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Part 1

Section 1 製銑プロセスの検討

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1. 高炉－転炉プロセス

高炉プロセスを図1-1に示す。
高炉プロセスは原料として塊成化鉱石もしくは塊鉱石とコークスを必要とする。
このプロセスは一般的にコークス炉と焼結機を必要とする。高炉から溶銑が生産され、転炉で製鋼される。

高炉プロセスでは、粉鉱石から作られた焼結及びペレットを使用し、粘結炭から作られたコークスを還元材及び燃料として使用する。これらの原燃料は高炉炉頂から装入する。

高温空気は高炉下部から吹き込まれ、炭材を燃焼する。発生したガスは炉内を上昇しながら、鉄酸化物を還元し、装入物を昇温する。鉄鉱石類は炉内を降下しながら高炉中部から下部にかけて軟化溶融する。溶銑は炉床に貯蔵され、数時間間隔で出銑される。

高炉炉頂ガスは、ガス清浄設備でダストが除去された後、製鉄所内で加熱用燃料として使用される。余剰ガスは発電所の燃料に使用する。

高炉－転炉法は世界の大多数の製鉄所で採用されており、最も一般的で技術の確立されたプロセスである。

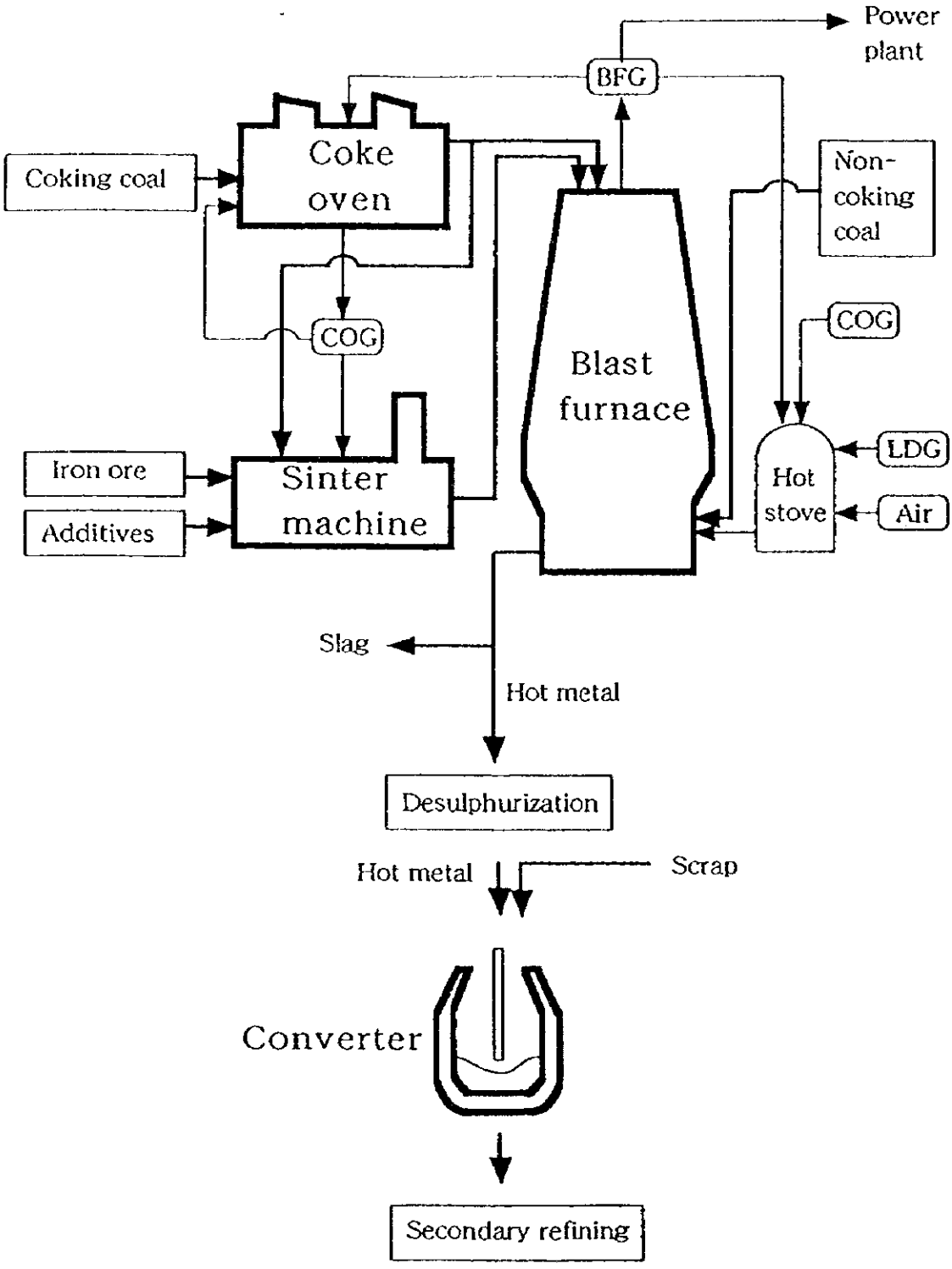


Figure 1-1 Blast furnace process flow

2. 直接還元-電気炉

直接還元-電気炉法による製鋼法は現在世界で操業中の製鋼法の中で二番目に大きなシェアーを占めている。直接還元法の中でも、工業規模で実績を有するか商業的に提案されている次のプロセスが代表的なものである。

天然ガスによるプロセス；
- MIDREX プロセス
- HYL-III プロセス
- FINMET（従来の FIOR）プロセス
- IRON CARBIDE プロセス

石炭によるプロセス；
- SL/RN プロセス
- FASTMET プロセス

2.1 MIDREX プロセス

最初の MIDREX プラントは、米国 Midrand Ross Corp.により買収されていた Surface Combustion Co.の MIDREX 部門によって 1969 年に米国オレゴン州ポートランドに建設された。1974 年には Korf グループが同部門を買収し Midrex Corp.を設立したが、1980 年代初頭に Korf グループは資金面で行き詰まり、1983 年に Midrex を神戸製鋼に売却し現在に至っている。

MIDREX プロセスは（図 1-2 参照）酸化鉄ペレットや塊鉱石を高純度の還元鉄（DRI）もしくはホット・ブリケット（HBI）に転換するプロセスである。酸化鉄の還元は連続的に進行し、シャフト炉の炉頂から供給される酸化鉄が重力により下降しながら還元が進み、炉底部から DRI もしくは HBI となって排出される。還元ガスは化学量論の(stoichiometric) CO_2 リフォーマーで生成される。このリフォーマーは新規の天然ガスとシャフト炉から循環する炉頂ガスとの混合物を約 920℃で改質する。還元ガスは水素と一酸化炭素を 90 から 92%を含んでおり、平衡状態に近い状態でリフォーマーから出てくるので、クエンチングは必要とせず、直接シャフト炉へ供給され約 850℃で還元が行われる。

シャフト炉排ガスの一部はリフォーマー・バーナーの燃焼用に使用され、残りはリフォーマーへ循環する。リフォーマーの熱効率は包括的な熱回収システムにより飛躍的に向上している。熱交換器がリフォーマーの煙道ガスから顕熱を回収しリフォーマー・バーナーで使用する燃焼用空気を 650℃まで予熱し、リフォーマーへ供給されるプロセス・ガス（炉頂ガスと天然ガスとの混合物）を 540℃まで予熱する。

製造される還元鉄は常温で排出することもできるし、ホット・ブリケット状で排出もできる。ブリケットはクエンチ・タンクで冷却されるか散水で冷却される。シャフト炉は低圧で運転され、炉内には固体とガスとの接触を容易にするための多くの機械的な装置やフロー・エイド装置が内蔵されている。

MIDREX プロセスの大きな特徴はその製品品質にある。シャフト炉内の一様なガス分配は原料鉱石が変わった時でも一様な金属化率が得られることを確実なものにしている。

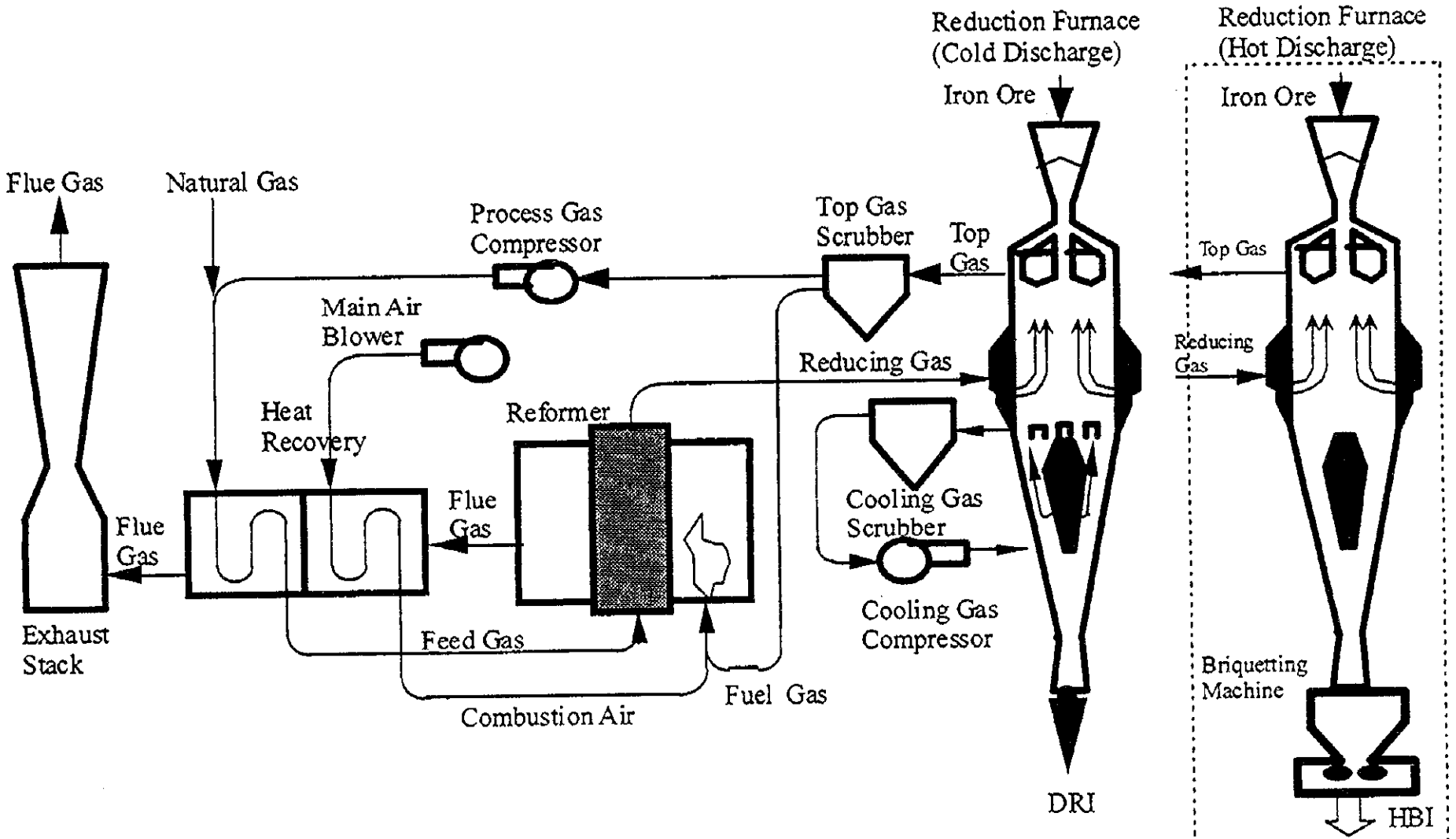


Figure 1-2 MIDREX Process Flow

2.2 HYL-III プロセス

最初のHYLプラントは1957年にメキシコのPueblaに建設された。この技術はHYL-Iとして知られバッチ式に運転される4基の固定層リアクターを使用していた。1969年には改良型バッチ式のHYL-IIの開発が始まった。それと同時にHYLはシャフト炉を用いた連続プロセスであるHYL-IIIの開発に着手し、最初の商業規模のHYL-IIIプラント2M5が1979年に運転を開始した。

HYL-IIIプロセスは（図1-3参照）酸化鉄のペレットあるいは塊鉱石をシャフト型リアクターで還元するプロセスである。還元ガスは、還元プロセスの補給用としての水素と一酸化炭素を作る、水蒸気リフォーマーで生成される。改質されたガスはクエンチされて過剰の水蒸気が除去されてから再加熱される。

還元ガスは補給されたガスと循環ガスとの混合ガスから成る。還元サーキットの基本的構成はリアクター以外では（1）還元ガスを920℃まで加熱するためのガス・ヒーター（2）炉頂ガスを除塵し冷却しH_2Oを除去するためのスクラバー（3）循環ガス圧縮機（4）CO2除去装置から成り立っている。ここでは循環ガスの再利用をより効率的にするためにシステムからCO_2が選択的に除去される。

電力ゼロ方式では発電用にスティーム・タービンを用いる。タービン用の蒸気は還元ガスをクウェンチングする過程で得られる熱を利用して発生する。シャフト炉は高圧で運転され、炉の出口部にある“クラスター・ブレーカー”以外は炉内には機械的な装置やフロー・エイド装置などは内蔵されてはいない。

リアクター排出ガスはCO_2が除去された後、循環して使用される。製造されるDRIは常温で排出もできればホット・ブリケットにもできる。ブリケットはクエンチ・タンクで冷却される。

