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Iran’s Iron and Steel Industry Report

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Energy Commission

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Introduction

The iron and steel industry is one of the main pillars of the industrial and export development of the Iranian economy. At the same time, due to its significant energy consumption and the dependence of part of the production chain on natural gas and electricity, it is considered an important sector in policies to reduce energy intensity and greenhouse gas emissions.

This report aims to provide a technical and policy framework to present the capacities, challenges, and opportunities for decarbonizing the Iranian steel industry within the framework of discussions related to COP31.

This report presents macro-industry trends, major company actions, and relevant national and international data. The data in this report is mainly extracted from sustainability reports, management commentary reports, and specialized news related to major Iranian steel companies, as well as national reports and international data.

In this report, the following methodological distinction has been made between the three types of data:

- **Statistical and performance data of Iranian industry:** including production statistics, exports, energy consumption, and macro-industry indicators.
- **Modeled data and case studies:** including results of modeling energy scenarios and ranking energy efficiency and emission reduction solutions.
- **Policy objectives and proposals:** which should not be confused with approved goals or achieved data.

Also, wherever available resources do not allow for direct calculation of indicators such as annual emission reduction, CAPEX, IRR or payback period, providing unsubstantiated numbers has been avoided.

Chapter 1: Baseline and Current Ecosystem

1-1- Sector megatrends and economic importance

Iran's crude steel production reached about 32.055 million tonnes in 2025, an increase of about 7% compared with the previous year and the highest reported production level. Iran's steel production also rose from about 15.641 million tonnes in 2013 to 32.055 million tonnes in 2025, representing growth of about 105% over this period.

The export value of Iran's iron and steel chain, from iron ore to final products, was reported at about USD 9.7 billion in 2025, an increase of 15% compared with the previous year. However, based on seven-month statistics for 2025, the share of production units in steel exports decreased to about 40%, indicating growth in exports of raw materials (concentrate and pellets) and a decline in the share of final product producers in this growth.

This position shows that any energy efficiency improvement program in Iran's steel industry, given the scale of production, has considerable potential for impact. The competitive advantages of Iran's steel industry include access to natural resources, raw materials and iron ore mines; low production costs resulting from cheap energy and local technologies; geographical location and export capacity; environmental sustainability potential; and rapid industrial growth.

Table 1. Trend of Iranian Steel Production (2013-2025)

Year	Intermediate steel production (million tons)
2013-2014	15,641
2020-2021	29,270
2021-2022	30,000
2022-2023	31,100
2023-2024	30,000
2024-2025	29,958
2025-2026	32,055

Source: Iranian Alloy Steel Producers Employers' Association [1].

Table 2. Comparison of capacity and production of major Iranian steel companies

Company	Nominal capacity (million tons)	Actual production in 2025 (million tons)	Main product type	Technology
Mobarakeh Steel	~11.5 (Development Program)	~7.5	Hot, Cold, Coated Sheets	DRI–EAF
Khuzestan Steel	~3.8	~3.5	Billet, slab	DRI–EAF
Isfahan Steel	~3.6	~2.5	Beam, Rail	BF-BOF
Hormozgan Steel	1.5	~1.5	Slab	DRI-EAF
Iranian Butia Steel	1.5 (EAF)+2.0 (DRI)	~1.0	Slab, Sponge Iron	DRI-EAF

1-2- Greenhouse gas emission inventory and share of national emissions

The steel industry accounts for about 6% of the country's gas consumption, and the gas consumption of this industry in 2025 was reported at about 53.2 million cubic meters per day. The maximum total gas consumption of the country in the winter of 2025 was also announced at about 886 million cubic meters per day. The steel industry's share of the country's electricity consumption is also reported at about 9.3%. These data show the position of the steel industry in the country's energy balance, but energy consumption alone is not an indicator equivalent to the greenhouse gas emissions inventory.

Iran's steel industry is mainly based on the gas-based direct reduction–electric arc furnace (DRI-EAF) route, and about 80% of its energy is supplied by natural gas. This structure makes its emission intensity significantly lower than that of the blast furnace–basic oxygen furnace (BF-BOF) route, but higher than routes based on scrap and clean electricity.

International evidence and case study

The iron and steel sector accounted for about 20% of total industrial energy consumption worldwide in 2020. China's iron and steel industry also consumes about 15.2% of total national energy. According to international reports, the iron and steel industry accounts for about 6 to 7% of global greenhouse gas emissions. The global emission intensity of the BF–BOF route is reported at about 2.33 tonnes of CO_2 per tonne of crude steel, and that of the EAF route at about 0.68 tonnes of CO_2 per tonne of steel. The management discussion and analysis report

of Mobarakeh Steel for the year 2025 cites CO_2 figures of 2.09 and 1.74 tonnes per tonne of two different types of products.

Comparison of estimated absolute emissions of Iranian steel companies in 2025

The chart below shows the ranking of 20 steel companies based on reported emissions in million tonnes of carbon dioxide equivalent ($MtCO_2e$). This indicator represents absolute annual emissions from direct sources and should not be confused with "emission intensity per tonne of steel" or "total emissions of the complex". Larger companies may have higher absolute emissions simply because of the scale of production. Also, a valid comparison among companies requires consistency in the reporting year, organizational boundary, coverage of direct and indirect emissions, and calculation method. Therefore, this ranking should be used as an initial picture for identifying focus points in emissions data collection, and not by itself as a criterion for judging companies' environmental performance or technological efficiency.

