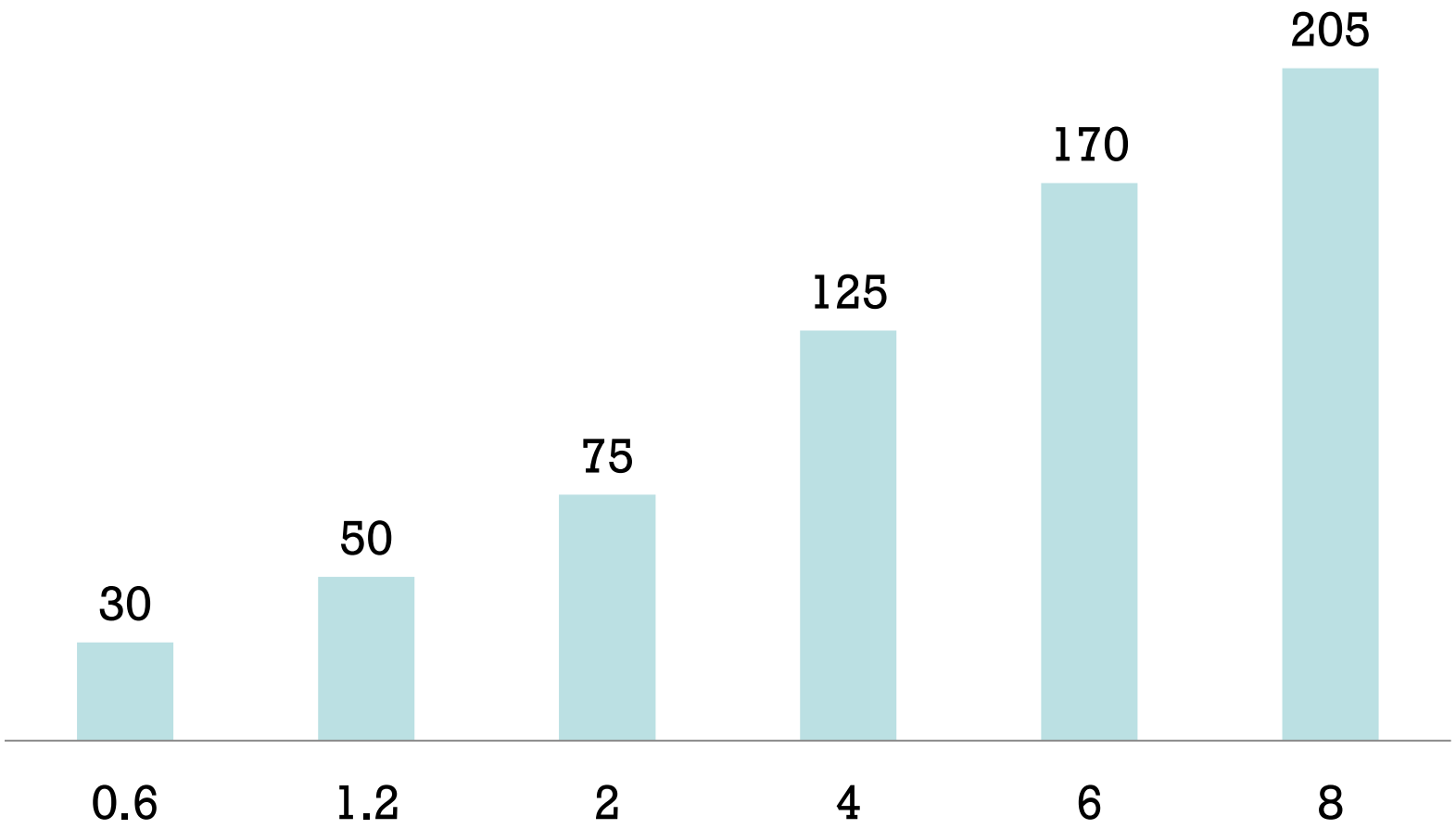
WATER : STAND-ALONE BENEFICIATION PLANT

all figures are in m^3/h



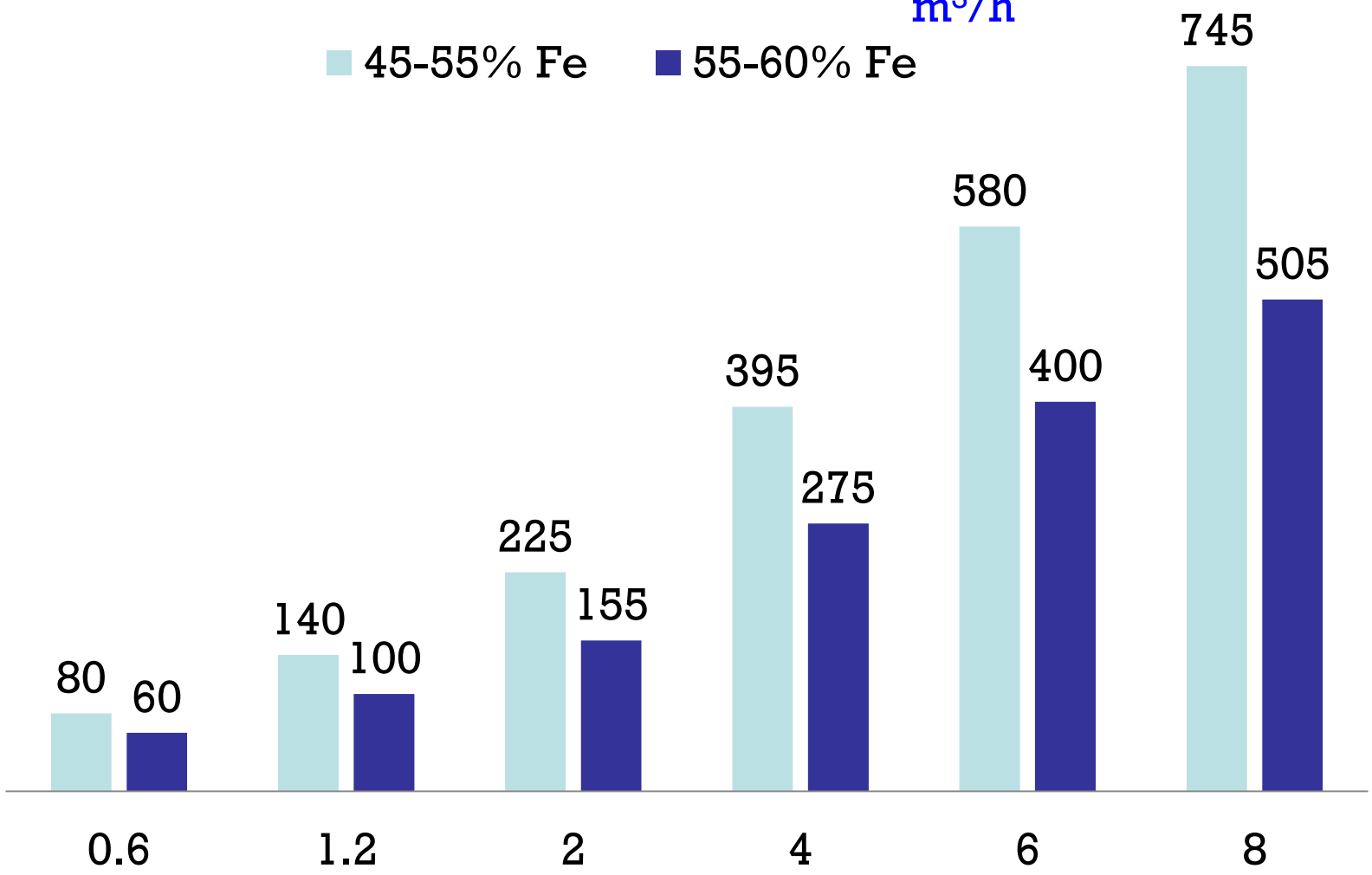
WATER : STAND-ALONE PELLET PLANT

all figures are in m^3/h



WATER : INTEGRATED BENEFICIATION & PELLET PLANT

all figures are in m^3/h



