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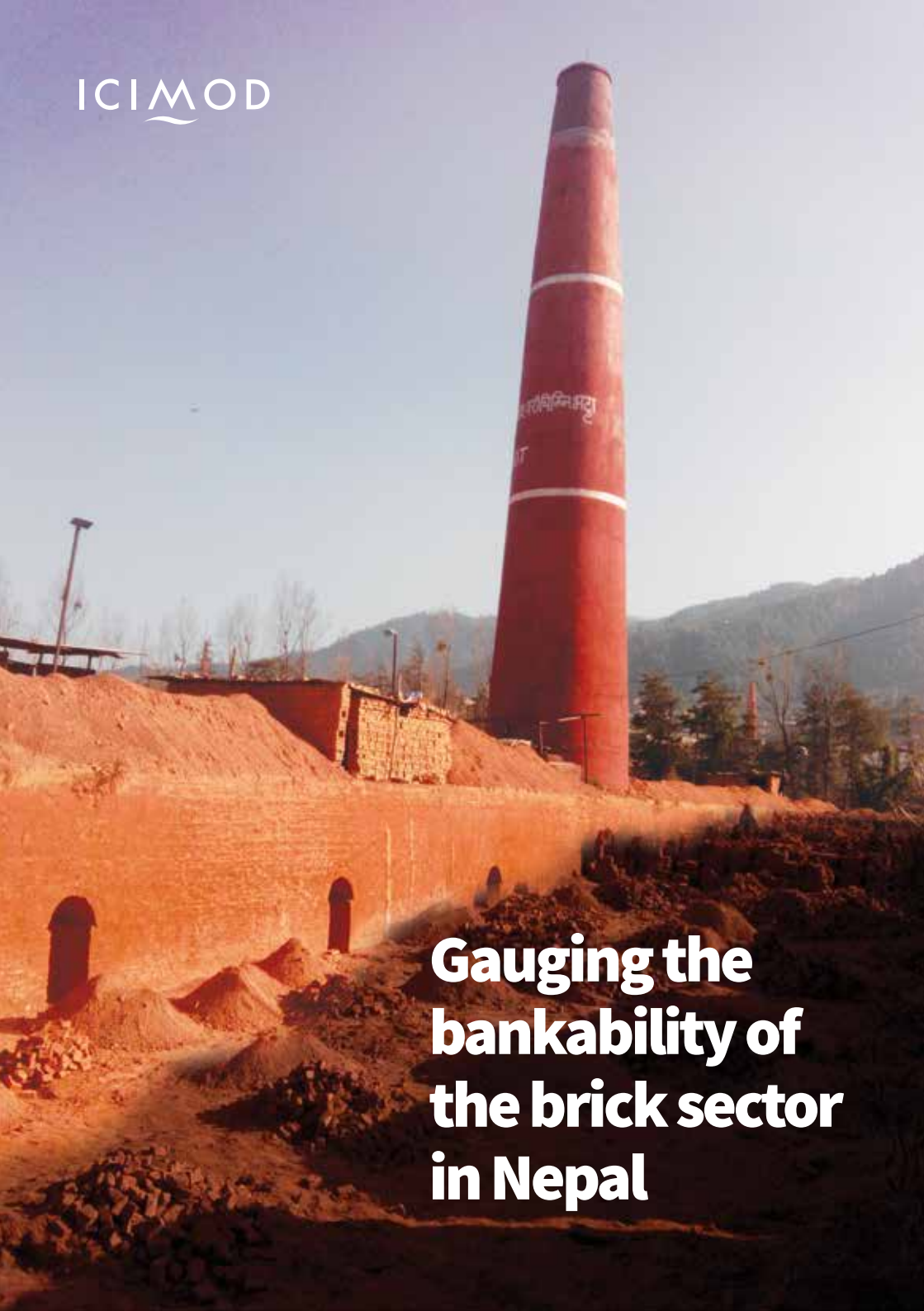

Gauging the bankability of the brick sector in Nepal

In Nepal, rapid urbanization has resulted in the growth of the housing and construction sectors, which has fuelled the growth of brick kilns. Analysis of the technical viability, social acceptability, and economic feasibility of the brick industry in Nepal indicates that the sector is bankable and may support further growth of all engaged in the industry.

This finding is based on an assessment of factors including business understanding; opportunities and trends; technical, social, and environmental aspects of business; economic feasibility; risk factors associated with the business; financing alternatives for the business; bankability of the business; and business projections and valuations.

Overall, brick kilns are seen to be economically feasible. The economic feasibility, technical viability, and social acceptability criteria indicate zig-zag kilns to be the technology of choice based on all counts of economic feasibility (investment and financial indicators) as well as business valuation (technical viability and social acceptability).