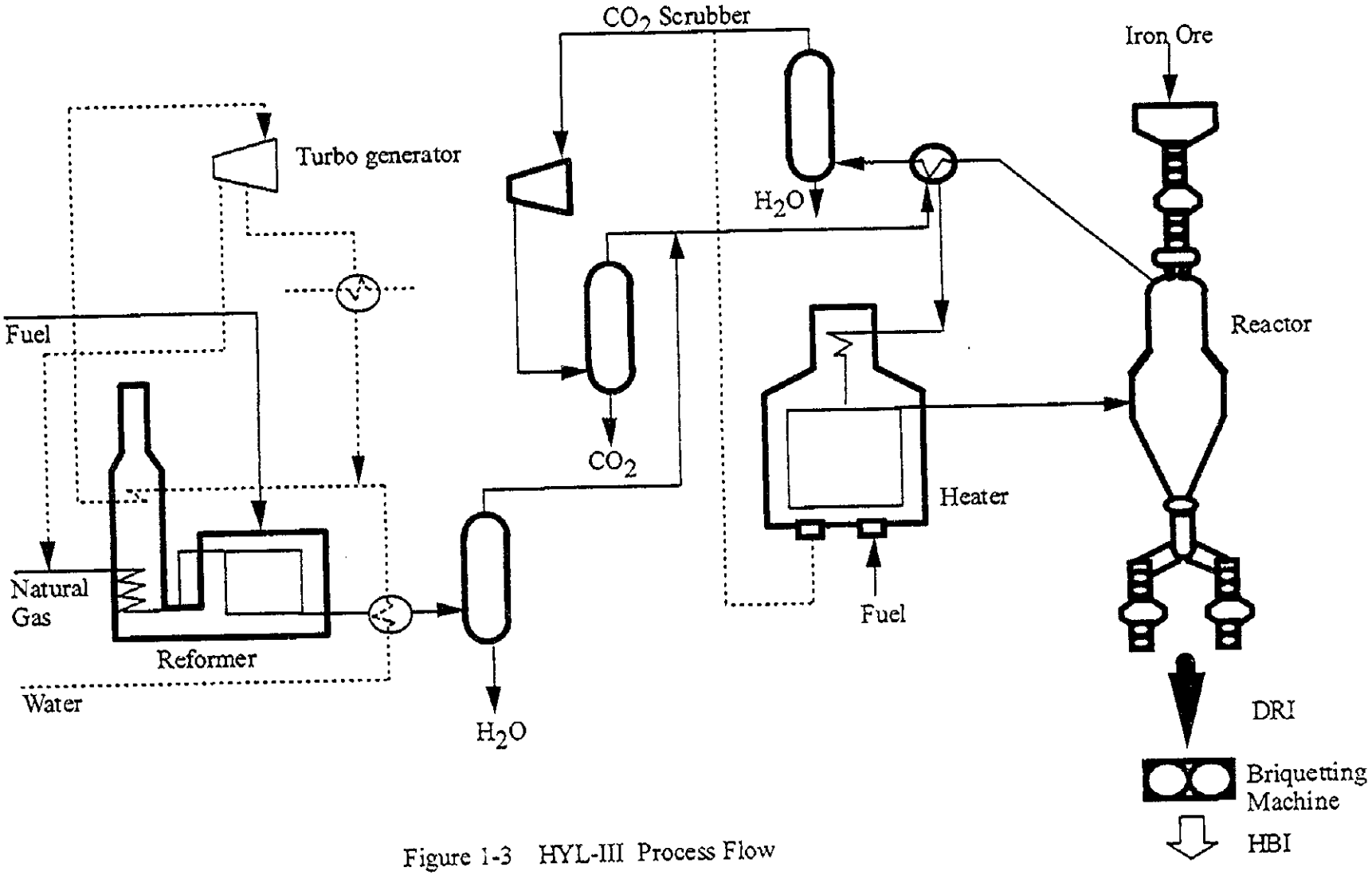


Figure 1-3 HYL-III Process Flow

2.3 FINMET（従来の FIOR）プロセス

流動層式鉄鉱石還元プロセス（FIOR）は 1950 年代に A. D. Little と Esso Research and Engineering Co.によってその概念が開発された。1971 年には A. G. McKee Co.が FIOR の技術をサブ・ライセンスする権利を取得し、ライセンスを FIOR de Venezuela へ売りそこで 1976 年に 400,000 t/y のプラントが操業を開始した。

FIOR プロセスは（図 1-4 参照）鉄鉱石粉を還元するのに 4 基の流動層式リアクターを用いる。粉鉱石は最初のリアクターに供給され、予熱されて順次残りの 3 基に流れて行く。還元ガスは水蒸気リフォーマーで作られる。製品は熱間で排出されブリケットにされ空気冷却される。

FIOR プロセスの改良型は現在 FINMET プロセスとして市場に出されており、しばしば FIOR II プロセスとも呼ばれる。FINMET プロセスは FIOR プロセスにおける鉱石の予熱、CO_2 除去、サイクロンの寿命、固形物運搬、再還元用物質の循環上の欠陥を改善するために設計されている。

FIOR の予熱用リアクターは鉄鉱石の予熱に天然ガスを使用しているが、FINMET プロセスではこの工程をなくして、代わりに還元用リアクターの排ガスによって熱は供給されている。

CO_2 除去システムは循環ガスのみならず還元ガスも一緒に除塵・冷却する（scrub）ことができる。FIOR プラントでは還元ガスのみが除塵・冷却されているが、この場合は還元ガスの中で使用できる CO の量を制限することになる。FINMET プロセスではプロセスの熱効率を改良するため高いパーセントの CO が利用される。

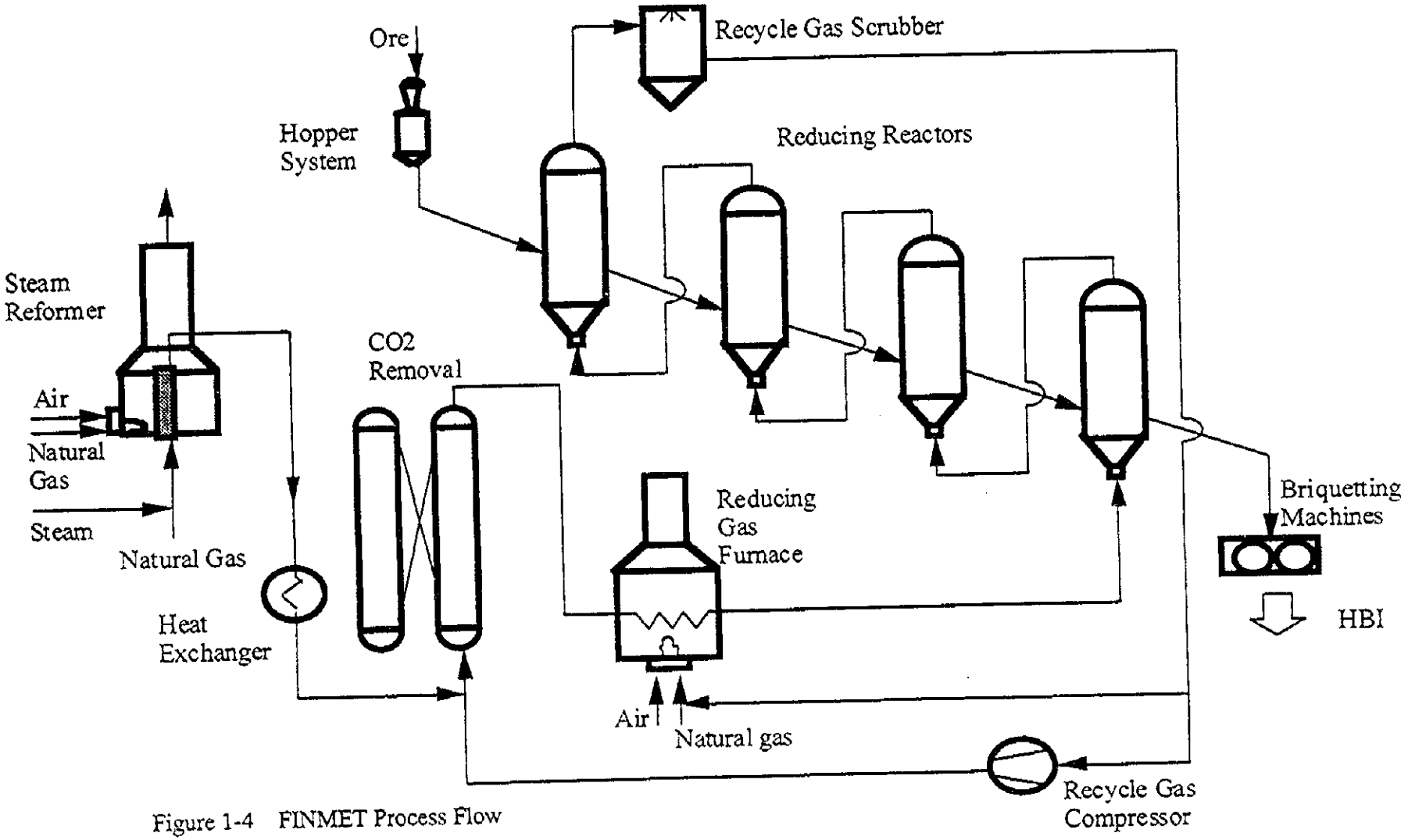


Figure 1-4 FINMET Process Flow

2.4 IRON CARBIDE プロセス

米国 Nucor へ製品を供給するために、能力 40 万トン/年の最初の商業規模の IRON CARBIDE プロセス・プラントが 1994 年にトリニダードで操業を開始した。

IRON CARBIDE プロセスでは鉄鉱石粉を還元するために 1 基のバブリング流動層リアクターが使用される。リアクターは鉄鉱石とガスとの間で充分な接触が可能となるように一連の内部仕切りを有している。水素が還元ガスとして使用され、これは天然ガスを水蒸気改質した後 CO_2 除去工程を経て製造される。

アイアン・カーバイドは単段のガス固体反応で作られる。温度 550℃から 600℃、1.8 気圧の流動層リアクターへ酸化鉄が供給される。一酸化炭素、二酸化炭素、メタン、水素および水蒸気の混合ガスを含んでいる予熱されたプロセス・ガスがアイアン・カーバイドを形成するために導入される。このプロセスの一般的な反応は次の通り。

$$3Fe_2O_3 + 5H_2 + 2CH_4 = 2Fe_3C + 9H_2O$$

リアクター排ガスは再びリアクターへ戻される。製品は供給される鉱石を予熱する熱交換器で冷却される。製品はアイアン・カーバイド (Fe_3C)の形をしており、約 6 パーセントの炭素を含んでいる。

アイアン・カーバイドを製造するシステムのダイアグラム（図 1-5 参照）はこのプロセスの主要な要素を明らかにしている。

先ず第一に、篩い分けられ分級された鉄鉱石や精鉱は予熱されて流動層リアクターへ導入され、ここでガスの混合体の熱流が鉱石層を吹き上がり鉄化合物から酸素を抜き取る（水を形成）一方、炭素を含むガスにより炭素原子 1 個がそれぞれ鉄原子 3 個と結合しアイアン・カーバイド- Fe_3C を形成する。

第二に（リアクター頂部の）水分を含んだ排ガスは頂部のサイクロンで大部分のダストが除去されてから冷却のため熱交換器を通り、スクラバーによって、残留している小粒径のダストとともに流体から水分が凝縮・分離される。

第三に炭素と水素が部分的に消耗され除塵冷却されたガスは新たに補充されたガスにより再編成され再度昇圧されて後、昇温するために熱交換器を通過し、最終的に予熱されて流動層リアクターの底部から再び吹き込まれ、サイクルを繰り返す。

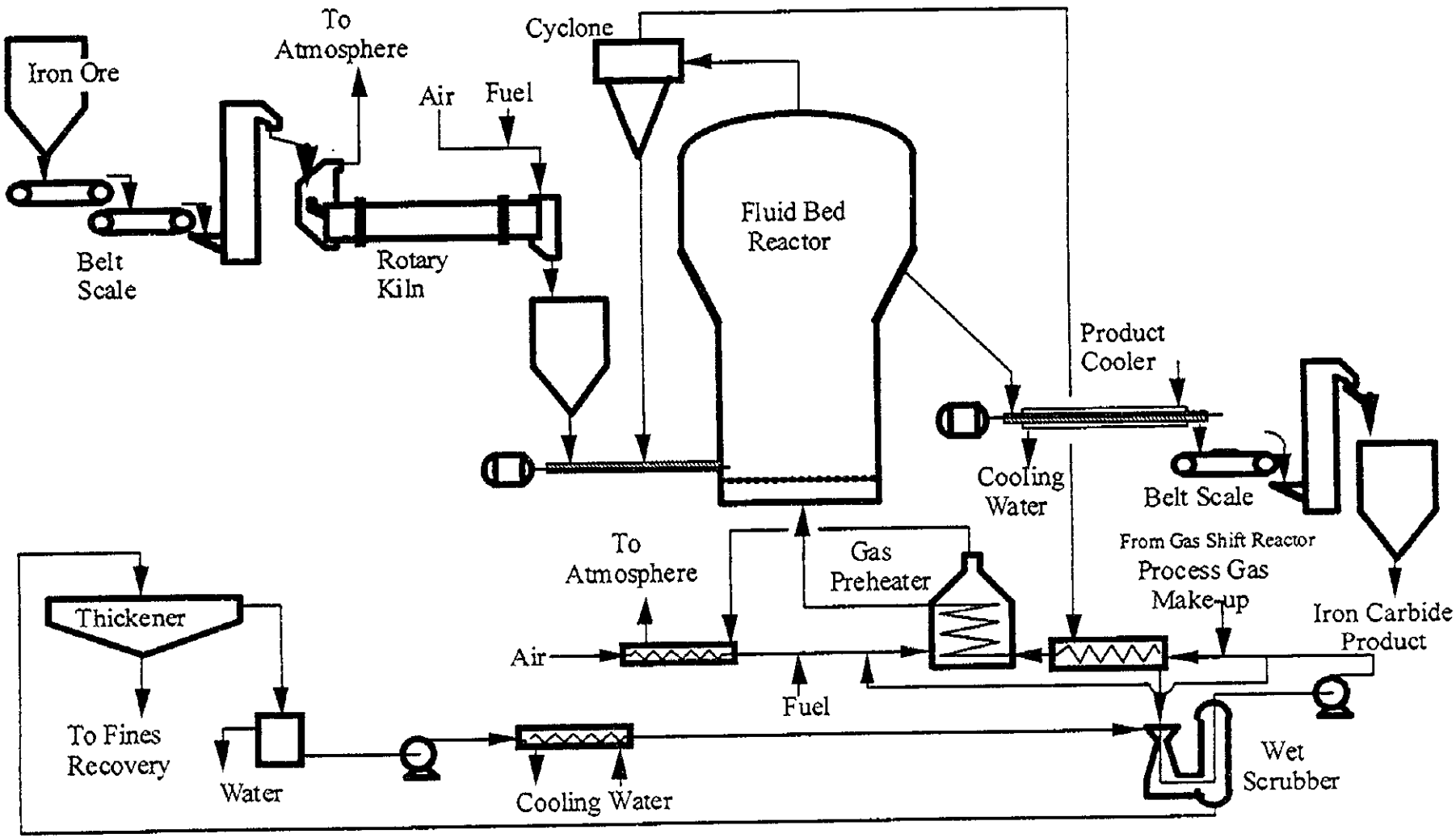


Figure 1-5 IRON CARBIDE Process Flow

2.5 SL/RN プロセス

SL/RN プロセスは 1920 年から 1930 年の間に開発された Republic Steel と National Lead (RN)の両プロセスと、1960 年頃開発された Stelco と Lurgi (SL)の両プロセスとの組み合わせによって開発された。1968 年から 1984 年にかけて南アフリカの Highvelt Steel and Vanadium Corp.は鉄鉱石の予備還元用に SL/RN キルンを 13 基設置した。DRI 製造用のプラントに加えて、合金鉄製造用の数多くのプラントの実績がある。