REQUIREMENT OF POWER

Sl. No.	Capacity of the plant (in Mt/yr)	0.6	1.2	2.0	4.0	6.0	8.0
	Description	Maximum Demand (in MVA)					
1.	Standalone beneficiation plant (45-55% Fe)	6	9	14	30	43	55
2.	Standalone beneficiation plant (55-60% Fe)	4	7	11	22	33	42
3.	Standalone pellet plant	6	10	21	39	55	64
4.	Integrated beneficiation plant (45-55% Fe) and pellet plant	12	19	35	69	100	123
5.	Integrated beneficiation plant (55-60% Fe) and pellet plant	11	17	32	63	91	110

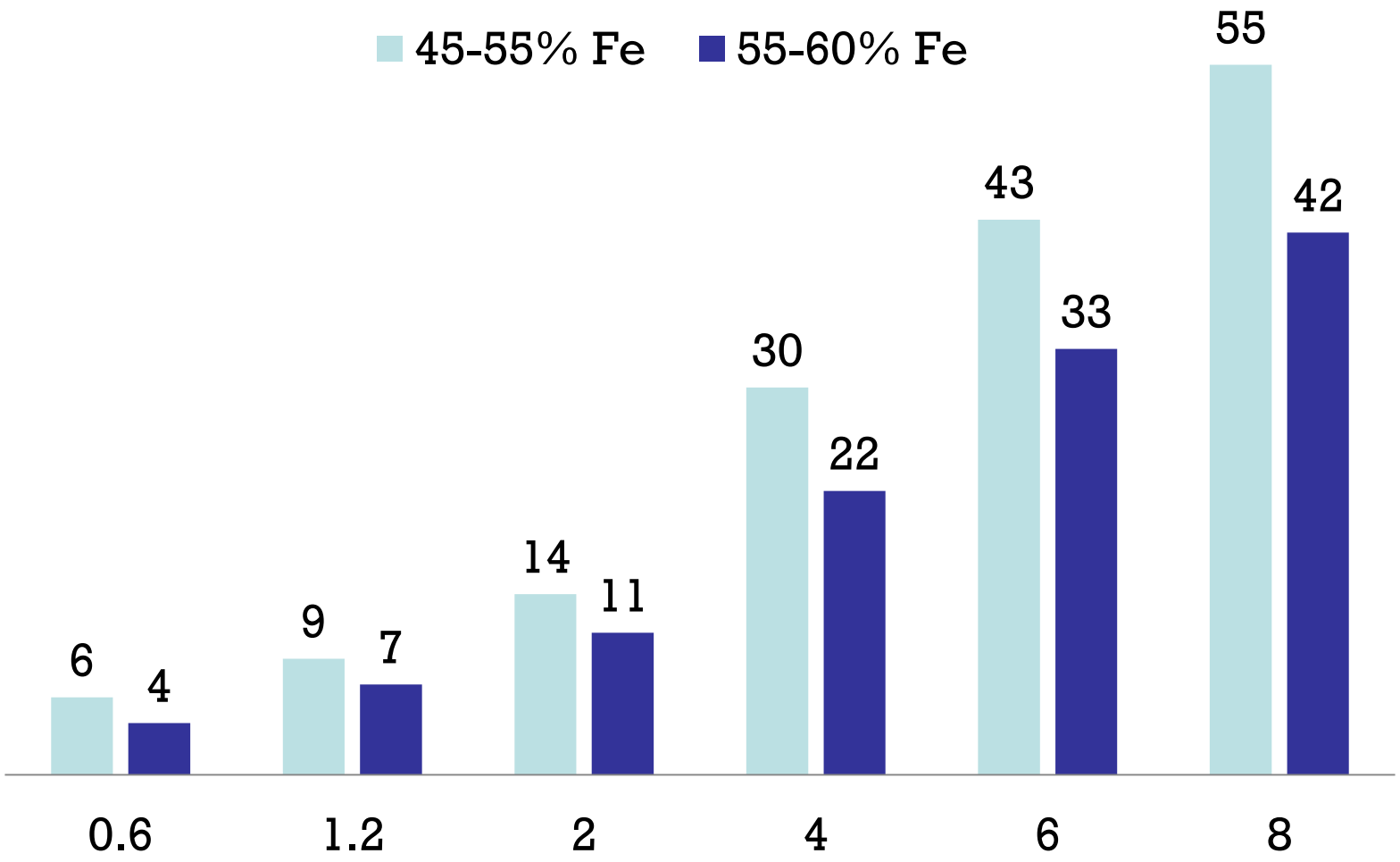
Assumptions of Basic Design Parameters –