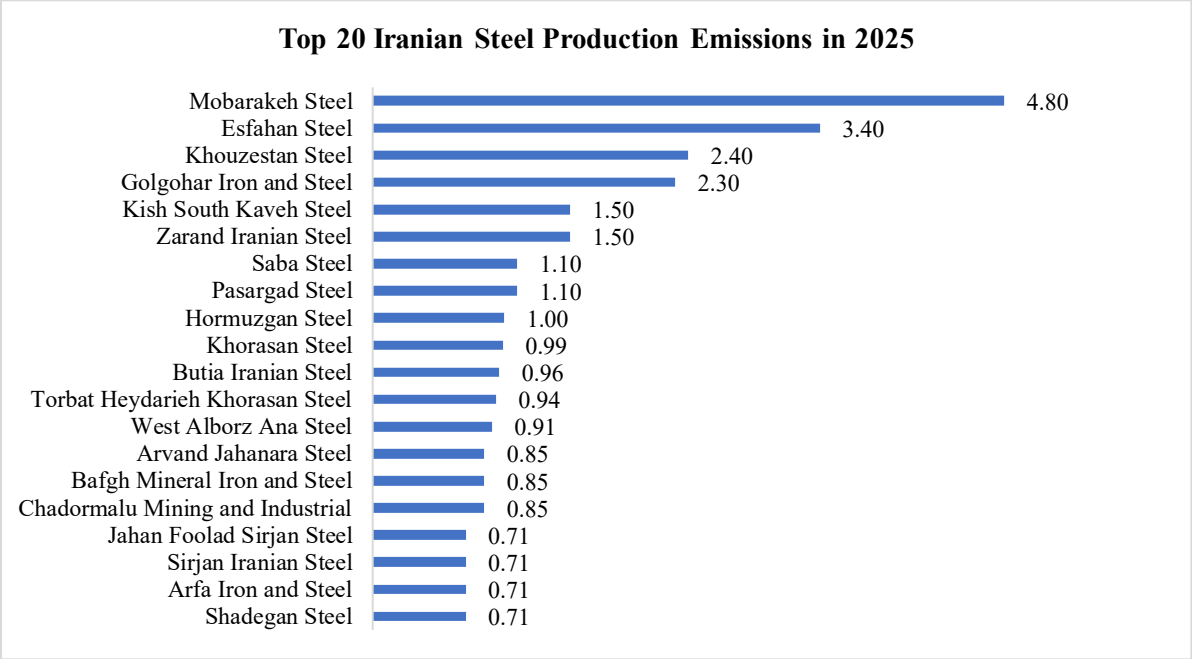


Figure 1. Absolute Emission Ranking of Iranian Steel Companies [9]

Historical trend of metals sector releases

According to the national climate change reports published by the Department of Environment, three national reports have so far been published based on data for the base years 1994, 2000

and 2010. In the third national report, greenhouse gas emissions from the industrial processes sector in 2010 were reported at 61,857 gigagrams, of which the share of the metals industry (including iron and steel) was about 12,090 gigagrams.

The values for 1994, 2000 and 2010 are referenced in the table to the national reports; in contrast, the values for 2018 and 2025 are explicitly presented as "estimates." The increase in the estimated value in recent years may be affected by changes in the level of industrial activity, data coverage and estimation method, or an increase in industrial output.

Table 3. Historical and estimated emissions data for the metals manufacturing sector

Year	Metal Production Emission ($MtCO_2e$)	Reference
1994	12.74	Iran 1st National Communication
2000	13.50	Iran 2nd National Communication
2010	12.09	Iran 3rd National Communication
2018	28.27	Estimate
2025	32.20	Estimate