SL/RN プロセスでは（図 1-6 参照）ペレット状や塊鉱状の酸化鉄がロータリー・キルンへ供給される。石炭がキルン先端から供給されガス化して酸化鉄を還元する。キルンの数カ所からは空気が導入される。

製品はリアクターから排出され、ロータリー・クーラーで冷却されて、磁力選別機で灰分が分離された後、ペレットか塊鉱状で排出される。排ガスは燃焼室で燃焼され冷却されて除塵される。しかる後この排ガスは発電用に供することができる。

異なる還元材を使用する面では、SL/RN プロセスは褐炭のような非粘結炭から無煙炭やコーク・ブリーズまで全ての石炭を使用できるので、大きな適用性があるのが特徴といえる。

SL/RN プロセスのもう一つの特徴は発電用の高圧スティームを発生させるための廃熱ボイラーを使用することにより比較的大量のエネルギーを回収する可能性があることである。

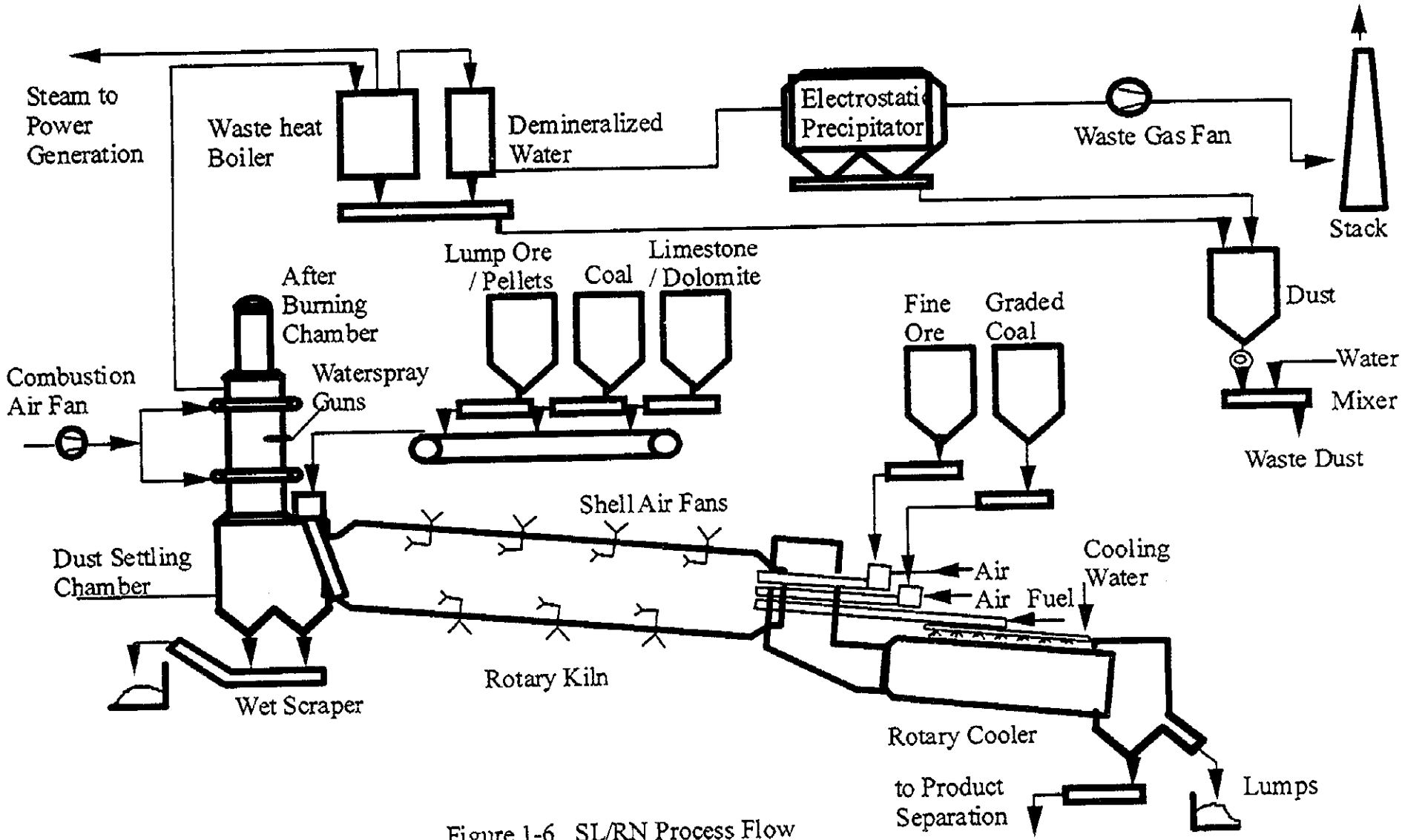


Figure 1-6 SL/RN Process Flow

2.6 FASTMET プロセス

FASTMET プロセスに関する研究室規模の試験は 1991 年ノース・カロライナ州シャーロッテの Midrex 研究所で始まった。1995 年 12 月には Midrex と神戸製鋼は日本の加古川工場にて 2.9t/h の実証プラントの運転を開始した。

FASTMET プロセスは（図 1-7 参照）鉄鉱石粉と石炭粉とバインダーとを混合してペレットを作り、それを低温で乾燥させた後、ロータリー・ハース・ファーネス(RHF)へペレットが一層もしくは二層の深さになるように供給する。RHF に付いているバーナーでペレットは加熱され、ペレットの中の石炭がガス化して鉄鉱石を還元する。RHF が回転するに連れて、ガスか重油か石炭焚きバーナーによってペレットは 1250-1350℃まで加熱される。炉床上の滞留時間は一般的には 6-10 分である。

FASTMET プロセスでは還元ガスの発生と還元反応の両方がペレット内で起きる。ペレットが加熱されると還元材の炭素は一酸化炭素(CO)に変わり、続いてこれが酸化鉄(Fe_3O_4 か Fe_2O_3)を金属鉄(Fe)に還元する。酸化鉄と炭素の充分な接触と高温での還元は結果として非常に早い還元速度を実現する。排ガスは未燃焼分を分離すべく調質され、燃焼用ガスを予熱するために用いられ、硫黄分を除去するために冷却洗浄除塵されて大気へ放散される。

RHF の 1 回転後（10 分以内）ペレットは熱間（約 1000℃）で排出される。製品は EAF にホット・チャージするために、隣接する製鋼工場へ運搬するための煉瓦張りした運搬容器に積み込むか、ホット・ブリケットにされる。

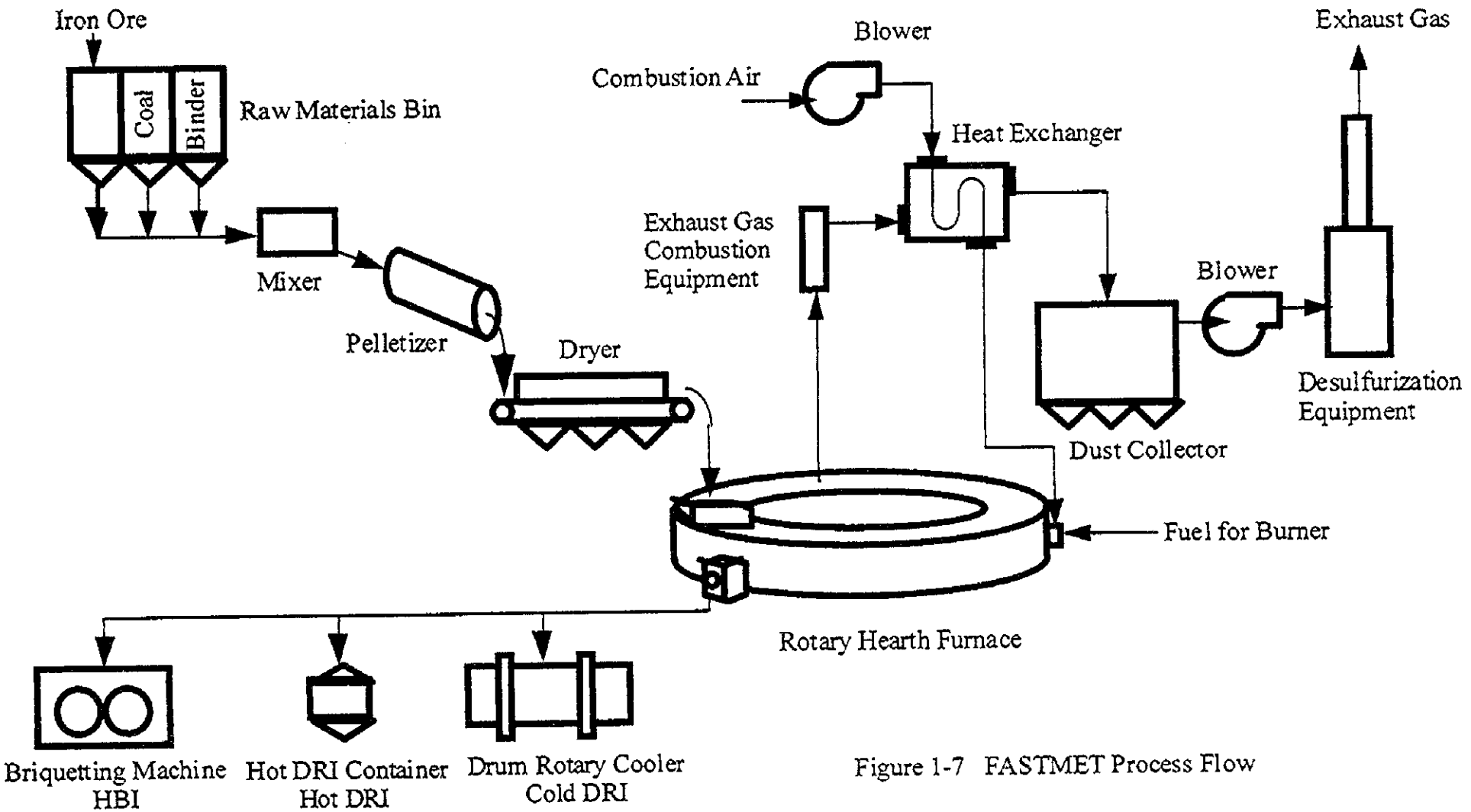


Figure 1-7 FASTMET Process Flow

3. 溶融還元、転炉法

溶融還元ー転炉法は最近開発されてきた。これらのプロセスは溶銑製造に粘結炭を使用しないという特徴を持つ。この節では、3プロセスを紹介する。

- ＤＩＯＳ、転炉
- ＣＯＲＥＸ、転炉
- ＲＯＭＥＬＴ、転炉

3.1 ＤＩＯＳプロセス

ＤＩＯＳプロセスフローを図1-8に示す。

ＤＩＯＳプロセスは鉄鉱石を直接溶融還元する方法である。このプロセスはコークス工程、鉱石塊成化工程を経ずに直接粉鉱石と一般炭を使って、溶融銑鉄を製造する。

ＤＩＯＳプロセスの開発は日本鉄鋼連盟によって1988年に始まり、1996年に終了した。最初の3年間は要素研究を実施した。要素研究の結果を集約してパイロットプラントを建設した。 500 ton/day の溶銑生産能力を持つパイロットプラントを 1993 から 1996 年まで操業した。 最後に、パイロットプラント操業の結果から、トータルシステムとフィジビリティについて検討した。

ＤＩＯＳプロセスの燃料は一般炭を使用できる。鉄原料は粉鉱石を使用できる。

鉄鉱石は予熱炉を経て、予備還元炉に供給される。 石炭は乾燥後、直接溶融還元炉に供給される。溶融還元炉の圧力は $1.9kg/cm^2$ に保持される。 炉上部のランスから溶銑とスラグが入った溶融還元炉に酸素が吹き込まれ、石炭と発生ガスを燃焼する。 底部から吹き込まれた窒素ガスは溶銑及びスラグを撹拌する。鉄酸化物はチャーと溶銑中カーボンで還元される。 製造された溶銑とスラグは出銑口から数時間間隔で排出される。

排出ガスは溶融還元炉に装入する前の鉄鉱石を還元し、予備還元炉に装入する前の鉄鉱石を予熱し、廃熱ボイラーで余剰熱を回収する。 廃熱ボイラーを通過したガスは電気に転換される。

3.2 COREXプロセス

COREXプロセスは 2 段製錬法であり、塊成化もしくは塊鉱石を使って溶融銑鉄を製造する。 COREXは還元シャフト(reduction shaft)及び 溶融ガス化炉(melter gasifier)と呼ばれる還元、溶融プロセスに基づく。 このプロセスでは、石炭はコークスプロセス無しに直接使用される。

COREXプロセスは多年にわたり、実機化開発が行われた。 COREXの最初の実機は 1,000 ton/day の生産能力を持ち、南アフリカに建設され、1989 年に稼動した。 2 番目のプラントは 2,000 ton/day の能力を持ち、韓国に建設され、1995 年に稼動した。

COREXプロセスの燃料には一般炭を使用できる。鉄原料としては塊鉱石及び/もしくはペレット、焼結鉱のような塊成化された鉱石が必要である。

冶金的な反応は 2 つの分離されたプロセスで実行される。 2 つのプロセスは還元シャフトと溶融ガス化炉から成る。 鉄鉱石は還元シャフトに装入され、溶融ガス化炉から上昇してくる還元ガスによって 90%まで還元される。 還元鉄はシャフト炉から排出され、溶融ガス化炉に供給される。石炭は溶融ガス化炉ドームから供給され、ガスとチャーに分解する。 酸素は溶融ガス化炉の下部から吹き込まれ、還元ガスを発生する。

残存酸素を持つ鉄鉱石は溶融ガス化炉中の流動石炭層及び固定石炭層を通過する間に溶融還元され、溶銑となる。 出銑滓及び溶銑の取り扱いは高炉溶銑と同様である。

還元シャフトから排出されたガスはおよそ 7,500kJ/Nm^3 のカロリーを持っている。このガスは冶金的、加熱、乾燥及び発電に利用される。

3.3 ROMELTプロセス

ROMELTプロセスフローを図 1-10 に示す。

ROMELTプロセスは 1 段製錬法で、粉鉱石もしくは塊鉱石を使用して溶銑を製造する。 製錬法は反応容器と熱伝達用に大容量、高攪拌スラグ浴を使用する。

ROMELTプロセスのパイロットプラントは 1985 年からノボリペツク冶金コンビナートにあるモスクワ鋼合金研究所(MISA)によって操業されてきた。ROMELTプロセスの原型は銅ニッケル硫化鉱石がガス攪拌され、液体スラグで満たされた反応器で酸化精錬する Vanyukov プロセスである。パイロットプラントは 20㎡ の炉床面積であった。