Incoming power supply – 220 / 132 / 33 kV, 3 Ph., 50 Hz

Power factor – 0.95 and above

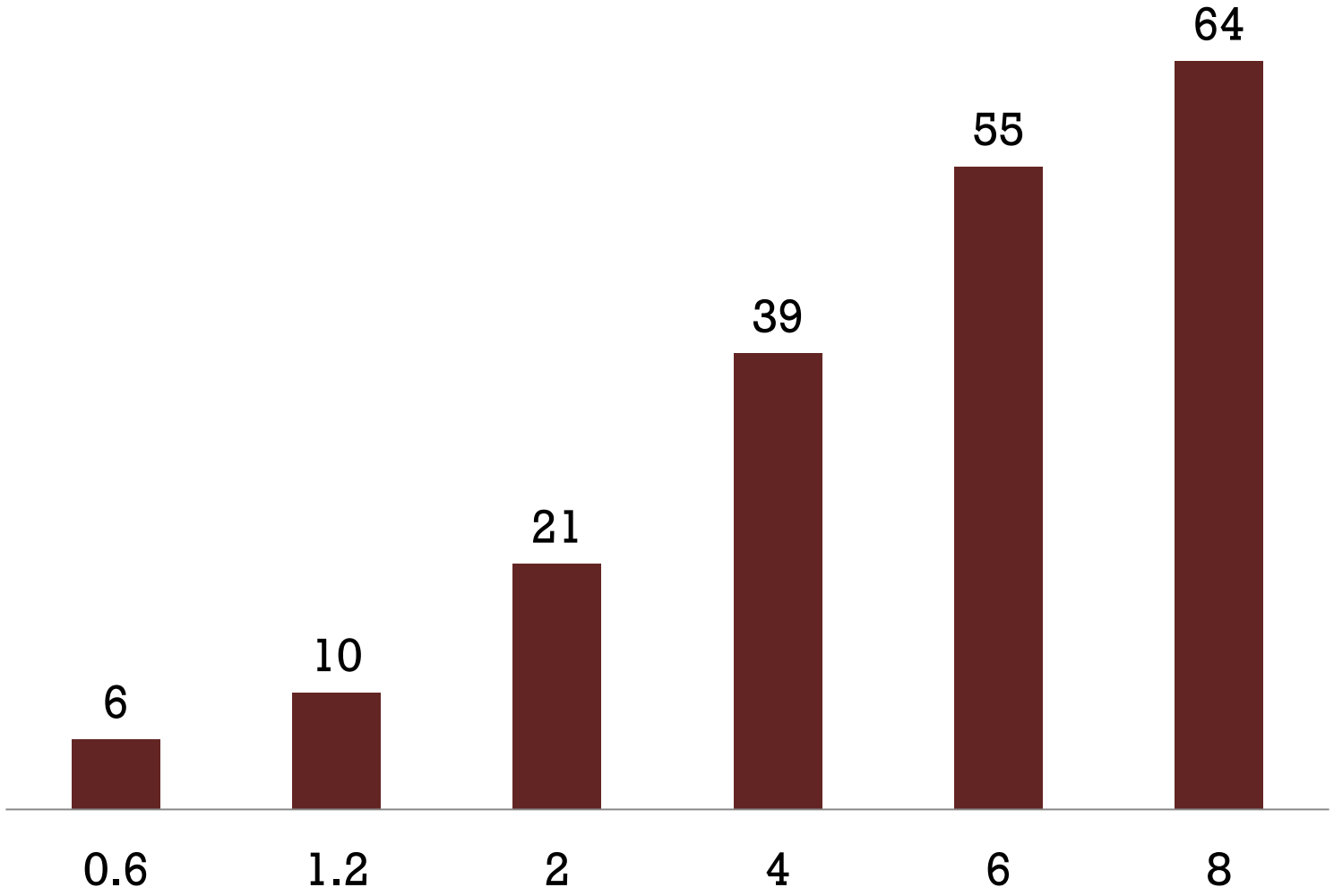
POWER : STAND-ALONE BENEFICIATION PLANT

all figures are in MVA



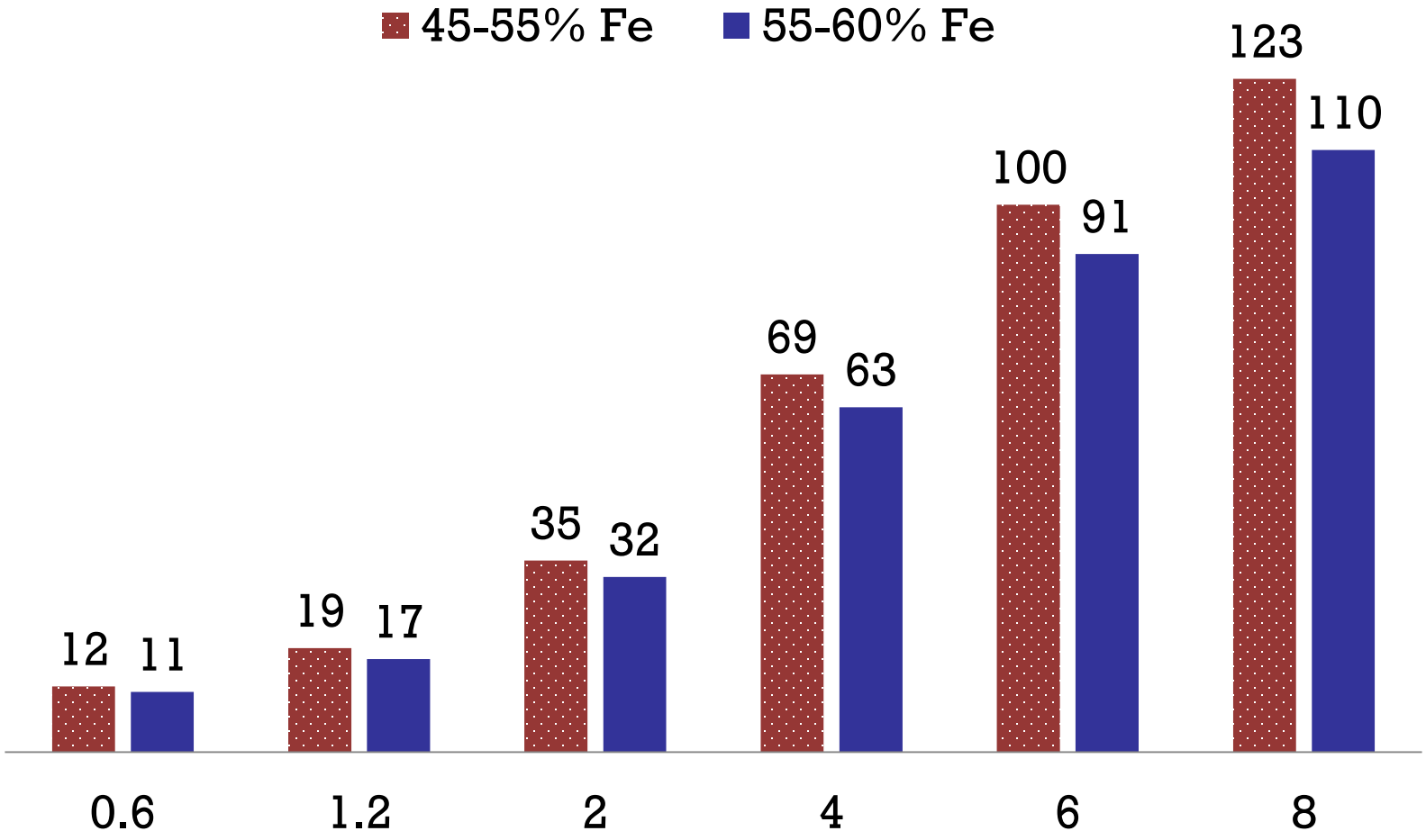
POWER : STAND-ALONE PELLET PLANT

all figures are in MVA



POWER : INTEGRATED BENEFICIATION & PELLET PLANT

all figures are in MVA



BREAK-UP OF LAND AREA REQUIREMENT

- Raw materials and finished products storage
- Water reservoir
- Green belt
- Technological facilities
- Service facilities
  - CAS & electrical system