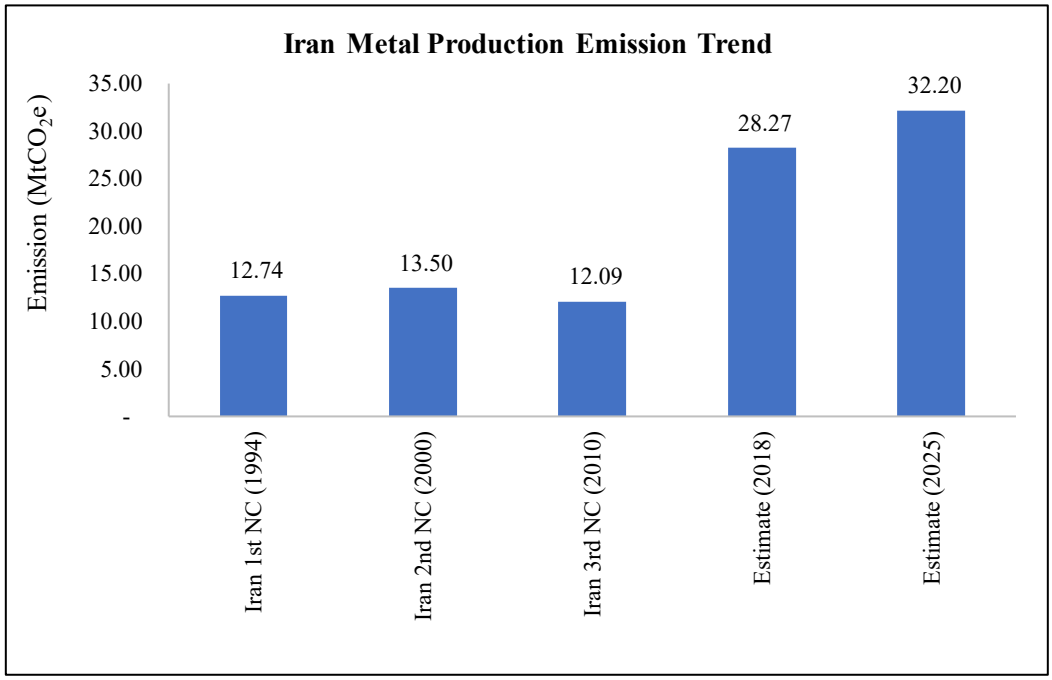


Figure 2. Historical trend of metal production emission estimates in Iran

1-3- Evaluation of previous emission reduction measures

In 1404, about 7.66 million tonnes of steel production were lost due to energy constraints, and the corresponding foreign-exchange loss was reported at about USD 3.16 billion. The total production lost due to electricity and gas constraints in the years 1400 to 1404 was about 33.82 million tonnes, with a corresponding foreign-exchange loss of about USD 16.45 billion. Therefore, the lever of energy constraints has also been added to the incentive of iron and steel companies to set emission reduction targets, and as a result, extensive measures have been designed and some of them implemented.

Table 4. Key actions of steel companies in the field of emissions and environment (2023-2025)

Company	Action	Details
Mobarakeh Steel	Carbon footprint calculation	Conducted according to ISO-14064 and ISO-14067
Mobarakeh Steel	Reducing energy consumption	From 28 gigajoules to less than 25 gigajoules per ton
Khuzestan Steel	Installation of 39 dust collectors	11.7% reduction in dust emissions despite increased production
Khuzestan Steel	520 MW combined cycle power plant	The first phase of the program
Khuzestan Steel	Windfencing Project	Height 27 meters, area 37 hectares
Khuzestan Steel	Wastewater recycling	70 Percentage of treated wastewater recycled
Khuzestan Steel	Green space	550 Hectare (5.5times the legal requirements)
Isfahan Steel	PCI Project (Powder Coal Injection)	Reducing coke consumption and reducing2000 tons of CO_2 In the year
Isfahan Steel	Reducing water withdrawal from Zayandeh Rood	Wastewater treatment plant with a capacity of 6.7 million cubic meters per year
Hormozgan Steel	Hydrogen injection program in direct reduction unit	Hydrogen Reduction Pilot
Hormozgan Steel	Purchase of municipal wastewater	125 million cubic meters of wastewater from Bandar Abbas
Iranian Butia Steel	Air quality monitoring station and wastewater analyzer	Credit of 160 billion Rials
Iranian Butia Steel	Green space	3050 Hectare
Setareh Simin Hormoz	1.72-million-ton direct recovery megamodule	Iranian technolog, IRRmore than 42 percent

Source: Sustainability and performance reports of companies and specialized news agencies.

Development of renewable power plants in steel companies

In recent years, many Iranian steel companies have placed the development of solar and wind power plants on their agenda. Mobarakeh Steel, with the 600-megawatt Aftab Shargh plant, has implemented a project to build a concentrated solar power plant with a capacity of 600 megawatts. Mobarakeh Steel also has a plan to build a 200-megawatt wind power plant on its agenda. Butia Iranian Steel is also constructing a 400-megawatt solar power plant. Khuzestan Steel also has a 520-megawatt combined cycle power plant in its plans.

Based on data collected from major steel companies, the total nominal capacity of the renewable projects identified in this report, including projects under implementation and planned, is about 2,000 megawatts, which indicates the industry's serious commitment to moving toward clean energy. This trend has accelerated in recent years and can be pursued as one of the main axes of the working group's mission in the area of reducing carbon emission intensity.

1-4- Regional benchmarking and comparison of carbon intensity with global standards

In 2025, Iran ranked tenth among the world's steel producers with crude steel production of about 32 million tonnes. Turkey ranked seventh with about 38.1 million tonnes, and Saudi Arabia ranked eighteenth with about 10.8 million tonnes.

Table 5. Comparison of Iran's crude steel production with regional countries

Country	Production (million tons)	World ranking
Türkiye	38.1	7
Iran	32.0	10
Saudi Arabia	10.8	18
United Arab Emirates	3.8	35

Performance gap in energy efficiency

The criterion of "performance gap in energy productivity" is considered an important issue for evaluating the performance of Iran's steel industry, but converting this proposition into a national numerical gap requires the collection of independent and verifiable operational data and energy accounting. Moreover, a review of international studies shows that energy

productivity in Iran's iron and steel industry is low due to equipment obsolescence and cheap energy, and the level of energy waste in this industry is high.

In recent years, the carbon footprint of steel products has been compiled in some Iranian producing companies. Access to this information is not possible due to industrial confidentiality, but energy intensity or emission intensity indicators can be used as another criterion for comparing the performance of Iranian producers with other regional and international companies.

The intensity of production diffusion in Iran

- Gas-based DRI-EAF route: about 1.10 to 1.2 tonnes of CO_2 per tonne of crude steel,
- BF-BOF route (limited share in Iran): about 1.85 to 2.5 tonnes of CO_2 per tonne,
- Industry-wide average: a calibrated scientific analysis for 2024 estimated an average of 1.58 tonnes of CO_2 per tonne of crude steel for Iran's entire industry.

Comparison with regional benchmarks

Available statistics show that Iran lies in the middle range of the region, but its "low-emission" basis is fragile. The gas-based DRI-EAF route has prevented the high emissions associated with the BF-BOF route, but emission intensity in the range of 1.1 to 1.2 tCO_2e per tonne of product remains significantly higher than the statistics reported for Turkey and the UAE. Iran's main challenge is not "technological backwardness," but the dual lock-in of natural gas as both a reducing agent and an energy source. Another analysis shows that "full gasification" of the existing route would bring only about a 14% reduction in emissions, whereas hydrogen-based direct reduction could achieve decarbonization of up to 80%.