原料庫に貯蔵されている粉鉱石、副原料及び石炭のような原料は適当な比率でコンベヤー上に切り出される。これらの原料はシュートを通してROMELT炉に装入される。鉄鉱石のみならず鉄系ダスト、ミルスケール及び多くの鉄原料をROMELTは使用できるので原料リサイクルには他のプロセスよりも優れている。石炭も低から高揮発分まで使用できる。

還元反応は1,400から1,500℃の激しく撹拌されたスラグ浴で生ずる。石炭は燃料と還元材の役割を持つ。酸素富化された空気は下部羽口から吹き込まれ、スラグ層を撹拌し、石炭の一部を燃焼し、スラグに熱を供給する。上部羽口から吹き込まれた酸素はスラグ層から発生するガスを燃焼し、スラグに熱を供給する。溶銑は下部羽口以下の静止スラグ層を通過中にスラグと分離される。溶銑と溶融スラグは出銑口から排出される。

1,500から1,800℃の排出ガスはボイラーを通過した後、ガス清浄設備に導かれる。ガスの熱エネルギーはボイラーと発電機で電力に変換される。ＲＯＭＥＬＴ炉は大気圧(数mm Aq)で操業するので、複雑な機械的シールは不要である。

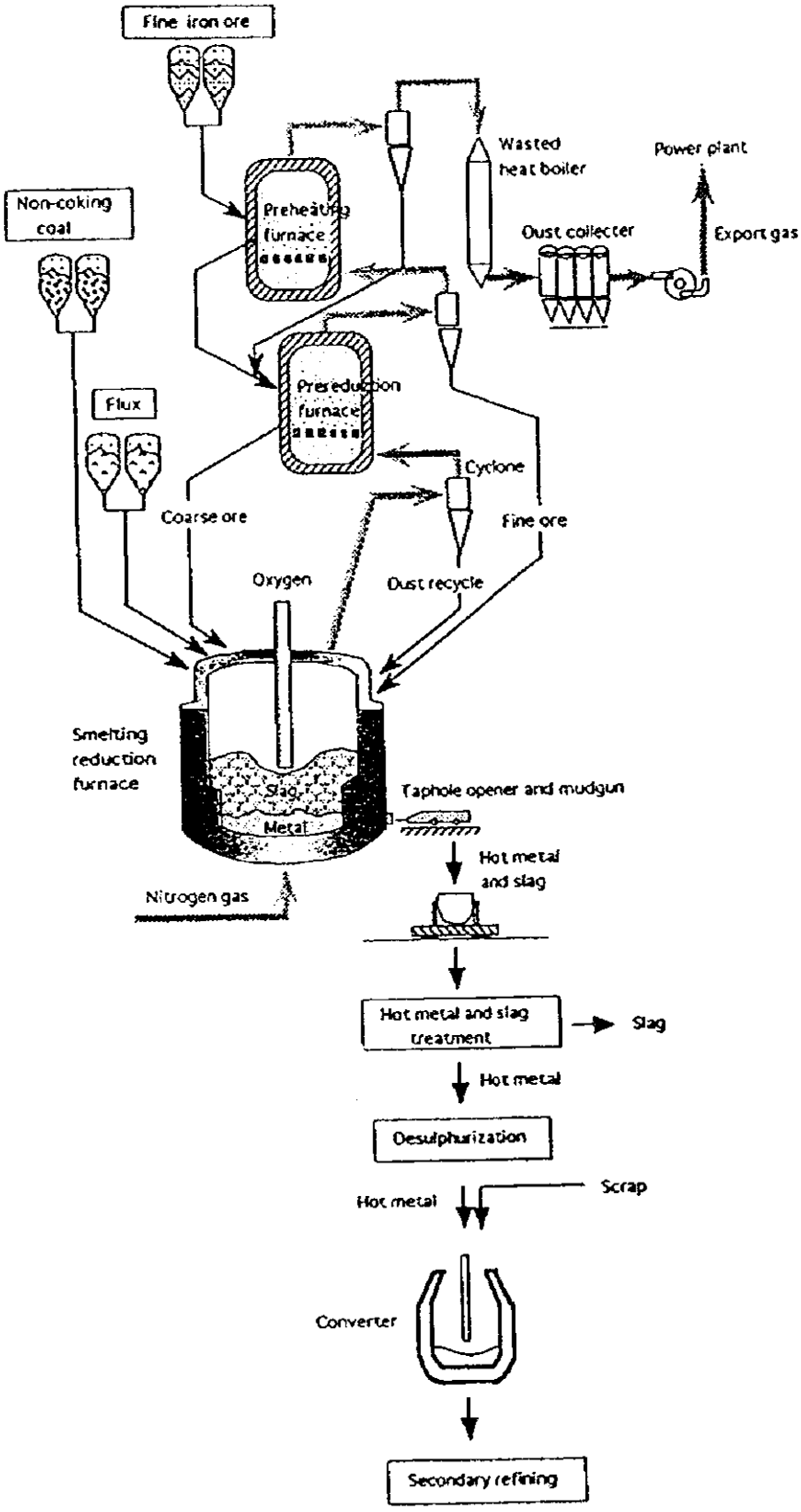


Figure 1-8 DIOS process flow

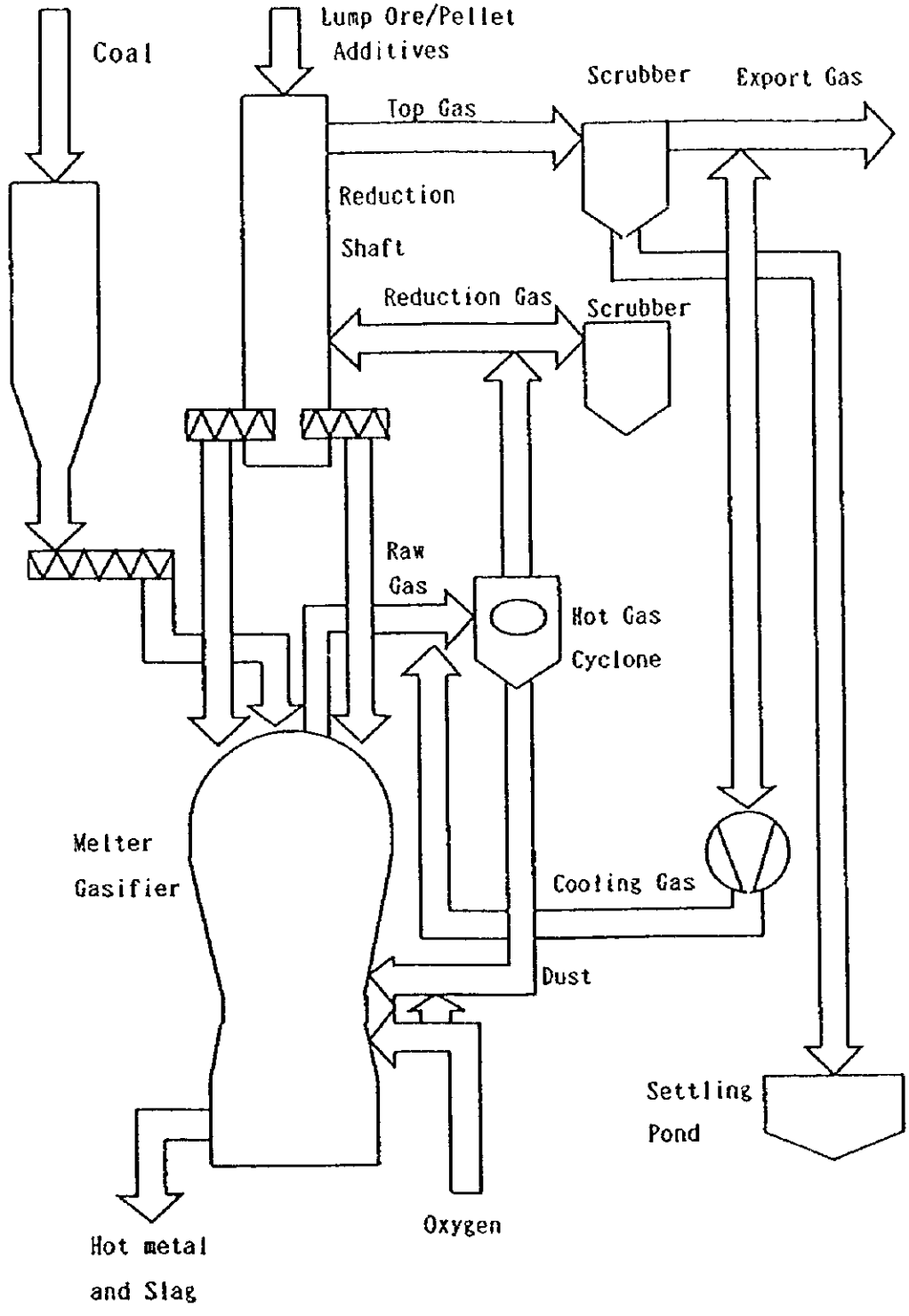


Figure 1-9 COREX process flow

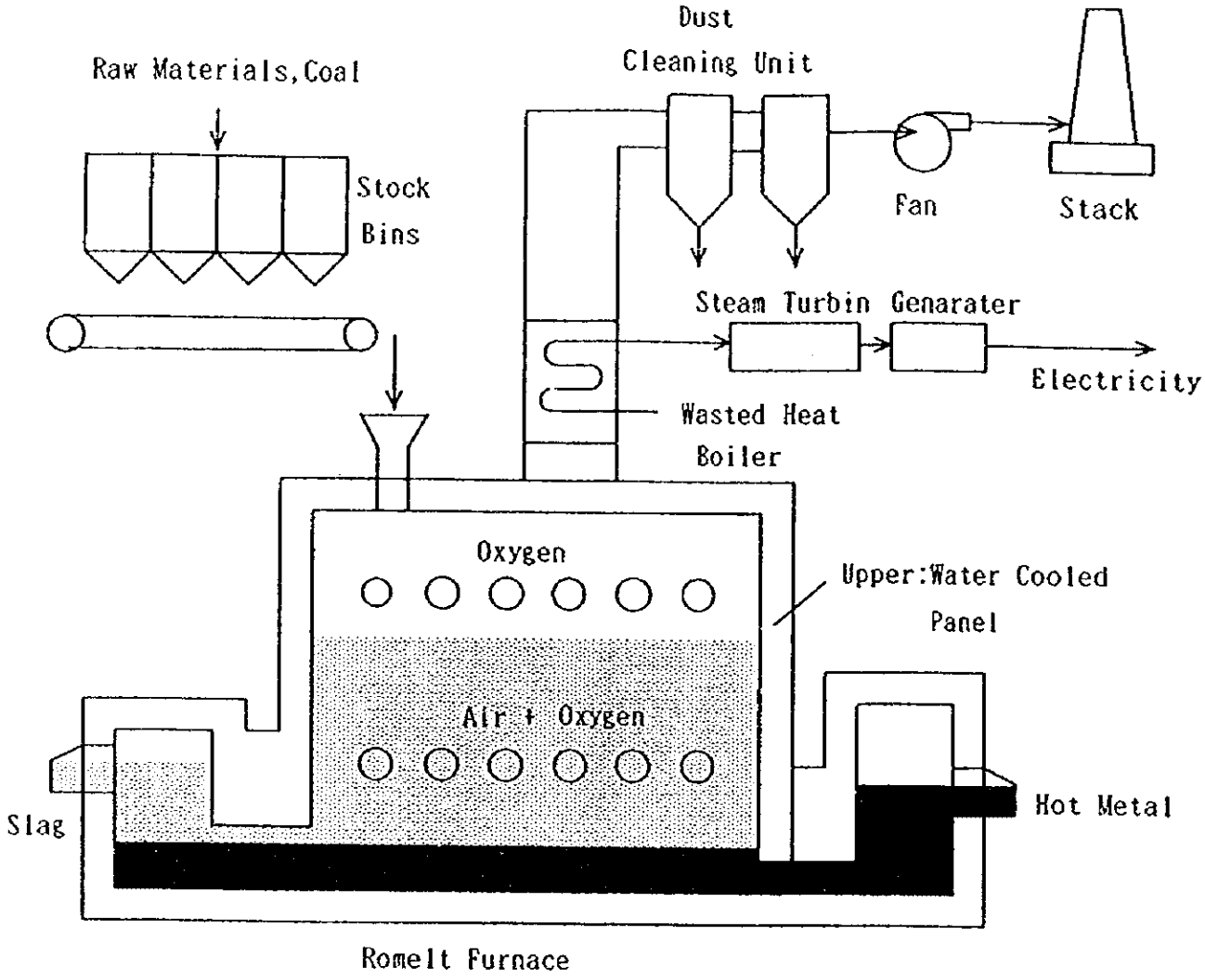


Figure 1-10 ROMELT process flow

4. スクラップ／電気炉プロセス

(1) プロセスの特徴

(a) このプロセスはスクラップを電気炉（ＥＡ）で溶解、成分調整を行い溶鋼を製造するものである。
スクラップ／電気炉プロセスで製造可能な鋼種はスクラップの品質によって制限される。

(b) スクラップから入る微量元素（Cu, Sn, Cr, Ni,その他)と電気炉で精錬中にピックアップされる窒素成分［N］のために高級薄板を製造することは難しい。

(c) このプロセスは通常は電気炉本体と、鍋精錬（ＬＦ)、及び脱ガス装置からなる。

表 1-1 スクラップ／電気炉プロセスの概要を示し、図 1-11 は同プロセスの概略フローを示す。

Table 1-1 Outlines of scrap/EAF process

Item	Sub items	Figure & Remarks	Remarks
Main Equipment	EAF Annual capacity Capacity t/ht Trans. Capacity Ladle Furnace	 Approx. 0.8 x10^6t/y/Furnace EAF 120～150 t/ht 80～ 90 MVA	 T-T;60～70min η ; 70～80%
Raw materials unit consumption	Scrap Pig iron etc.	1,080 kg/t-s ( )	η ; approx. 93%
Energy unit consumption	Electric power (EAF+LF) Electric power of others Electrode (EAF+LF) Oxygen Aux. fuel	Approx. 420 kWh/t-s " 80 " 2.0 + 0.4 kg/t-s " 30 Nm3/t-s " 1.5 L/t-s (Oil)	
Additive material	CaO Carbon Other Ferro alloy	Approx. 30 kg/t-s " 12 " 3 " 12	
Refractory	Refractory	Approx.2.0 kg/t-s	
By-product	Slag	Approx 60 kg/t-s	
Construction cost		Low	
Cost of molten steel		(See other data)	
Industrial status	Commercial	Many plant operated	

Note ; The values of unit consumption are the examples of usual EAF process.