  - Others comprise of water supply facilities (excluding water reservoir), pump houses, roads & drainage, administrative building, repair & maintenance shop, welfare canteen, security post & other service buildings, etc.

AREA REQUIRED FOR RMHS & FINISHED PRODUCTS

Sl. No.	Capacity of the plant (in Mt/yr)	0.6	1.2	2.0	4.0	6.0	8.0
	Description	Area (in Acres)					
1.	Standalone beneficiation plant (45-55% Fe)	8.4	12.8	16.2	31.2	46.9	60.8
2.	Standalone beneficiation plant (55-60% Fe)	7.4	8.8	13.6	26.5	39.2	45.2
3.	Standalone pellet plant	7.9	9.3	12.0	22.7	34.2	38.8
4.	Integrated beneficiation plant (45-55% Fe) and pellet plant	13.1	18.4	23.7	46.1	69.2	85.6
5.	Integrated beneficiation plant (55-60% Fe) and pellet plant	12.1	14.5	21.1	41.4	61.5	70.0

AREA REQUIRED FOR WATER RESERVOIR

Sl. No.	Capacity of the plant (in Mt/yr)	0.6	1.2	2.0	4.0	6.0	8.0
	Description	Area (in Acres)					
1.	Standalone beneficiation plant (45-55% Fe)	1.5	3.0	4.1	7.4	10.4	14.8
2.	Standalone beneficiation plant (55-60% Fe)	0.9	1.5	2.0	4.1	5.9	7.6
3.	Standalone pellet plant	0.9	1.5	2.0	3.3	4.4	5.3
4.	Integrated beneficiation plant (45-55% Fe) and pellet plant	2.2	3.7	5.9	10.5	14.8	19.2
5.	Integrated beneficiation plant (55-60% Fe) and pellet plant	1.5	2.7	4.1	7.0	10.1	12.9