Turkey's advantage is structural and is not related to the efficiency of individual units. The low emission intensity in Turkey's reports stems from the 70% share of electric steel and the 85% scrap utilization rate. If Iran wants to approach this level, the main levers are increasing the scrap share in the electric arc furnace and reducing the electricity emission factor.

Saudi Arabia and the UAE show high internal dispersion. The high average emission intensity in Saudi Arabia compared with the statistics of the other countries mentioned is mainly due to the BF-BOF share. The statistics published for the UAE, with a large gap between the low and

high levels, show that the industry average can make the picture look either too bad or too good.

In summary, Iran, with the gas-based DRI-EAF route at about 1.1–1.2 tonnes of CO_2 per tonne, stands higher than Turkey with its predominantly electric structure (0.36), close to the UAE industry average (1.32) but higher than the best Emirati practices (0.67), and lower than the Saudi production average (2.20). The narrative of emission reduction in Iran's steel sector should focus on the transition from gas-based DRI to hydrogen-based DRI, and not merely on optimizing the existing gas-based route.

Chapter 2: Decarbonization Roadmap and Potentials

2-1- Quantitative emission reduction targets

The lack of a mandatory and uniform reporting system at the industry level makes direct comparison of company targets difficult. Targets should be compared with one another by specifying the system boundary, base year and methodology, and this requires a mandatory sectoral reporting framework as a prerequisite for compliance with international standards. Despite this, the emission reduction targets announced by Iranian companies in this sector have been introduced. The current picture of the target-setting of Iran's iron and steel companies can be summarized in three layers: corporate targets (with significant differences in ambition), technological plans, and industrial frameworks.

At the governance level, IMIDRO and the Iranian Iron and Steel Association have emphasized the formulation of a green steel production roadmap. The resolution of the 1403 Steel Symposium includes items such as the use of hydrogen in iron ore reduction instead of carbon, moving toward clean energy, and smartization. The Iranian Steel Producers Association also emphasizes that, given the high share of sponge iron (more than 70%), the emission intensity of Iran's industry is lower than that of the blast furnace route, but the use of hydrogen without renewable clean energy does not bring about a real reduction in carbon emissions. Therefore, without simultaneous decarbonization of the electricity grid, the claim of hydrogen-based "green steel" can in practice lead to a transfer of emissions from Scope 1 to Scope 2.

Mobarakeh Steel has the clearest and most structured target-setting. The company has set a target of a 30% reduction in greenhouse gas emissions by the year 1410 (2031) and achieving carbon neutrality by the year 1428 (2050). These targets have been formulated within the framework of a carbon neutrality roadmap and based on emission calculation according to ISO 14064 and carbon footprint according to ISO 14067. Mobarakeh has received the first international certificates for greenhouse gas emission management and product carbon footprint in Iran.

Khuzestan Steel has announced the most ambitious target and has spoken of a 90% reduction in carbon emissions by the 1410 horizon. This target is defined in connection with an investment of 10,500 billion rials in hydrogen-based reduction and the deployment of digital

infrastructure. However, this figure, compared with other actors and without a precise separation of system boundary and base year, requires independent verification.

Hormozgan Steel has not announced a specific numerical target, but has focused on hydrogen injection in the direct reduction unit as the main path for green steel production and is in the process of concluding a contract for the construction of hydrogen transmission pipelines from the refinery in order to become "Iran's first green steel producer."

Isfahan Steel has a different approach based on process improvement. The company has succeeded in reducing greenhouse gases by 20% through the pulverized coal injection (PCI) project in the blast furnace. Also, by reducing coke consumption, about 2,000 tonnes of carbon dioxide emissions have been reduced annually. These measures are specific operational steps, but Isfahan Steel, as the only major producer with a blast furnace–basic oxygen furnace route, faces a much more serious structural challenge for deep decarbonization than other companies.

Kaveh South Kish Steel has also taken a technological path and focuses on replacing hydrogen with methane gas and establishing carbon market infrastructure in cooperation with the National Environment Fund. The company is also constructing an 85-megawatt solar power plant.

Chadormalu Company has also not announced a specific numerical reduction target, and its focus is on improving energy productivity in the reduction plant and moving strategically toward "green industry."

2-2- Proposing a balanced decarbonization path

According to statistics from the Iranian Steel Association, in 2025 about 75% of the country's crude steel production capacity is based on gas-based direct reduction technology combined with electric arc furnace (DRI-EAF), and only the remaining 25% is supplied through the blast furnace–basic oxygen furnace (BF-BOF) route. This technology route generally has lower carbon emission intensity compared with the conventional blast furnace route, but it still depends on a stable supply of energy resources. Iran's steel industry produced about 32.055 million tonnes of steel in 2025, and its capacity utilization rate was about 63%. Also, 7.66 million tonnes of production were lost due to energy constraints. Based on the calculations

presented, the 63% utilization rate means that actual production in 2025 was equivalent to about 7.5 months of operation at full capacity, and about 4.5 months of capacity was lost.

On this basis, targets have been proposed for the country's iron and steel industry to reduce this gap while also reducing greenhouse gas emissions through increased productivity and process integration, as follows:

Short-term:
Reducing production lost due to energy constraints from 7.66 million tonnes to less than 5 million tonnes per year.

Medium-term:
Increasing the utilization rate from 63% to more than 80%, subject to the removal of energy, water, infrastructure and market constraints.