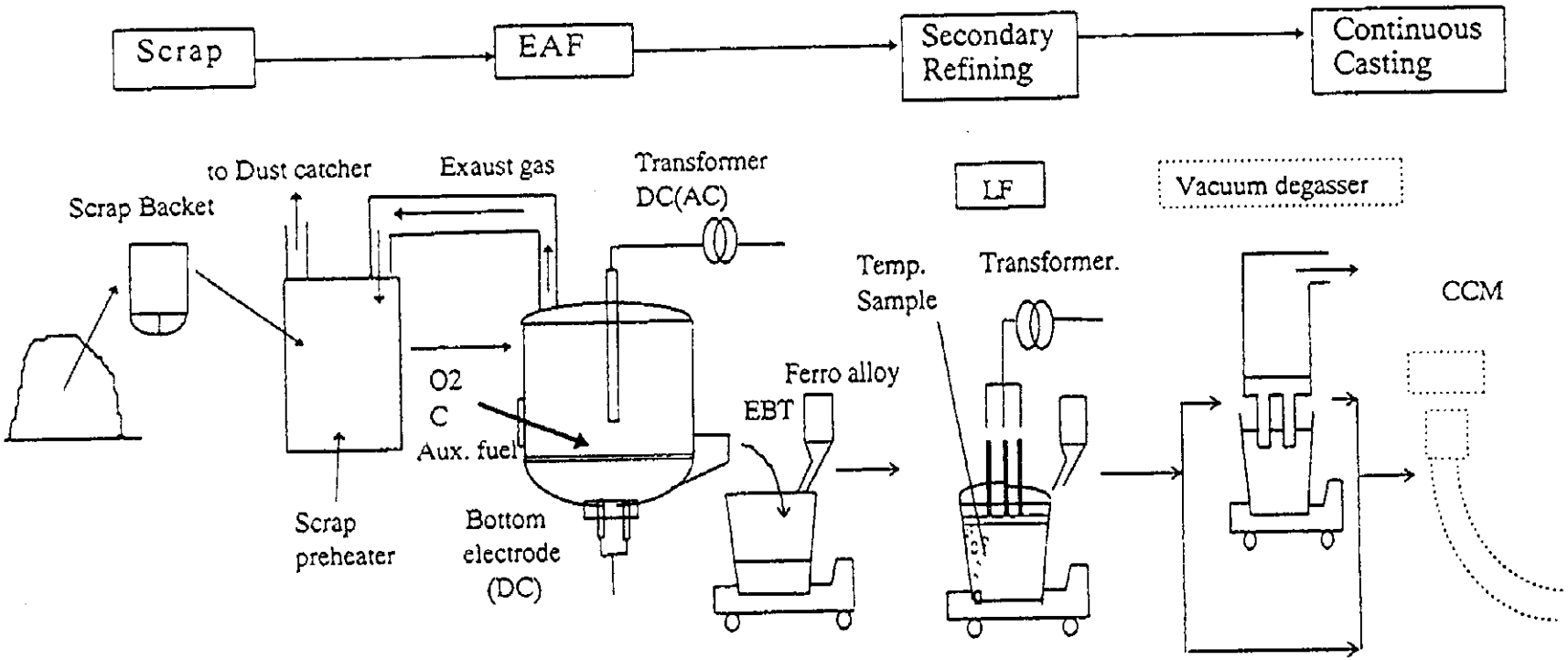


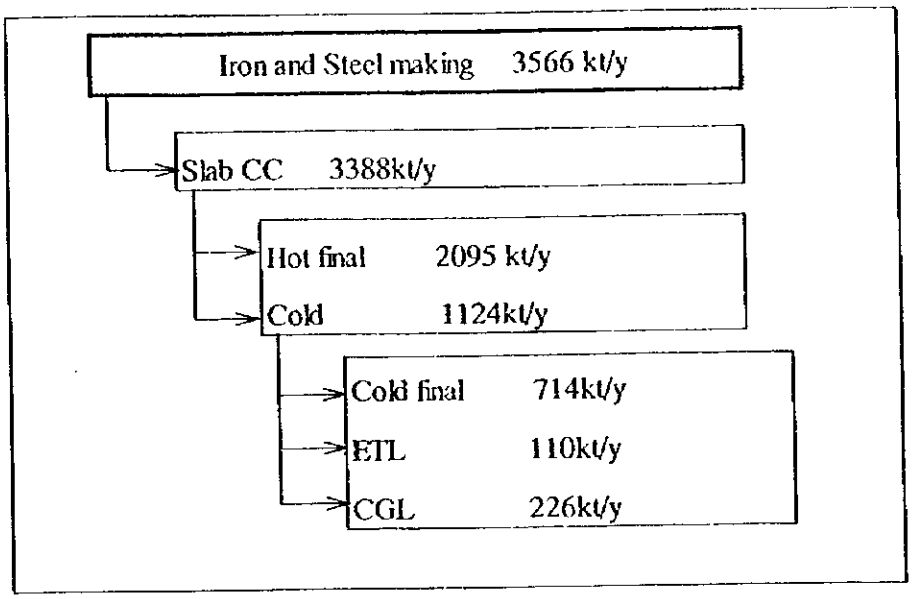
Figure 1-11 Schematic Diagram of Scrap／EAF Process

5. 適用すべき製銑,製鋼プロセスのエネルギーバランスの検討

5.1 エネルギーバランス検討のための前提条件

適用すべき製銑,製鋼プロセス比較のため、表 1-2 に示す年産 300 万トンレベルの生産条件にて、電力,燃料のエネルギーバランス及び粗鋼エネルギー原単位を推定する。

Table 1-2 Production plan to estimate the energy balance



5.2 電力バランスの予測

表 1-3 に粗鋼年産 300 万トン計画における電力バランスを示す。

Table 1-3 Power balance for a 3 million ton of crude steel / year plan

Unit : Mwh/h

		Plant	BF+BOF	DR+ EAF	SR+BOF	EAF
Consumption	Average Power	Iron /Steel making Plant	104	281	78	199
		Rolling mill	61	61	61	61
		Air separation Plant	25	6	207	10
		Utilities & others	29	29	29	29
		Total	219	376	374	298
	Peak demand		273	551	440	453
Production	Average power	Power plant in the steelworks	226	447	393	352
		(Output (MW) x No. of units)	(125 x 2)	(165x3)	(145 x 3)	(130 x 3)
Purchase	Average power		-7	-71	-19	-54
	Peak demand	(1 unit stop in power plant)	154	237	165	206

Note: Negative average power in purchase means that average power generated in the steelworks will be supplied to power company.

(1) DR+EAF 及び SR+BOF プロセスの消費レベルは同等である。
両プロセスとも多量の電力を消費する。その要因は次の通り:
- DR+EAF プロセスにおける EAF の高電力原単位
- SR+BOF プロセスにおける SR,BOF の高酸素原単位

(2) BF+BOF プロセスが最も電力消費が低い。

(3) 各プロセスの中で DR+EAF プロセスが最も高いピーク電力デマンドを発生する。

(4) 電力会社に対するピーク電力デマンドを削減するため、発電所の容量が製鉄所平均消費電力より大きく設定されているので、 購入平均電力は電力会社へ逆送となる。

5.3 燃料バランスの予想

表 1-4 に粗鋼年産 300 万トン計画における燃料バランスを示す。

表 1-4 Fuel balance for a 3 million ton of crude steel / year plan

Unit: 10^6 kcal/h

	Plant	BF+BOF	DR+EAF	SR+BOF	EAF
Consumption	Iron /Steel making Plant	386	13	13	13
	Rolling mill	141	141	141	141
	Utility,Other	77	77	77	77
	Sub total	604	231	231	231
	Power plant	538	1064	935	839
	Total	1142	1295	1166	1069
Production	Iron and steel making plant	1045	0	1719	0
Purchase		97	1295	(Surplus) -553	1069

(1) BF+ BOF プロセスは、発電所を除いた生産工場で最も多量の燃料を消費する。これは、DR+EAF, SR+BOF 及び EAF プロセスの製鉄,製鋼では、原則として操業で燃料を消費しないためである。

(2) DR+EAF プロセスは、製鉄所全体で最も燃料を消費する。これは大容量の発電所の燃料消費が多いことによる。

(3) BF+BOF と SR+BOF プロセスは多量の副生ガスを発生する。 SR+BOF プロセスでは、副生ガスが多量に余剰となるので有効活用を考慮する必要がある。

(4) BF+BOF プロセスでの燃料購入は少量である。又 SR+BOF プロセスでは必要ない。

5.4 粗鋼エネルギー原単位

年産300万トンレベルでの粗鋼トン当たりエネルギー原単位を表1-5に示す。粗鋼エネルギー原単位は下記の式で計算される。

粗鋼エネルギー原単位 =(還元用の石炭,天然ガスを含んだ購入エネルギー
- 外販エネルギー)/(粗鋼生産量)

Table 1-5 Unit energy consumption for a 3 million ton of crude steel / year plan

Unit: Mcal/t

	BF+BOF	DR+EAF	SR+BOF	EAF
Purchased Energy				
Coal	6118	0	7920	0
Natural gas	0	2797	0	0
Fuel	237	3181	0	2626
Electric power	0	0	0	0
Sold energy				
By-product gas	0	0	-1357	0
Electric power	-46	-425	-113	-323
Energy Unit consumption	6309	5553	6450	2303

(1) スクラップを使用するため、 EAFプロセスの粗鋼エネルギー原単位が最も低い。

(2) BF+BOF, DR+EAF, SR+BOF及び EAFプロセスでは、発電所より発電された電力の1部が電力会社に平均的に逆送される。この逆送は、これらのプロセスでピーク電力を抑えるため大容量発電所を設置したことによる。

Section 2 製鋼プロセスの検討

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1. 製鋼プロセスの適用検討

1.1 製鉄、製鋼プロセス

1.1.1 スクラップ／電気炉プロセス

(1) プロセスの特徴

－このプロセスはスクラップを電気炉（ＥＡ）で溶解、成分調整を行い溶鋼を製造する。
－スクラップ／電気炉プロセスで製造可能な鋼種はスクラップの品質によって制限される。
－スクラップから入る微量元素（Cu, Sn,Cr, Ni,その他)と電気炉で精錬中にピックアップされる窒素成分［N］のために高級鋼を製造することはむずかしい。
－このプロセスは通常は電気炉本体と、鍋精錬（ＬＦ）、及び 脱ガス装置からなる。

表 1-1 はスクラップ／電気炉プロセスの概要を示し、表 1-2 は新しい技術を備えた近代的電気炉プラントを示す。図 1-1 はマテリアルフロー、図 1-2 はプロセスフローを、及び図 1-3 は電気炉技術の改善の過程を示す。

Table 1-1 Outline of scrap/EAF process

Item	Sub items	Figure & Remarks	Remarks
Main equipment	EAF furnace ・ Annual capacity ・ Capacity t/ht ・ Trans. capacity Ladle furnace	(For example) Approx. 1.0 x10^6t/y EAF 130 ～150 t/ht 80～ 90 MVA	 T-T: 65 min η : 80%
Raw materials unit consumption	Scrap Pig iron etc.	1,090 kg/t-s α	η = 92%
Energy unit consumption	Electric power(EAF+LF) Electric power of other Electrode (EAF+LF) Oxygen Aux. fuel	Approx. 420 kWh/t-s " 80 " 2.0 + 0.4 kg/t-s " 30 Nm^3/t-s " 1.5 l/t-s (oil)	
Additive material	CaO Carbon Other Ferro alloy	" 30 kg/t-s " 12 " 3 " 12	
Refractory	Refractory	EAF 5.0 kg/t-s, Other 3.0 kg/t-s	
Industrialized status	Commercial	Many plant operated	