Towards bankable brick kiln projects

For existing brick kiln entrepreneurs, shifting from fixed chimney Bull's trench kiln (FCBTK) technology to fixed chimney zig-zag technology is convenient in terms of economic feasibility, social and environmental acceptability, and technical viability.

Specific recommendations based on a bankability assessment are:

- From an investment perspective, (technical, environmental, legal, social and economic factors) upgrading to zig-zag kilns from existing FCBTKs is


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feasible for entrepreneurs. Productivity and revenue streams are significant as the technology produces a greater volume of better quality bricks.

- For new start-ups with moderate risk appetite and medium return expectation, zig-zag kilns are the most suitable investment.
- As the most environmentally friendly technology, tunnel kilns are technically viable and socially acceptable. However, they require higher initial investment and therefore may be less feasible for some entrepreneurs. For new start-ups with high risk appetite and high return expectation, however, tunnel kilns are a most suitable long-term investment.
- Almost 60% of brick entrepreneurs in Nepal are operating FCBTKs and 26% are operating zig-zag kilns. For most investors, immediate switching of technology to tunnel kilns may be economically challenging.

About the brick sector

Bricks are the primary building material in Nepal. Clay, the main raw material for brick making, is available locally at low cost. Coal, the main fuel used by kilns, is imported from India. A small fraction of sawdust, firewood, bagasse, and agriculture residue are also used as fuel. Brick making is an energy- and labour-intensive process. Hand moulding of green bricks is widely practiced in Nepal and there is no mechanization of this process (except in large Hoffman Kiln units and a few FBTKs). The industry operates on a seasonal basis from November to May with the exception of a few large mechanized kilns with sheds for storing bricks.

Various modern and traditional technologies are used to manufacture bricks in Nepal: fixed chimney Bull's trench kiln (FCBTK), vertical shaft brick kiln (VSBK), fixed chimney zig-zag (both natural draught and induced draught), Hoffman kiln, and tunnel kiln. A majority of brick kilns use either FCBTK or fixed chimney zig-zag, and there is minimal use of VSBK, Hoffman, and tunnel kiln technologies.

- While FCBTKs are economically feasible – they require low investment during establishment in existing market conditions – they are highly polluting and are discouraged on social, environmental, and technical grounds. Although there is earning potential at present, the technology will face many challenges in the years to come.

A major shift towards zig-zag technology, which is fuel efficient, has high production quality, and reduces pollution emissions is already taking place. Taking into account technical, environmental, legal, social, financial and economic factors into consideration, FC zig-zag are the most suitable technology for transformation and upgradation on existing FCBTKs. Production and revenue streams have both proven to be excellent.

Under optimistic (best), average (likely) and pessimistic (worst) scenarios, year-on-year net profit and net profit margins are high enough to attract entrepreneurs. Annual net profit for a five-year period ranges from ~NPR 2 million to NPR 26 million. The projected internal rates of return for all three scenarios show above market returns. The converted projects also have a quick payback period. Adequate debt service coverage ratio means banks are more open to financing loans and average return on equity is high enough to attract entrepreneurs to the conversion to zig-zag kilns.

THE BUSINESS CASE FOR CONVERTING FCBTKS TO ZIG-ZAG KILNS

	FCBTK to zig-zag		
Key financial indicators	**Optimistic**	**Average**	**Pessimistic**
Project internal rate of return (%)	123.39	72.57	36.12
Project payback period (Years)	1.34	1.83	2.64
Debt service coverage ratio	13.04	9.50	6.31
Interest coverage ratio	67.80	48.70	31.36
Average return on equity (%)	18.80	16.50	13.10

COMPARISON OF THREE TYPES OF BRICK KILNS, COST OF CONVERSION, AND POTENTIAL REDUCTION OF DIFFERENT TYPES OF POLLUTANTS

Base data	**Cost (NPR millions)**	**Energy consumption (MJ/kg of fired brick)**	**Environmental performance (g/kg of fired brick)**					
			SPM	$PM_{2.5}$	SO_2	CO	CO_2	Black carbon
FCBTK	20	1.22	0.86	0.18	0.66	2.25	115.00	0.13
Technology transfer (assuming equivalent production)	**Additional investment for conversion (NPR millions)**	**Energy saving (MJ/kg of fired brick)**	**Environmental performance (reduction in comparison with FCBTK) (g/kg of fired brick)**					
			SPM	$PM_{2.5}$	SO_2	CO	CO_2	Black carbon
FCBTK to VSBK	30	22.1%	87.2%	50.0%	18.2%	18.2%	39.1%	98.5%
FCBTK to zig-zag	10.5	8.2%	69.8%	27.8%	51.5%	34.7%	10.4%	69.2%
FCBTK to tunnel	210	-20.5%	63.9%	0.0%	-9.1%	-8.9%	-44.3%	~100%
FCBTK to Hoffmann	70	45.1%	70.9%	NA	NA	NA	26.1%	