Long-term:
A gradual but ambitious move toward:

- Increasing the scrap share and Scrap–EAF
- Improving the productivity of DRI–EAF routes
- Developing renewable electricity
- Reducing specific energy consumption
- Technical and economic assessment of H_2-DRI
- Developing emission measurement and reporting infrastructure.

2-3- Opportunities and costs of emission reductions

Investment trends in renewable power plants in the steel industry

In recent years, Iran's major steel companies have undertaken extensive measures to build renewable power plants. Table 2-1 provides a summary of notable projects. For example, Mobarakeh Steel, by building a 600-megawatt solar power plant, has created the country's largest concentrated solar power plant. With the full operation of this plant, 350 million cubic meters of gas will be saved annually and 810 thousand tonnes of CO_2 emissions per year will be prevented. These statistics show that renewable energies are recognized as one of the fundamental axes for green investment in Iran's iron and steel industry, and given the large number of producers in this industry, there is still high potential for growth in this trend.

Estimation of electricity needs of the steel industry

According to the monitoring report, to realize the 20-year vision at the 1404 horizon and produce 57.77 million tonnes of intermediate steel, 47,382 million kilowatt-hours of electricity per year are required (equivalent to an average load of about 5,410 megawatts); this amount is about 1.11 times the current steel consumption. For 1407, more than 11,500 megawatts of electricity is estimated.

Table 6. Investment trend in renewable power plants in the steel industry

Company	Power plant type	Capacity (MW)	Status	Details
Mobarakeh Steel	Solar	600	The first phase of 120 MW was put into operation	Investment of 350 ;million euros saving 350 million cubic meters of gas per year; reducing810 thousand tonsof CO_2 peryear
Mobarakeh Steel	Wind	200	On the agenda	Engineering design
Mobarakeh Steel	Combined cycle	914	Two gas units put into operation	58% net efficiency, 97.9% water saving and 40% gas saving
Khuzestan Steel	Solar	600 (Three Phases of 200)	The first phase is in Behbahan, the second phase is in Gotvand	First phase groundbreaking ceremony, November 2024
Khuzestan Steel	Combined cycle	546	The second phase was put into operation	Three-unit block including two gas units and one steam unit
Iranian Butia Steel	Solar	400	Under construction	Article 16 License; One of the Largest Solar Projects in the Industry
Steel Sangan	Wind	200	On the agenda	Khaf-Sangan area EPC/EPCF contract

Article 16 of the law and the Requirements for Providing Renewable Electricity

Based on Article 16 of the Knowledge-Based Production Leap Law, industrial units with a consumption power exceeding one megawatt are required to supply the equivalent of one percent of their annual electricity needs through the construction of renewable power plants, and this amount must reach at least five percent by the end of the fifth year. Also, based on the Law on Removing Obstacles to the Development of the Electricity Industry, energy-intensive industries are required to build at least 1,000 megawatts of renewable and clean power plants by the end of the year 1404 from their internal resources. The estimated future electricity demand of the steel industry, on the one hand, and the law requiring the construction of renewable power plants, on the other hand, show that the investment of steel companies in renewable energies is no longer a choice, but a necessity for their sustainable development and profitability.

Emphasizing the necessity of calculating carbon footprints and international frameworks

At the international level, the global steel industry is moving toward stricter carbon footprint standards. This makes the accurate calculation of the carbon footprint of Iranian steel products and the obtaining of valid international certificates doubly necessary as a prerequisite for maintaining export competitiveness. Among the most important carbon- and sustainability-related frameworks in the steel industry, one can mention ISO 14067, the GHG Protocol, CBAM rules, and the concepts of Responsible Steel, GRI and CDP.

Mobarakeh Steel Company of Isfahan, for the first time in this industry, has completed the project of establishing a carbon management system and calculating the carbon footprint of products based on ISO 14064 (quantification and reporting of organizational emissions) and ISO 14067 (product carbon footprint) standards and has successfully received their valid international certificates after undergoing verification processes in 2025. Other major Iranian steel companies have also begun similar measures in this direction and are in the process of establishing carbon management systems and compiling the carbon footprint of their export products. The implementation of these measures is recommended in all producing companies of the iron and steel industry, especially exporters.

The necessity of using international voluntary carbon markets (VCMs)

Given the constraints on domestic financial resources, voluntary carbon markets can be examined as a complementary source. Industrial emission reduction projects can be evaluated for crediting through regional markets, including the GCC; however, the issuance and sale of credits are not guaranteed and depend on the baseline, monitoring and reporting, verification, and market conditions. It is recommended that feasibility studies be conducted to assess this pathway for energy efficiency projects, renewable energy, and other emission reduction pathways that have methodologies.

2-4- Assessing technology needs and technological gaps

Studies conducted show that the main technological needs of Iran's iron and steel industry in the field of greenhouse gas emission reduction are as follows:

1. **Energy efficiency and load management:** Given the high consumption of electricity and gas and grid constraints, energy management systems, heat recovery, furnace optimization and smart load management should be placed on the implementation priority. In recent years, Mobarakeh Steel has been able to reduce its energy consumption from 28 gigajoules to less than 25 gigajoules per tonne.
2. **Renewable energy:** A study by Mobarakeh Steel shows that solar and wind resources have suitable capacity for integration with the industrial load pattern.
3. **Energy storage:** Another review shows that batteries can increase supply stability, but a useful life of 5 years and high replacement costs affect the economic justification of the project.
4. **Circular economy and scrap:** The emission intensity of Scrap–EAF is reported at about 0.69 tonnes of CO_2 per tonne of steel; therefore, increasing the use of scrap can be considered one of the potential pathways for reducing carbon emission intensity, subject to the availability, quality and appropriate price of scrap.
5. **H_2-DRI:** Hydrogen is one of the potential long-term pathways for steel decarbonization, but for Iran, low-carbon hydrogen production, renewable electricity,

electrolyzers, transmission infrastructure and final cost must be assessed independently and taking into account technical-economic assumptions.