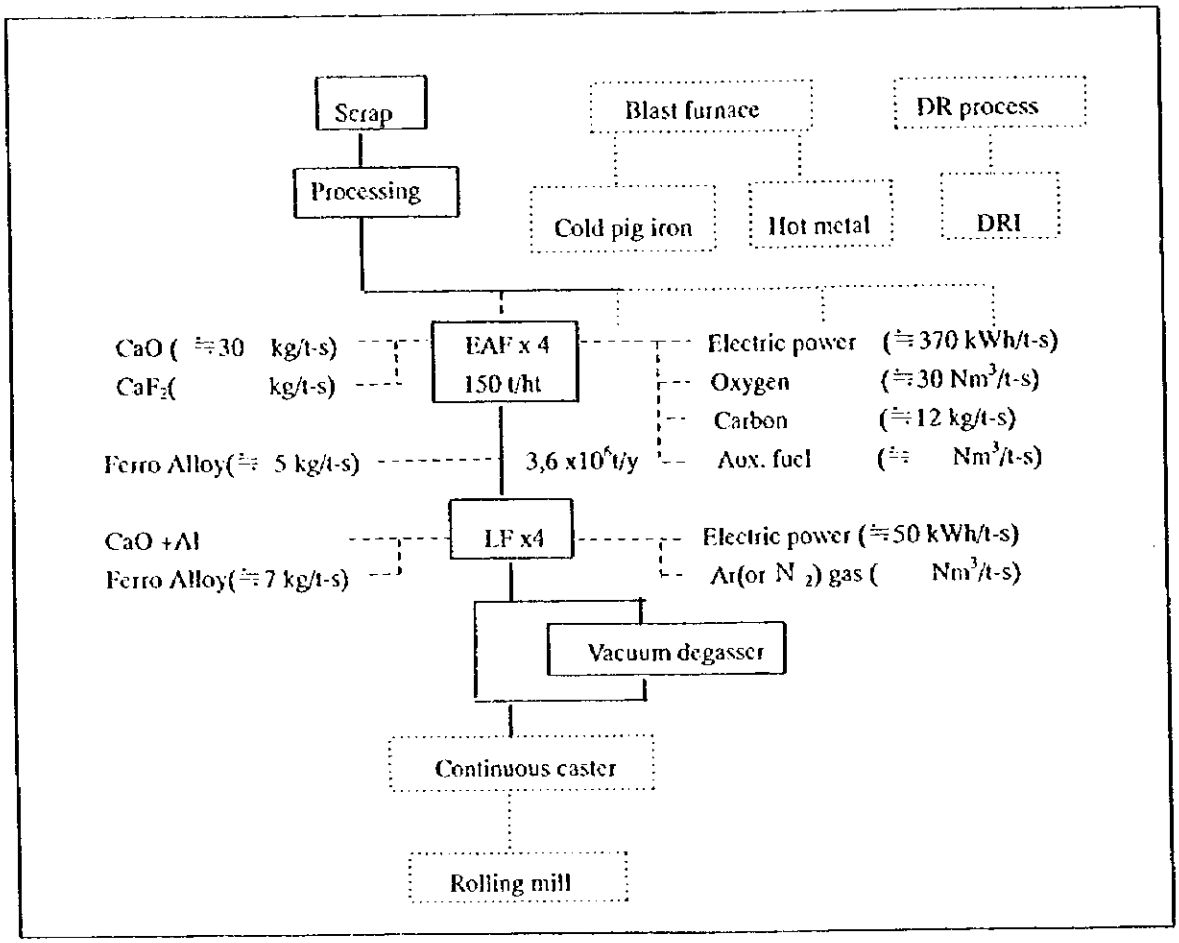


Figure 1-1 Typical material flow of EAF process

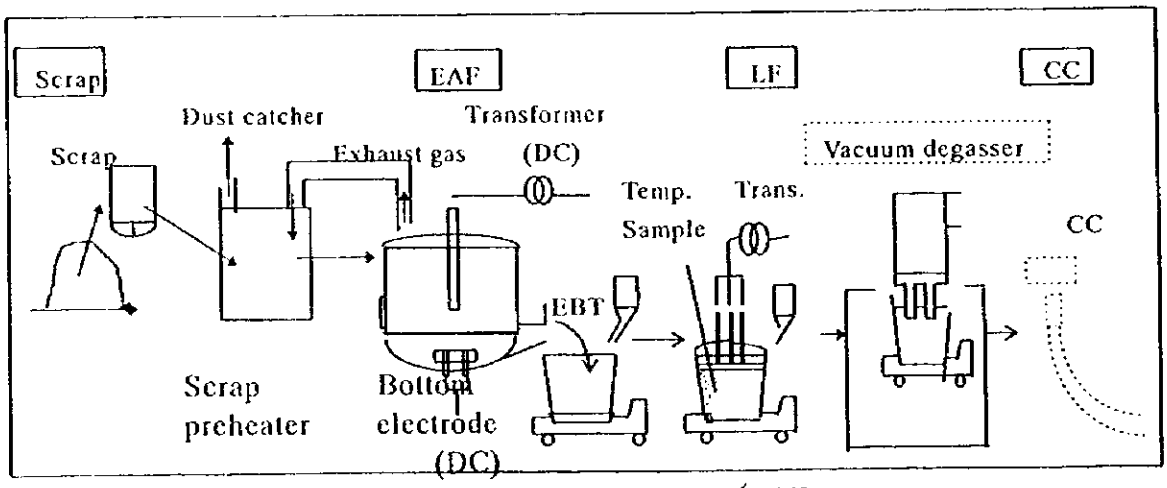


Figure 1-2 Schematic flow of scrap/EAF process

Table 1-2 Modernized scrap/EAF process technology

Item	Technology	Aim and effects
Scrap	Processing	Cutting, pressing, gas cutting, shredding
	Scrap preheating (SPH)	Energy saving
Productivity	Oxygen blowing	Electric unit consumption saving
	Ladle refining(LF, Vacuum)	Tap-Tap decreasing, Refining improving
	Water cooled wall, roof	Refractory saving, High power operation
	HP,UHP operation	Unit consumption improving, Short T-T time
	Big capacity EAF	~200 t/ht, operation index improving
	Carbon injection	Slag forming, Electric unit consumption saving
	Fuel burner	Electric unit consumption saving
	Twin shell type EAF	Energy saving by SPH, Reduction of T-T-time
	D C furnace	High power long arc operation, Flicker improving
	Bottom gas blowing (Stirring)	Yield, electric power saving, Prevention of boiling
	Sequence Casting ratio	Yield improving
Quality	EBT(Eccentric Bottom Tapping)	Slag free tapping
	LF & Degassing	RH, VOD, etc.
Automation	Automatic operation	Labor saving
Environment	Dust catcher	Furnace, Sky house, Building

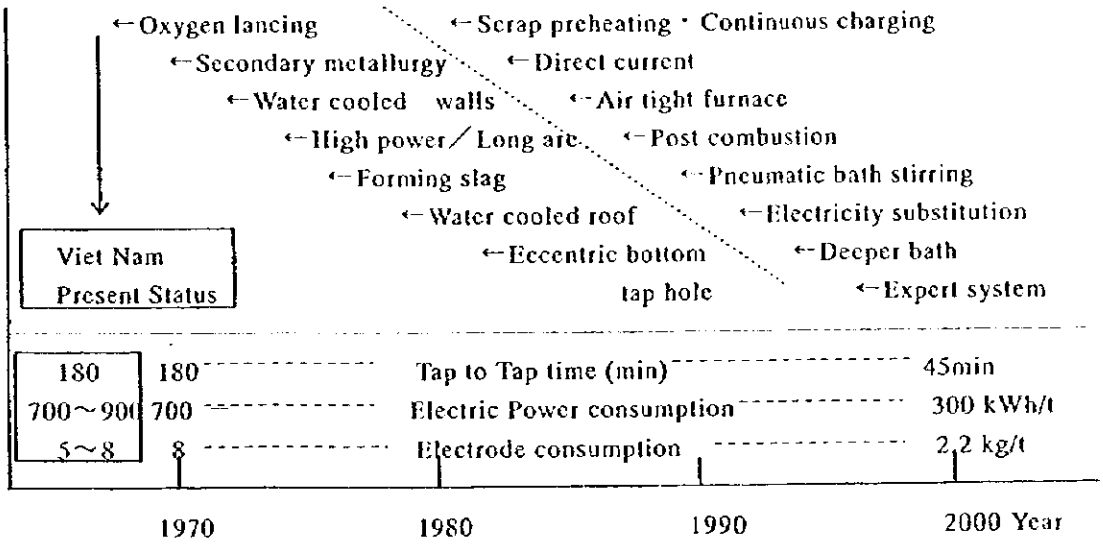


Figure 1-3 Improvements in the EAF technologies (By IISI 27 '93. Henri Faure)

1.1.2 転炉プロセス（ＢＯＦ）

転炉（ＢＯＦ）プロセスの特徴は①高生産性、②高品質溶鋼の製造、③設備コストは電気炉に比べて比較的高い点である。

表 1-3, 表 1-4, 及び表 1-5はＢＯＦプロセスの概要を示し、図 1-4は典型的な転炉（ＢＯＦ）プロセスのフローを示す。

Table 1-3 Outline of BOF typical process divided into three(3) stages

Stage	Item	Description	Remarks
1)Hot metal pretreatment	Vessel (transportation)	Torpedo car	
	De-[S]	Top lance injection	CaO+Al, CaC_2, Powder
	De-[Si], De-[P]	Top lance injection	For extremely low[S], [P] steel grade. *1)
2)LD converter (BOF)	Raw material	Hot metal ratio> approx. 80% Scrap ratio < approx. 20%	
	Combined Blowing	Oxygen about 50 Nm^3/t-s	Top lance blowing
		Bottom blowing	O_2(+LPG), Ar, N_2, CO_2, depending on process
	Suppressed gas(LDG) recovery process	Dust collector LDG recovery (CO gas)	About 80～100Nm^3/t-s
	Sub lance system	Measuring : ・Temperature ・Carbon composition ・Free [O] ・Sampling End point dynamic control	Measuring during blowing & at blow end
	Flux & alloy charging	CaO, Iron ore, Sintered ore, Fluorspar, Coolant etc.	Batch or continuously charge to converter
	Slag stopper	Tap hole closing after tapping	Minimizing slag in molten steel ladle
3)Secondary refining	CAS-OB system	Air tight alloy charging Temperature control	A typical method
	Degassing system	Degassing & de[C]	RH, DH, VAD, etc.
	Bottom gas injection	Stirring of molten steel Floating of inclusion	

Note : *1) This process is possible to add in the future when such steel grade is required.

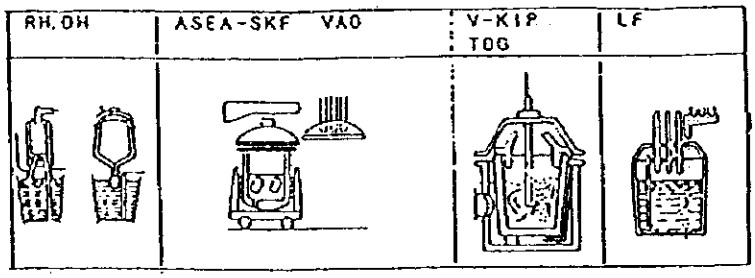
Table 1-4 Outline of typical BOF process(BOF)

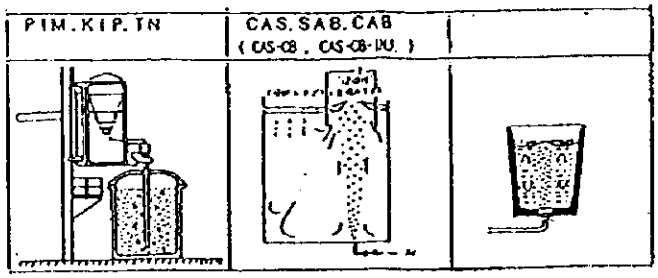
Item	Sub items	Description	Remarks
Main Equipment	LD converter Annual capacity Capacity t/ht Oxygen blow Ladle Furnace CAS & RH	 1.5～3.0 x10^6 t/y Furnace LD 150～330 t/ht 30000～70000 Nm^3 ／hr	 T-T; 35～40min WTR; 70～85% (Example)
Raw materials unit consumption	Total Hot metal Scrap Pig iron	1,090 kg/t-s 960 130 α	η ; 92 % HMR 88 %
Energy unit consumption	Oxygen Electric Power Ar, N_2, CO_2,	Approx. 50 Nm^3/t-s 30 kWh/t-s Nm^3/t-s	
Additive material	CaO Other Ferro Alloy	Approx. 50～60 kg/t-s Approx. 9 10～12	
Refractory	Refractory	Approx. 6～8 kg/t-s	
By-product	Slag LD-gas	80～100 kg/t-s 80～100 Nm^3/t-s	 2000 kcal/Nm^3
Construction cost		Generally high	
Industrialized status	Commercial	Many plants are operated	

Note ; The values of unit consumption are the examples of usual BOF process.

Table 1-5 The characteristics of secondary refining process

Typical Process	RH(OB) DH VOD	ASEA - SKF VAD	V-KIP	LF	PIM TN	CAS(-OB) SAB	Bottom blowing
① Vacuum	○	○	○	–	–	–	–
② O2 blowing	(○)	–	–	–	–	(○)	–
③ Powder injection	–	–	○	–	○	–	–
④ Arc heating	–	○	–	○	–	–	–
⑤ Bottom gas blowing	–	○	(○)	○	(○)	○	○
⑥ Air tight shield	○	○	○	–	○	○	–
⑦ E.M. stirring	–	○	–	–	–	–	–
⑧ Flux refining	–	○	–	○	–	(○)	–
Heating(Temp. control)	(○)	○	–	○	△	△(○)	△
De[O], Clean Steel	△	○	○	○	○	○	○
Composition adjustment	○	○		○	○	○	–
De-[S]	–	○	○	○	○	○	–
De-[P]	–	△	–	△	–	–	–
De-[H]	○	○	○	–	–	–	–
De-[C]	○	○	○	–	–	–	–
De-[N]	○	○	○	△	–	–	–
Typical BOF Process	○					○	





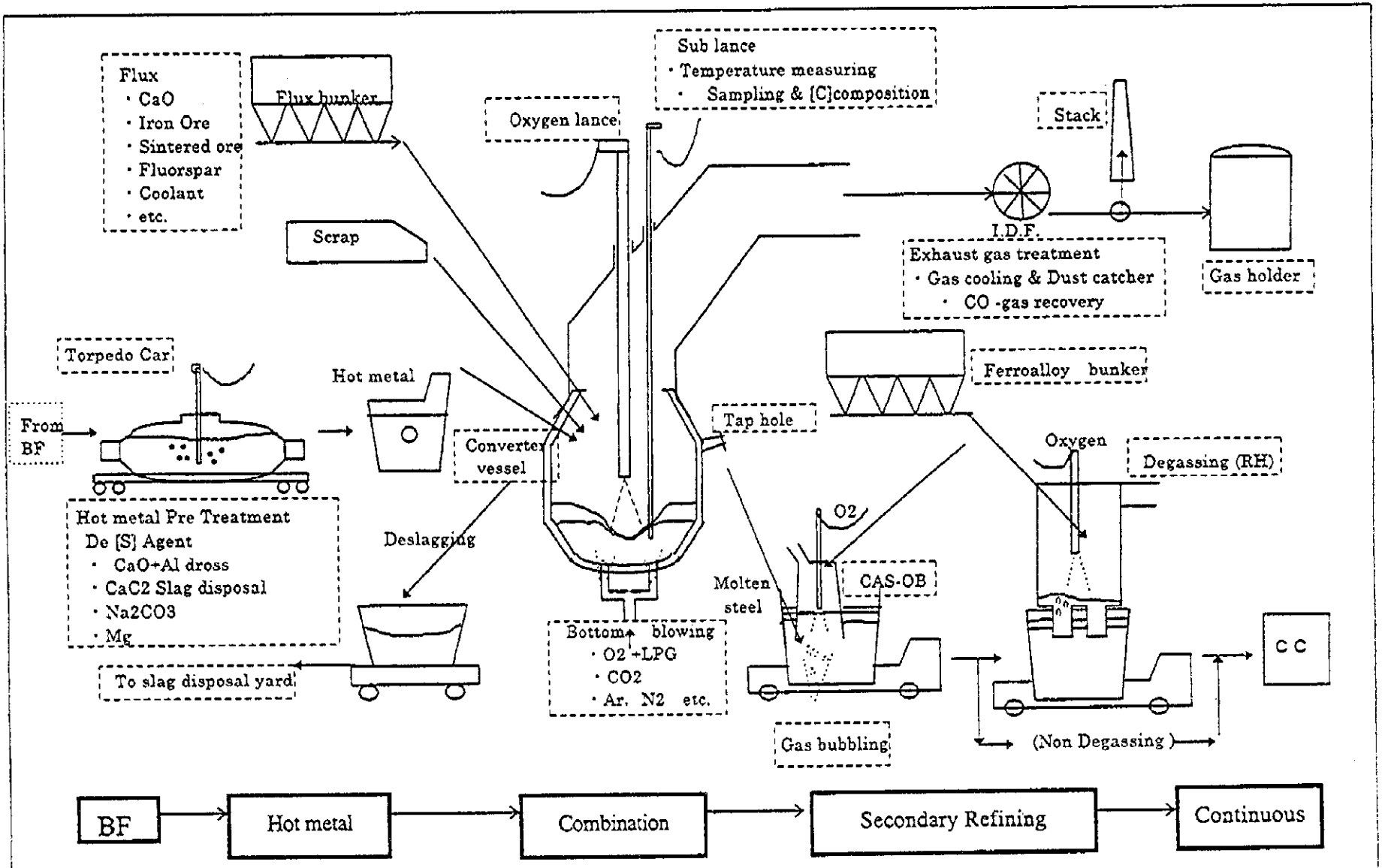


Figure 1-4 Schematic diagram of basic oxygen furnace (BOF) process

1.2 連続鋳造／熱間圧延プロセス

1.2.1 薄スラブ方式（ＴＳＰ）

－ＴＳＰは一般にミニミルで電気炉と組み合わされる。
－薄スラブ法は低設備費、操業コスト故に一般鋼に対しては優位なプロセスである。
－スクラップ中の高トランプエレメントと高速鋳造のために自動車外板のような超深絞り高級鋼の製造はむずかしい。
－ミニミルはアイアンカーバイドとかＤＲＩのようなバージンアイアンの使用、ＥＭＳ(電磁撹拌)のような新鋳造技術の使用により製造可能鋼種の拡大を指向する方向を目指している。