AREA REQUIRED FOR GREEN BELT

Sl. No.	Capacity of the plant (in Mt/yr)	0.6	1.2	2.0	4.0	6.0	8.0
	Description	Area (in Acres)					
1.	Standalone beneficiation plant (45-55% Fe)	19.8	24.8	28.1	43.9	57.1	68.0
2.	Standalone beneficiation plant (55-60% Fe)	19.8	20.7	24.8	33.7	48.2	56.4
3.	Standalone pellet plant	14.9	16.5	20.5	38.3	46.2	49.5
4.	Integrated beneficiation plant (45-55% Fe) and pellet plant	32.0	39.3	44.9	71.0	87.8	101.0
5.	Integrated beneficiation plant (55-60% Fe) and pellet plant	32.0	34.7	42.2	62.4	78.9	89.8

AREA REQUIRED FOR TECHNOLOGICAL FACILITIES

Sl. No.	Capacity of the plant (in Mt/yr)	0.6	1.2	2.0	4.0	6.0	8.0
	Description	Area (in Acres)					
1.	Standalone beneficiation plant (45-55% Fe)	18.2	20.7	22.0	30.3	35.2	37.4
2.	Standalone beneficiation plant (55-60% Fe)	19.1	19.2	20.8	22.7	31.6	37.1
3.	Standalone pellet plant	11.8	12.5	15.2	28.5	30.4	31.0
4.	Integrated beneficiation plant (45-55% Fe) and pellet plant	31.8	36.8	39.3	56.0	60.3	64.2
5.	Integrated beneficiation plant (55-60% Fe) and pellet plant	32.9	34.0	38.8	50.0	56.7	63.6

AREA REQUIRED FOR SERVICE FACILITIES

Sl. No	Capacity of the plant (in Mt/yr)	0.6	1.2	2.0	4.0	6.0	8.0
	Description	Area (in Acres)					
1.	Standalone beneficiation plant (45-55% Fe)	12.1	13.8	14.7	20.2	23.4	25.0
2.	Standalone beneficiation plant (55-60% Fe)	12.8	12.8	13.9	15.1	21.1	24.7
3.	Standalone pellet plant	9.6	10.2	12.4	23.3	24.9	25.4
4.	Integrated beneficiation plant (45-55% Fe) and pellet plant	17.9	20.7	22.1	31.5	33.9	36.1
5.	Integrated beneficiation plant (55-60% Fe) and pellet plant	18.5	19.1	21.8	28.2	31.9	35.8

BREAK-UP OF QUANTITY OF WATER REQUIREMENT

- **Technological requirement**

- **Others**
  - **Losses : Compressor losses, Cooling losses, etc.**
  - **Balance requirement includes drinking, fire-fighting, ACVS, etc.**

WATER REQUIRED FOR TECHNOLOGICAL FACILITIES

Sl. No.	Capacity of the plant (in Mt/yr)	0.6	1.2	2.0	4.0	6.0	8.0
	Description	Make-up water (in m^3/h)					
1.	Standalone beneficiation plant (45-55% Fe)	40	80	130	245	380	500
2.	Standalone beneficiation plant (55-60% Fe)	20	40	67	134	200	267
3.	Standalone pellet plant	20	36	52	91	134	163
4.	Integrated beneficiation plant (45-55% Fe) and pellet plant	60	116	182	336	514	663
5.	Integrated beneficiation plant (55-60% Fe) and pellet plant	40	76	119	225	334	430

WATER REQUIRED FOR OTHER FACILITIES

Sl. No.	Capacity of the plant (in Mt/yr)	0.6	1.2	2.0	4.0	6.0	8.0
	Description	Make-up water (in m^3/h)					
1.	Standalone beneficiation plant (45-55% Fe)	10	10	20	25	30	40
2.	Standalone beneficiation plant (55-60% Fe)	10	10	13	16	30	33
3.	Standalone pellet plant	10	14	23	34	36	42
4.	Integrated beneficiation plant (45-55% Fe) and pellet plant	20	24	43	59	66	82
5.	Integrated beneficiation plant (55-60% Fe) and pellet plant	20	24	36	50	66	75