Energy productivity improvement solutions

A comprehensive study has identified 30 solutions in three general categories—production, process, and consumption management—for improving energy productivity in Iran's steel industry. This set can be used as an initial framework for identifying the technological and managerial needs of Iran's steel industry. The identified solutions are:

- Precise control of the melting process by installing sensors sensitive to melting parameters;
- Preventive and regular maintenance of production equipment;
- Use of heat-recovery burners for furnace heating and reduction of flue gas outlet temperature;
- Smart energy monitoring and management and identification of loss variables;
- Reduction of tapping temperature and number of stoppages to reduce melting time;
- Control of oxygen level and adjustment of combustion air fan speed;
- Creation of foamy slag in the electric arc furnace;
- Temperature control and reduction of excess air in the preheating furnace;
- Heat recovery from the transfer section;
- Use of high-efficiency compressors;
- Control of pressure and temperature in the compressed air system;
- Preheating of scrap in electric arc furnaces;
- Separation and compaction of scrap to reduce melting time;
- Control of furnace pressure and prevention of cold air entry into the preheating furnace;
- Use of recuperative burners for reheating furnaces;
- Insulation of furnaces, heat exchangers and transfer pipes;
- Continuous smart monitoring and control of the production process;
- Optimization of steelmaking and continuous casting scheduling;
- Implementation of direct rolling (integrated casting and rolling);
- Use of high-efficiency electric arc furnace;

- Commissioning of an optimized combined heat and power system;
- Preheating of scrap and post-combustion in the shaft furnace;
- Use of variable speed drives in ventilation fans;
- Use of modern and airtight doors;
- Pulverized coal injection;
- Separation of electricity consumption of different sections by installing separate meters;
- Reduction of the coincidence factor of large consumers to reduce demand and increase the load factor;
- Implementation of lighting management programs in the plant;
- Adjustment and calibration of furnace thermocouples;
- Use of high-efficiency electric motors in furnace fans.

This list shows the most important technological gaps in Iran's steel industry from the perspective of energy productivity and can be used as a basis for formulating short-term and medium-term implementation plans.

2-5-Analysis of obstacles to develop steel industry and its decarbonization

The most important barriers to the development of the iron and steel industry have been identified as follows.

A) Energy imbalance

In 2024, blackouts began earlier than usual, and in May, severe restrictions were imposed on electricity consumption by the steel and cement industries, and an increase in industrial electricity tariffs to about 28 times the 2019 level was also reported. Electricity restrictions from mid-April in some cases reached 90%, and in practice only units that had their own power plant or had purchased green electricity from the energy exchange were able to maintain a minimum level of production. For this reason, in the spring of 2025, steel production decreased by 4.8% compared with the same period the previous year.

B) Electricity and gas infrastructure

The steel industry's heavy dependence on electricity and gas means that grid instability directly affects production, productivity and the economics of industrial projects. According to reports, the household sector's share of electricity and gas consumption has reached about

80 to 85 percent, which has shifted the main burden of energy constraints onto productive sectors, including industry and agriculture, during peak consumption periods.

C) Investment and technology limitations

Decarbonization projects require advanced equipment, long-term capital and access to technology. Therefore, financing and technology transfer mechanisms must be defined as core components of the decarbonization roadmap. According to reports, the total investment required to resolve the imbalances in the electricity sector alone is estimated at USD 84 billion.

D) Regulatory barriers

The development of green projects requires coordination among energy, industrial, trade, tax and environmental policies. Equipment obsolescence and cheap energy are among the main causes of energy waste in Iran's iron and steel industry. Also, a comprehensive study on identifying and ranking energy productivity improvement solutions in Iran's steel industry is considered an important research gap. The barriers to the development of decarbonization in Iran are not only infrastructural and economic, but also knowledge-related and informational. Sanctions, restrictions on technology transfer, domestic regulations, electricity and gas grid infrastructure, or foreign investment risk are among the influencing factors.

2-6- Just transition requirements and employment management

The transition to low-carbon steel production should not be reduced solely to reducing greenhouse gas emissions. Technological change may alter the structure of skills, employment and the supply chain. Therefore, the following measures are proposed:

- Training of human resources for low-carbon technologies;
- Development of energy and data skills;
- Creation of new job opportunities in renewable energy;
- Development of the domestic equipment supply chain;
- Support for regions dependent on steel industries alongside decarbonization projects.

Social and employment initiatives of steel companies

Given the considerable growth of renewable energy service companies in Iran, many of the engineering services and equipment required for these power plants will be supplied through

domestic consulting firms and manufacturers, which will result in indirect job creation and the expansion of the country's electricity industry in the renewable sector.

Water consumption and resource management

Many Iranian steel producers, including Khuzestan Steel, Mobarakeh Steel, Butia Iranian Steel, Kavir Kashan Steel and others, have taken fundamental measures in the field of water consumption optimization, such that today a significant percentage of the water used in their production processes is supplied through recycling systems or municipal wastewater treatment. In addition to reducing withdrawals from raw water resources, these measures have played an important role in managing water stress and reducing dependence on municipal and agricultural water resources.