(1) ＩＳＰ(In-line Strip Production)方式

－鋳造厚は未凝固圧下とインラインリダクションにより厚みを減少させる。
－目的は結晶微細化、偏析改善されたスラブの製造である。
－連鋳-熱延 プロセスをコンパクト化するためにコイルボックス方式が適用されており、プロセスの長さは約 190m と短い。

表 1-6 は当プロセスの概要を、 図 1-5 はＩＳＰの概略図を示す。

Table 1-6 The outlines of ISP

Item	Sub Items	Description	
General	Works	Arvedi (Italy)	Kwangyang POSCO
	Plant supplier	Mannesmann Demag	Mannesmann Demag
	Started	Jun.,1992	Oct., 1996
	Steel grade	Structural steel, Deep drawing, API piping, Plate, etc.	
CCM	Product capacity	0.5 x10^6t/y/unit	1.0 x10^6t/y/str x2str.
	Casting speed	Max. 6 mpm Ave. 4.5 mpm	Max. 5 mpm
	Mold thickness	80/60 mm concave, V-B	75 mm flat-parallel-vertical
	Immersion nozzle	Flat nozzle	Flat nozzle
	Soft reduction	60 →40 mm	75 → 60 mm(100 →80 mm)
	In line reduction	4Hi x 3 std, →15～25 mm	4Hi x 2 std, →20～25 mm
Hot	Induction heater	Max. 350℃ heat up	Less than Cremona
	Coil box	Cremona Furnace 2 coils	Holding furnace 5 coils
	Finishing mill	4 Hi x 4 std	4 Hi x 5 std
Plant	Length	approx. 190 m	CC→Coiler
Industrialized status		Commercial	Commercial(just started '96)

(2) ＣＳＰ(Compact Strip Production) 方式

－約 180 mm 厚のファンネル(Funnel)型モールドが鋳造を容易にするために使用される。
－凝固は垂直の鋳片支持範囲で完了する。
－長いスラブはトンネル炉で加熱され、仕上げ圧延機に供給される。
－最もコンパクトなプロセスの一つである。
－製造可能な鋼種には制限があり、一般にコマーシャルグレードの鋼種が製造可能である。

表 1-7 は当プロセスの概要を、図 1-6 はＣＳＰの概略図を示す。

Table 1-7 The outlines of CSP

Item	Sub items	Description	Remarks
General	Works	Nucor ; Crawfoldsville Hickman	
	Plant supplier	SMS (Germany)	
	Started	19989 & 1992	
	Steel grade CGC; commercial grade steel	C-steel(L-C, M-C, H-C) Deep drawing Construction etc.	
CCM	Product capacity	1.0～1.1 x10^6t/y/unit x2 units	
	Casting Speed	Max. 6 mpm	
	Mold thickness	180/50 mm Funnel mold	～ /60 mm
	Immersion Nozzle	Flat nozzle	
	Soft reduction	No	
	In line reduction	No	
Hot	Furnace	Tunnel furnace (buffer)	150～ 200m length
	Coil box	No	
	Finishing Mill	4 Hi x 6 std (no rougher)	Hi-pressure descaling
Plant	Length	approx. 350 m	CC－Coiler
Industrialized status		Many commercial plants	12 plants 15 CCM in operation
Cost	Construction Cost	Low for low production	

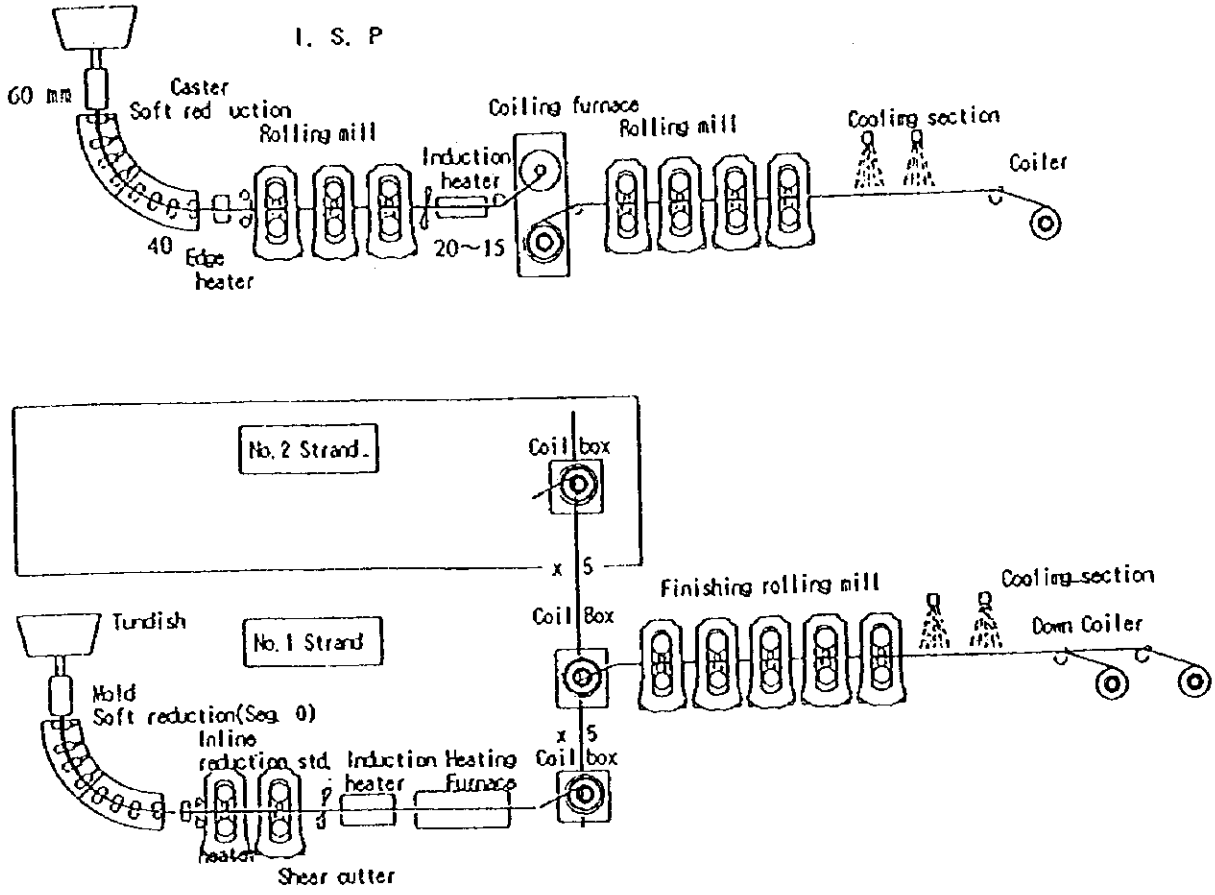


Figure 1-5 Schematic drawing of ISP

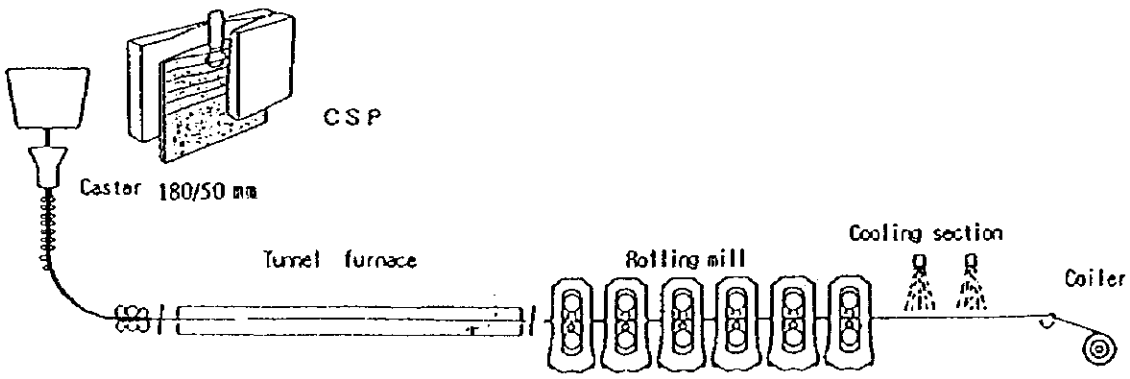


Figure 1-6 Schematic drawing of CSP

1.2.2　中厚スラブプロセス（ＭＳＰ）

－ＭＳＰ法は一般に電気炉と組み合わせてミルで使用される。
－この方式はＴＳＰ法と従来型連鋳－熱延プロセスの中間に位置する。
－スクラップ中のトランプエレメントと高速鋳造のために自動車の外板のような高級鋼は製造はまだむずかしい。
－厚みを厚くする目的は、直送圧延ではあるが、ＴＳＰよりも表面品質を改善するためである。
－もう一つの目的として、従来方式と同程度の生産性をコンパクトな設備で得ることである。

代表的プロセス

1)　Conroll（ＶＡＩ）プロセス　（図 1-7 参照）
2)　ＳＨＩ（Sumitomo Metal Industry）プロセス　（図 1-8 参照）

表 1-8 は当プロセスの概要を、図 1-7 及び 図 1-8 はＭＳＰの概略図を示す。

Table 1-8　The outlines of MSP

Item	Sub items	Description	
General	Works	ARMCO Mansfield (U.S.A.)	B-works
	Plant supplier	ＶＡＩ	ＳＭＩ／ＳＨＩ
	Started	Apr. 1995.	Nov. 1996
	Steel grade	Structural steel. Deep Drawing API piping Peritectic steel　etc.	Structural steel. Deep Drawing API piping Peritectic steel　etc.
CCM	Product capacity	0.5 x10^6t/y/unit	1.0 x10^6t/y/str
	Casting Speed	Max.　　mpm	Max. LC　5 mpm MC　3 mpm
	Mold thickness	75～125 mm Flat parallel	90 mm Flat-parallel
	Immersion Nozzle	Flat nozzle	Flat nozzle
	Soft reduction	No	No
	In line reduction	No	No
Hot	Reheating furnace	Working beam type	Tunnel furnace
	Coil box	No	No
	Mill	Rougher + Finishing 6 stds	Rougher 2std+ Finishing 6std
Plant	Length	approx. 450 m　CC－Coiler	
Industrialized status		Commercial (2 plants)	Commercial (Just started)
Cost	Construction cost	Medium for medium production	

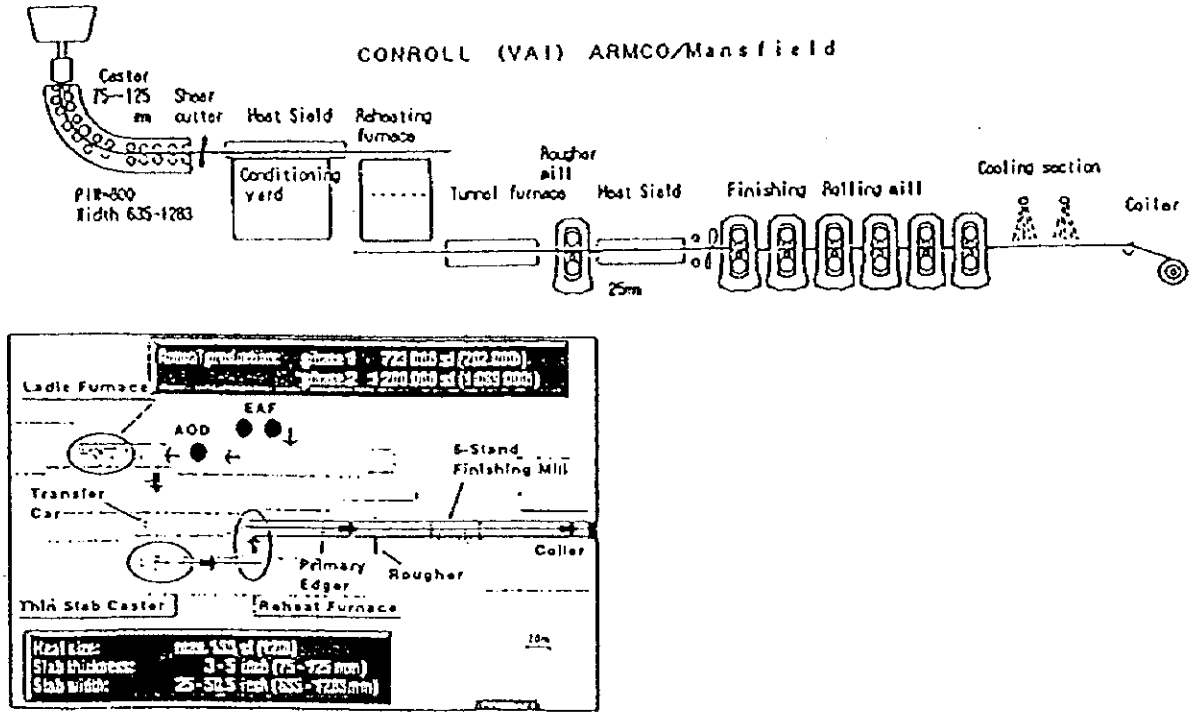


Figure 1-7 Schematic drawing of MSP
(CONROLL by VAI ARMCO/Mansfield)