Particulars	Investment (NPR)	Remarks
Structure change cost	8,000,000	This cost includes the cost of changing the width of the outer wall and reconstructing the flow of canals (nalis) inside the kiln. The labour and raw material charges and other charges are included here.
Transformer	1,000,000	As brick kilns are situated away from the main cities, a transformer is needed for high voltage of electricity
Fan	700,000	The fan needs power supply from a high-grade line
Fan motor	50,000	The motor required to run the fan
Fan regulator (VVT)	130,000	The regulator needed to change the speed of the fan as required
Generator	500,000	A backup system for the fan in the absence of electricity from the grid
Government charges	20,000	Electricity office charges for the installation of a new meter for high voltage lines
Miscellaneous	100,000	Other charges – for digging new nalis inside kilns or replacing wire required for electricity to the transformer from the main grid
Total	**10,500,000**	

At NPR 10,500,000, the cost of conversion from FCBTK to zig-zag is the lowest among technologies. Conversion cost estimates are as shown in the table above.

Profitability indicators for FCBTK, zig-zag and tunnel technologies over a five-year period are all positive for profit and loss account, total revenue, operating profit, and profit after tax. Average net margins span 8.10%–9.80% for FCBTK; 7.30%–16.80% for zig-zag kilns; and 8.30%–23.50% for tunnel kilns.

Sensitivity analyses for FCBTK, zig-zag and tunnel kilns based on key components such as number of bricks produced, number of bricks sold, selling price, cost of goods sold, and operating expenses were altered under optimistic, average and pessimistic scenarios over a projected period of five years. The sensitivity analyses illustrate that under all three scenarios, brick kilns generate profits which are sustainable over the projected period, illustrating the viability of brick kilns in Nepal.

Bankability of brick kilns: FCBTK, zig-zag, tunnel

Bank lending to set up or convert to any of the three types of kilns makes business sense, though conversion to zig-zag makes better business sense long-term. Even under the pessimistic scenario, the financial indicators illustrate strong business sustainability and viability of the brick kilns under the three technologies. These ratios improve further under average and optimistic scenarios.

Debt service coverage ratio (DSCR) is a popular benchmark used in the measurement of an entity's ability to produce enough cash to cover its debt payments. DSCR, even under a pessimistic scenario for FCBTKs, zig-zag kilns, and tunnel kilns are 6.08, 5.30 and 4.36 times respectively. DSCR above 1 is considered to be good for banks to disburse loans.

Returns on equity (ROE) measure how well a company uses investments to generate earnings growth. ROE, even under the pessimistic scenario for FCBTKs, zig-zag kilns, and tunnel kilns, are 12.90%, 11.50% and 9.70% respectively. The ROE's strength in the pessimistic scenario illustrates economic and business feasibility.

	Technologies under pessimistic scenario			Bankability
Key financial indicators	**FCBTK**	**FC Zig Zag**	**Tunnel**	
Project internal rate of return (%)	29.02	27.96	13.12	Strong
Project payback period (Years)	2.93	2.91	3.60	Strong
Debt service coverage ratio	6.08	5.30	4.36	Strong
Interest coverage ratio	30.73	25.80	19.30	Strong
Average return on equity (%)	12.90	11.50	9.70	Strong
Equity value per share	224.21	178.93	116.98	Strong

Project internal rates of return, even under a pessimistic scenario for FCBTKs, zig-zag kilns, and tunnel kilns are 29.02%, 27.96%, and 13.12% respectively. These are above average rates of return compared to the prevailing average fixed deposit rate (over the last decade) of around 8% in Nepal.

Project payback periods (PBP), even under a pessimistic scenario for FCBTKs, zig-zag kilns, and tunnel kilns are 2.93 years, 2.91 years, and 3.60 years respectively. PBPs are below four years for all technologies and below the number of projected years. Such quick payback periods make sense for banks and investors.

Equity value per share is another metric which equity investors would look into before making investment decisions. Even in pessimistic scenarios, all three kilns have sound business valuation and are attractive to equity investors. For instance, with tunnel kilns, investors stand to gain an additional NPR 16.98 on their initial investment of NPR 100.

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