Education and empowerment

Based on the reviews, the multi-criteria logic of the study shows that decision-making on productivity solutions should not be single-criterion. Implementation time, available technology, impact on energy consumption, implementation cost and required infrastructure must also be considered simultaneously. This approach can be used as a methodological principle in designing a broader just transition framework, provided that employment, skills and regional justice criteria are added to it in subsequent studies. It is also recommended that in future research, environmental and long-term sustainability criteria be added to the set of evaluation criteria, which can be taken into account in designing just transition programs. Paying attention to all these pillars not only requires supporting studies and research and development, but also the training and capacity-building of various individuals and stakeholders based on its results will be inevitable. In this process, different levels of stakeholders need to receive training and empowerment.

Chapter 3: Green Investment

3-1- Investment Opportunities Matrix

The main green investment opportunities in Iran's iron and steel industry, based on the previous data in this report, are categorized in the following matrix.

Table 7. Main green investment opportunities in Iran's iron and steel industry

Area	Opportunity basis	Financial data status
Increasing capacity utilization	63% Utilization rate	Requires feasibility study
Reducing energy constraints	7.66 milliontons of production lost	Need project design
Development of alloy steel	Imports 333 thousand tons, $630 million USD	Need a financial model
H_2 - DRI	High capacity of Iran's DRI	Requires independent study
Coated sheets	39% Exploitation	Requires feasibility study
Energy efficiency and consumption management	30 Rankedsolutions	E nomically screenable
Renewable energy and self-sufficiency	Projects over 2500 MW under construction	E nomically screenable

3-2- Identity card of priority projects

In the continuation of this section, priority projects in Iran's steel industry are introduced.

Project 1: Increasing the utilization rate of steelmaking capacity

The country's nominal steelmaking capacity is about 50.8 million tonnes and actual production is about 32.055 million tonnes, and therefore the utilization rate has been reported at about 63%. Increasing the utilization rate to 80% is the target proposed in this report, which, if realized, would add about 9 million tonnes to annual production.

Energy productivity in Iran's iron and steel industry is low due to equipment obsolescence and cheap energy, and the level of energy waste in this industry is high. Therefore, increasing the utilization rate of existing capacity is considered not only a production opportunity but also an opportunity to improve energy productivity and reduce greenhouse gas emissions. The solutions identified in the previous section, including precise control of the melting process by

installing sensors, preventive maintenance and smart energy monitoring, can be used as practical steps to increase utilization and reduce specific energy consumption in this project.

Project 2: Reducing production lost due to energy constraints

Statistical studies showed that the total production lost in the years 2021 to 2025 amounted to more than 33 million tonnes and the total foreign-exchange loss caused by it exceeded USD 16 billion. Reducing production lost to less than 5 million tonnes per year is the target proposed in this study, which, if realized, will result in an increase in production of 13 million tonnes over a five-year program.

Earlier-than-usual blackouts and the imposition of severe restrictions on electricity consumption by steel industries, as well as the increase in industrial electricity tariffs (to about 28 times the 2019 level), show that the steel industry, in order to reduce lost production, needs investment in stable energy supply (self-supply power plants, renewable energies, long-term electricity and gas contracts, and development of independent gas fields). Also, load management and consumption optimization solutions such as reducing the coincidence factor of large consumers can be used as low-cost measures to reduce losses caused by energy constraints.

Project 3: Development of alloy steels

Alloy steel production has been reported at about 1.6 million tonnes and its share at about 5%. Alloy steel imports were about 333 thousand tonnes worth USD 630 million; based on these figures, the average import value is about USD 1,892 per tonne, while the average export price of intermediate steel and steel products has been reported at about USD 431 per tonne. Reviews show that the development of technologies for producing higher value-added steel requires improving energy productivity and reducing specific energy consumption. Solutions such as precise control of the melting process, optimization of steelmaking and continuous casting scheduling, and implementation of direct rolling can be considered as part of the technology package required for the development of alloy steels.

Project 4: Hydrogen-based direct reduction

For the H_2-DRI process, capital cost, hydrogen price, hydrogen consumption, electricity cost, electrolyzer capacity, electricity emission intensity and baseline must be determined independently. This technology is currently considered an emerging and costly technology for

Iran's steel industry; therefore, H_2-DRI should be considered a long-term project requiring an independent and comprehensive feasibility study.

Based on the studies conducted, low-carbon hydrogen and renewable electricity in Hormozgan province of Iran can enable a very low-emission DRI–EAF-based steel production pathway. In some studies, hydrogen injection into the blast furnace reduces carbon emissions by up to 20%.

Project 5: Development of coated sheets

Coated sheet production has been reported at 1.7 million tonnes, while there is a nominal capacity of 4.4 million tonnes in Iran. This means that the utilization rate is 39% and the theoretical unused capacity is about 2.7 million tonnes.

For the development of coated sheets, energy productivity improvement solutions such as insulation of furnaces, heat exchangers and transfer pipes, heat recovery from the transfer section, and use of variable speed drives in ventilation fans can be considered as part of the technical design in order to reduce specific energy consumption and carbon emissions.

3-3- Roadmap and legal incentives for foreign investor entry

Based on the research conducted, four groups of incentives can be presented for investor entry into Iran's low-carbon steel industry.

1. **Tax incentives:** tax incentives for research and development, innovation, development of new grades and low-carbon technologies, drawing on international experiences. Currently, part of companies' costs in the field of research and development is deducted from their taxes.
2. **Energy incentives:** long-term contracts and stable energy supply mechanisms for projects that have demonstrated performance in reducing energy or carbon intensity. Contracts with Karvar companies that result in natural gas savings are among these incentives.
3. **Facilitating technology imports:** redesigning tariffs for equipment and technologies needed for decarbonization, subject to maintaining targeted support for domestic manufacturing, is one of the lines that can be pursued and implemented in this area.