PLANTS VISITED BY MECON TEAM AS CASE STUDIES

Sl. No.	Name of plant	Type of plant	Location	Status of plant
1.	Jindal Steel & Power Ltd.	Integrated BP & PP	Barbil, Keonjhar	In Operation
2.	Brahmani River Pellets Ltd.	Stand-alone beneficiation plant	Barbil, Keonjhar	In Operation
3.	Arya Iron & Steel Company Ltd.	Stand-alone pellet plant	Barbil, Keonjhar	In Operation
4.	International Minerals Trading Co. Pvt. Ltd.	Stand-alone beneficiation plant	Barbil, Keonjhar	Under Implementation
5.	Pro Minerals Pvt. Ltd.	Stand-alone beneficiation plant	Barbil, Keonjhar	Under Implementation
6.	Ardent Steel Ltd.	Stand-alone pellet plant	Telkoi, Keonjhar	In Operation
7.	Sree Metaliks Ltd.	Integrated BP & PP	Telkoi, Keonjhar	In Operation (only PP)
8.	Brahmani River Pellets Ltd.	Stand-alone pellet plant	Duburi, Jajpur	In Operation
9.	Essar Steel Ltd.	Stand-alone pellet plant	Paradeep, Jagatsinghpur	In Operation

IRON ORE BENEFICIATION PLANT AS CASE STUDIES

Item	Sree Metaliks Ltd.	Pro Minerals Pvt. Ltd.	MECON's Estimate
Capacity (Mt/yr)	1.0	1.0	1.2
Feed (% Fe)	58.0	57.2	55 - 60
Product (% Fe)	63.0	65.1	64.0
Land (acres)	Not available	70	63
Water (m^3/h)	45	46.6	50
Power (MVA)	2.5 MW	4.5 MW	7

IRON ORE BENEFICIATION PLANT AS CASE STUDIES

Item	Brahmani River Pellets Ltd.	MECON's Estimate	REMARKS
Capacity (Mt/yr)	4.0	4.0	Water requirement is on the higher side due to disposal of iron ore concentrate from Barbil to Jajpur through slurry pipeline (192 km).
Feed (% Fe)	57.0	55 - 60	
Product (% Fe)	64.5	64.0	
Land (acres)	84	102	
Water (m^3/h)	480	150	
Power (MVA)	20.5	22	

0.6 Mt PELLET PLANT AS CASE STUDIES

Item	Sree Metaliks Ltd.	Ardent Steel Ltd.	MECON's Estimate
Land (acres)	50	46.6	45
Water (m^3/h)	21	Not available	30
Power (MVA)	5.0	12.7	6

Power requirement of M/s Ardent Steel includes,

- Grinding of iron ore fines
- Raw material handling yard

1.2 Mt PELLET PLANT AS CASE STUDIES

Item	Arya Iron & Steel Company Ltd.	MECON's Estimate
Land (acres)	No data/information received	50
Water (m^3/h)		50
Power (MVA)		10

4.0 Mt PELLET PLANT AS CASE STUDIES

Item	Jindal Steel & Power Ltd.	Brahmani River Pellets Ltd.	MECON's Estimate
Land (acres)	No data/ information received.	90	116
Water (m^3/h)		Not available	125
Power (MVA)		25	39

- It seems that green belt & other associated facilities has been compromised
- Seven (7) days finished pellet storage yard
- Less power consumption due to not operating at full capacity

6.0 Mt PELLET PLANT AS CASE STUDIES

Item	Essar Steel Ltd.	MECON's Estimate
Land (acres)	103	140
Water (m^3/h)	234	170
Power (MVA)	44	55

- Pellet plant is under integrated steel plant complex.
- Water consumption is more due to the inclusion of wet grinding of iron ore.
- Plant is operating at lower production capacities.

CONCLUSION

These figures are guiding norms for State Govt. & also for Entrepreneurs for getting allocation of land and infrastructure facilities in an optimal manner.

THANK YOU

MECON Limited
(A Govt. of India Enterprise)