4. **Green financing:** establishing long-term credit lines for renewable energy, energy productivity, alloy steel and low-carbon technology projects is among other facilities that can be used depending on various conditions and facilities.

Chapter 4: Strategic Perspective and Demands

4-1- Task Force Mission Statement

The proposed mission of the Iron and Steel Industry Working Group of the Energy Commission of the Iran Chamber of Commerce for participation in the COP31 summit is: "The gradual transition of Iran's iron and steel industry from capacity-oriented development to a competitive, energy-efficient, low-carbon and value-added-based industry, while preserving the country's energy security, employment and export position."

This mission is based on the following five axes:

- Increasing productivity and energy security;
- Reducing carbon emission intensity;
- Developing the circular economy and scrap consumption;
- Developing high value-added products;
- Attracting technology and capital for green projects.

4-2- Policy stance towards global trends

Given the export-oriented nature of Iran's steel industry, the issue of "***reducing carbon emission intensity***" is considered not merely an environmental requirement but part of industrial competitiveness and access to global markets. The dependence of many emission reduction solutions on energy savings creates an additional necessity for their implementation in economic terms (both from the perspective of energy costs and from the perspective of avoiding production cuts due to energy constraints).

On the issue of trade restrictions related to carbon emissions, including the Carbon Border Adjustment Mechanism (CBAM), this report refrains from providing a specific figure for its cost or financial impact; however, it considers the following three policy measures necessary:

- Establishing a national measurement, reporting and verification (MRV) system for emissions;
- Developing a real carbon footprint for exported steel products;
- Building technical capacity to provide valid carbon data and certificates to international markets.

4-3- Policy recommendations to the government to facilitate regulations

The recommendations of the Iron and Steel Working Group for facilitating regulations related to the subject of this report are as follows:

1. **Prioritizing the energy security of the industry**

   Given the 7.6 million tonnes of production lost in 2025, resolving the electricity and gas imbalance should be considered one of the preconditions of industrial policy in the steel sector. Developing long-term renewable electricity contracts can strengthen energy security and reduce emissions.

2. **Financing decarbonization projects**

   Energy productivity, renewable energy, heat recovery and carbon emission reduction projects should have access to long-term and preferential financial resources. According to reports, the total investment required by the electricity industry to resolve the imbalances is estimated at USD 84 billion. This figure indicates the necessity of using diverse financial resources, including international voluntary carbon markets.

3. **Developing tax incentives for research and development**

   International experiences show that tax support for research and development can be one of the tools of industrial policy, especially in the field of energy and carbon optimization.

4. **Targeted reform of tariffs on decarbonization equipment and technologies**

   Tariffs on decarbonization equipment and required technologies should be set in a way that facilitates technology entry while supporting competitive domestic manufacturing.

5. **Establishing a steel MRV system**

Establishing a national Measurement, Reporting and Verification (MRV) system for emissions from the steel industry can be a prerequisite for Iran's systematic entry into low-carbon steel markets. Developing unified emission calculation and reporting procedures based on international standards and norms, including CBAM, ISO 14067, etc., can be part of the pillars of this system.

6. **Facilitating the use of international voluntary carbon markets**

It is proposed that the Ministry of Industry, Mine and Trade, in cooperation with the Department of Environment, examine the possibility of registering and validating emission reduction projects of the steel industry in voluntary carbon markets (such as the GCC) and selling their carbon credits. This pathway can serve as a complementary financial source and an incentive for the economic viability of many emission reduction solutions.

Final summary

The existing baseline evidence shows that Iran's steel industry is at an international scale in terms of production and exports, but it faces two simultaneous challenges: first, energy imbalance and infrastructure constraints; and second, the necessity of reducing energy and carbon intensity to maintain international competitiveness.

In 2025, with production of about 32 million tonnes of steel and chain exports of about USD 9.7 billion, Iran's steel industry is considered one of the country's strategic industrial and export sectors. The analyses in this report confirm that energy security, productivity and decarbonization of the steel industry must be viewed within an integrated policy framework. Operational data from major steel companies show that extensive measures have been taken in recent years in the areas of renewable power plants, emission reduction, water recycling and energy consumption optimization, which can serve as a basis for benchmarking and extending the experience to other industrial units. The total nominal capacity of the renewable projects identified in this report, including projects under implementation and planned, is estimated at about 2,000 megawatts, which indicates the steel industry's growing attention to the transition toward clean energy sources.

The decarbonization roadmap of Iran's steel industry should be based on three main pillars, including energy security, energy productivity and the development of low-carbon technologies. In the short term, priority should be given to reducing losses caused by energy constraints and implementing low-cost productivity solutions. In the medium term, increasing the utilization rate of existing capacity and developing renewable power plants should be placed on the agenda. In the long term, moving toward emerging technologies such as H_2-DRI and developing emission measurement and reporting infrastructure is essential.

The results showed that, in addition to the previous points, two key priorities for a sustainable future in the steel industry are:

- **The necessity of calculating the carbon footprint and obtaining international certificates:** Given the global shift toward stricter carbon standards, Iranian steel companies have placed the calculation of the carbon footprint of their products on the agenda based on CBAM or ISO 14067 standards and are in the process of obtaining valid international certificates. This is considered a prerequisite for maintaining export competitiveness and facing trade restrictions.

- **The necessity of using international voluntary carbon markets:** Given the constraints on domestic financial resources, voluntary markets (such as the GCC) can be examined as a complementary option for financing emission reduction projects.


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