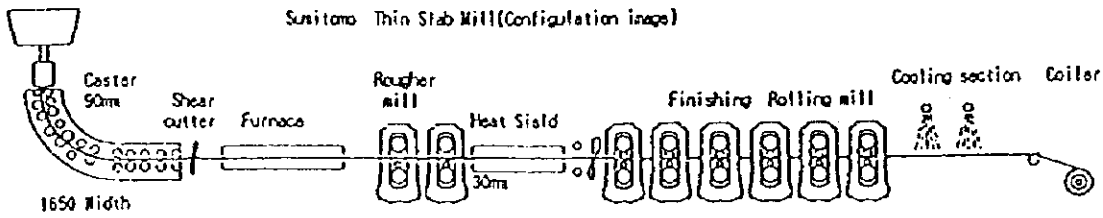


Figure 1-8 Schematic drawing of MSP
(Sumitomo Thin Slab Mill)

1.2.3 従来型連鋳－熱延 プロセス（ＣＶＰ）

－ＣＶＰ法は一般に一貫製鉄所として高炉／転炉プロセスと組み合わされる。(一部電気炉との組み合せもある)

－標準的厚みのスラブ連鋳機は世界中で最も普及した方式であり、工業的には完成している。

－このプロセスは自動車の外板に使用する超深絞り鋼のような高級鋼の製造には現状では不可欠である。

表 1-9 は当プロセスの概要を、表-10 は高級鋼を作るための主要な近代的技術を示し、図 1-9 はＣＶＰプロセスの概略図を示す。

Table 1-9 The outlines of CVP process

Item	Sub items	Description	Remarks
General	Works	Many works	
	Main Plant supplier	M-.Demag (Hitachi zosen), Concast(SHI), Danieli, VAI,	
	Steel grade	CGC DQ, DDQ, EDDQ SULC, Structural steel. API piping Peritectic steel Plate All steel grade is attainable	CGC; Commercial Grade CC steel SULC; Super Ultra Low Carbon steel
CCM	Product capacity	1.0～2.0 x10^6t/y/str	
	Casting Speed	Max. 2.0～3.0 mpm	
	Mold thickness	150～300 mm Flat parallel	
	Immersion Nozzle	Cylindrical nozzle	
	Soft reduction	Yes (at crater end)	Segregation free,
	In line reduction	No	
	Conditioning	Hot(cold) machine scarfing, Manual scarfing	Slab surface conditioning
Hot	Reheating Furnace	Working beam type	
	Coil box	No(Yes)	temperature uniformity
	Mill	Rougher + Finishing	
Plant	length	approx. 600 m	ＣＣ－Coiler(Not includes
Industrialized status		Commercial (many plants)	transportation)
Cost	Construction Cost	High for large production	

Table 1-10 The modernized main technologies

	Technology	Aim and effects
Productivity	Hot Direct Rolling Direct Hot Charge rolling	Energy saving, High slab temperature technique
	Width changeable mold	Productivity improve
	Thickness changeable mold	Productivity improve
	Continuous recycle operation of tundish under hot condition	Refractory, Labor, Energy saving
	C C ratio & sequence casting	Yield improving
Quality	Vertical bending type machine	Inclusion & gas floating
	Large scale tundish	Clean steel
	Temperature control in tundish	
	Revel control in mold	
	Coating of mold copper plate	Mold life up, Surface quality improving
	EMS, EMB in mold Mold powder optimizing	Surface quality improving
	Automatic casting control	Stable casing
	EMS at guide roll Soft reduction at crater end	Improving inner quality (Segregation)
	Compression casting	Outer, inner crack prevention
	Secondary cooling control	
Conditioning	Hot slab defect detector	
	Machine scarfing	

Note : TSP, MSP tends to apply some of these technologies.

1.2.4 従来型連鋳ーコイルボックス付き圧延プロセス（ＣＶＰ-Coil box)

ー直送圧延プロセスは近年盛んになって来た技術である。

ーＣＣＭと熱間圧延機は近接して設置され、出来るだけコンパクトに作られる。

ー特にこれはコマーシャルグレードの鋼種を生産する場合に効果的である。

図 1-10 は 従来型ＣＣＭ／Coil box 型 HSM プロセスの概略図の１例を示す。

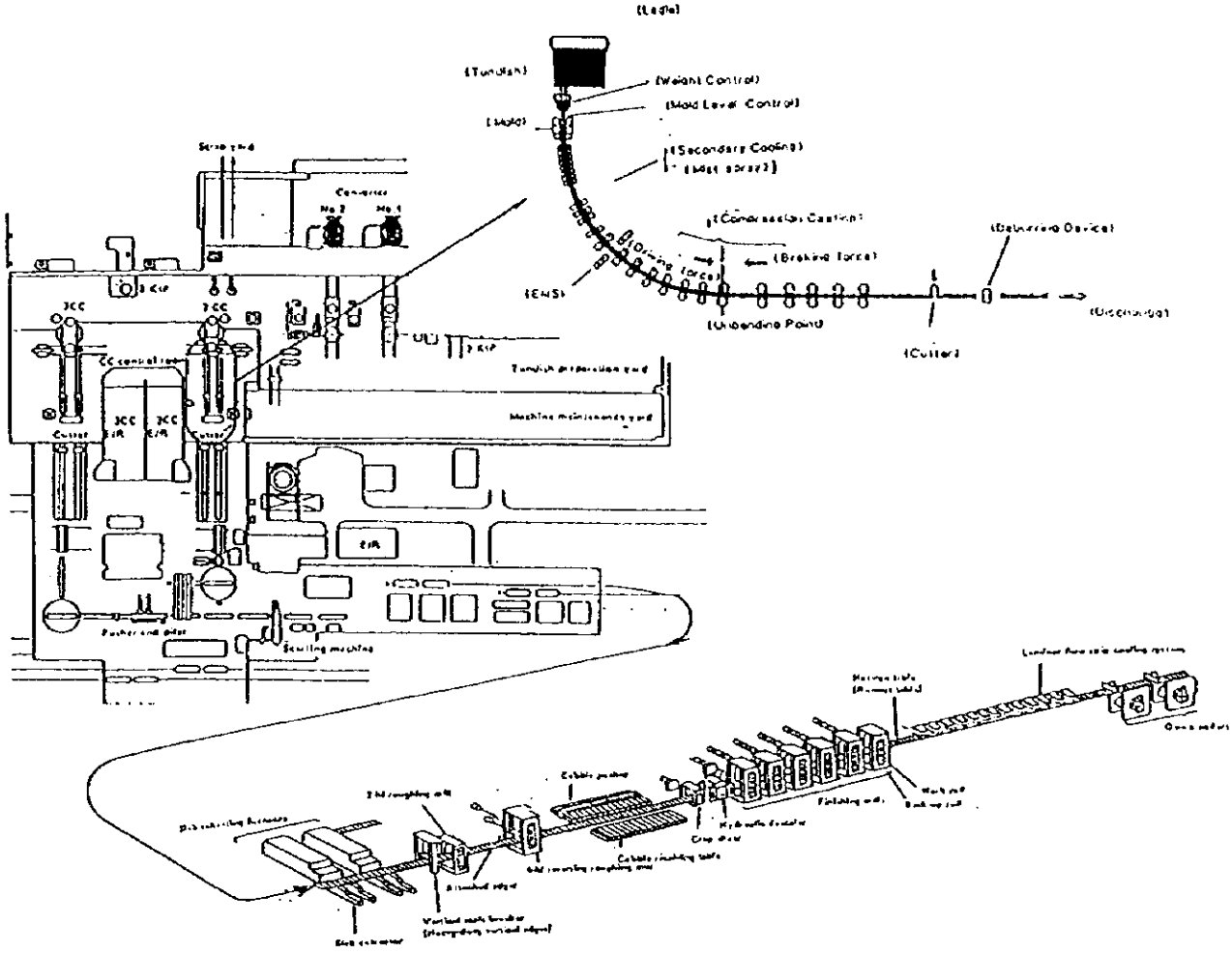


Fig 1-9 Conventional CC-Hot process (CVP)

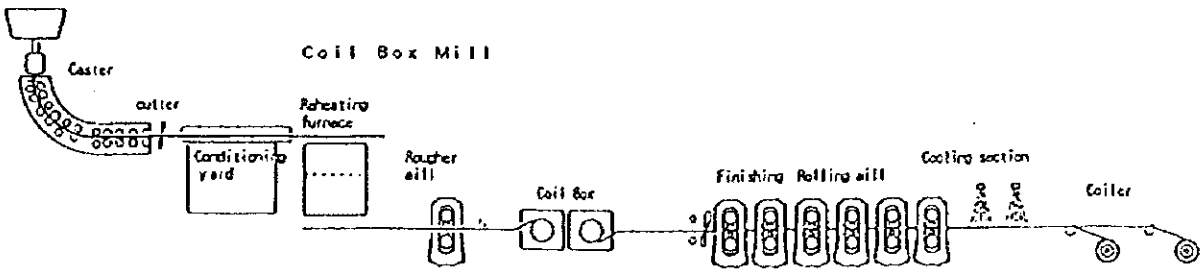


Fig 1-10 Schematic drawing of conventional coil box mill process

Section 3 騒音測定調査データシート

騒音測定調査データーシート (1)

1. 測定日時	1997. 8.15　N１＝11:10～11:20 N２＝11:40～11:50 1997. 8.16　N３＝16:20～16:25			
2. 気象条件	N１＝曇り N２＝曇り N３＝曇り			
3. 調査箇所	Ｈａｎｏｉ			
4. 測定場所	N１＝ Nang Iuong　(湖のほとり) N２＝ Pho Trang Tien　(本屋の前) N３＝ ホテルの近くのスーパー裏の住宅地			
5. 周辺状況	N１＝ 湖(HO Kiein)のほとりで交通量の多い場所で測定。 N２＝ Pho Trang Tien 通りの本屋の前で交通量の多い場所で測定。 N３＝ 遠くで金属音あり。(金槌でたたく音あり) また、時折オートバイの通過音あり。			
6. 使用機材	有　無	騒音計＋記録計	騒音計＋記録計	騒音計＋記録計
7. 測定結果		N１	N２	N３
	L eq	78．6	73．9	63．7
	L 5	82．4	78．0	66．8
	L 10	79．7	76．3	63．9
	L 50	72．9	72．3	55．0
	L 90	69．7	68．4	50．9
	L 95	69．0	67．4	50．2
	ﾁｬｰﾄNO	1	2	3
8. 備　考	1．測定点Ｎ１及びＮ２はHanoi の中心街の通りの騒音である。通行としては，自動車とオートバイであるが，オートバイの通行量が多い。騒音源としては自動車とオートバイであるが，走行音の他に絶えずクラクション音がある。 2．測定点Ｎ３はCapital Garden Hotel 近くのスーパー裏で測定。廻りは住宅地である。遠くで金属音(金槌でたたく音)あり。また、時折オートバイの通過音があるが，概して静かな状態。			

騒音測定調査データーシート（2）

1. 測定日時	1997. 8.17　N４＝14:40～14:50 N５＝ 6:50～ 6:55			
2. 気象条件	N４＝曇り N５＝曇り			
3. 調査箇所	Ｈａｎｏｉ			
4. 測定場所	N４＝ Thanh Cong Villa の中（レストラン赤坂の横で測定） N５＝ ＶＳＣの前の通り			
5. 周辺状況	N４＝ 表の通りでオートバイ の通過が時折ある程度。 N５＝ 通勤の車・オートバイ の通過が多い。			
6. 使用機材	有　無	騒音計＋記録計	騒音計	
7. 測定結果		N4	N5	
	L eq	53. 5	74. 5	
	L 5	56. 7	77. 9	
	L 10	55. 4	74. 6	
	L 50	52. 3	69. 6	
	L 90	50. 3	67. 5	
	L 95	49. 9	66. 9	
	ﾁｬｰﾄNO	4	なし	
8. 備　考	１．測定点Ｎ４は外国人（主に日本人）用住居の中で測定を実施。 測定中は廻りで騒音源は特になし。 但し，Thanh Cong Villa の前の通りを時折オートバイが通過している状態である。騒音としては比較的静寂な方である。 ２．測定点Ｎ５はＶＳＣの前の通りの騒音を測定。 早朝であるが，通行としては，自動車とオートバイであるが，オートバイの通行量が多い。騒音源としては自動車とオートバイであるが，走行音の他にクラクション音がある。			

騒音測定調査データーシート（3）

1. 測定日時	1997. 8. 20　N6＝15:35～15:40 N7＝15:50～15:55			
2. 気象条件	N6＝晴れ N7＝晴れ			
3. 調査箇所	サイト(ムイロン)			
4. 測定場所	N6＝ 海岸より少し陸地の所（車を駐車した場所） N7＝ 海岸線の場所			
5. 周辺状況	N6＝ 車の音が時折混在、人が若干動く音有り（現地の人）。 N7＝ 鳥の音、及び波の音が主。			
6. 使用機材	有　無	騒音計＋記録計	騒音計＋記録計	
7. 測定結果		N6	N7	
	L eq	39．5	40．2	
	L 5	41．8	43．6	
	L 10	39．9	42．5	
	L 50	36．5	38．8	
	L 90	34．9	36．1	
	L 95	34．2	35．3	
	ﾁｬｰﾄNO	6	7	
8. 備　考	1．測定点N6及びN7は一貫製鐵所建設候補地のMuironでの測定である。廻りは特に人家や工場等はなく、自然の騒音レベルである。 2．騒音レベルはL eqで40 dB前後で，静寂な状態。測定は昼間であったが，夜間でも同レベルの騒音と推定される。 このレベルが一貫製鐵所建設後（他に騒音源が無い場合）の暗騒音レベルと考えられる。 3．一貫製鐵所の敷地境界の騒音レベルが一般的には50～55 dBであり，製鐵所建設後に他に騒音源が無ければ，製鐵所敷地境界の騒音レベルは製鐵所の騒音で決まる。			

騒音測定調査データーシート（4）

1. 測定日時	1997. 8.21　N８＝15:40～15:45 1997. 8.22　N９＝ 8:50～ 9:00 1997. 8.22　N 10＝16:40～16:45			
2. 気象条件	N８＝晴れ N９＝曇り N 10＝曇り			
3. 調査箇所	N８＝ Ha Tinh N９＝ Vinh N 10＝ Vinh			
4. 測定場所	N８＝ People's Committee 会議室(3F)の騒音測定 N９＝ Huu Nghi Hotel (#208 号ﾍﾞﾗﾝﾀﾞより外の騒音測定) N 10＝ Huu Nghi Hotel の交差点			
5. 周辺状況	N８＝ オートバイ通過音、前の広場のマイクロホンの音あり（訓練）。 N９＝ 車・オートバイの通過音、その他生活雑音。 N 10＝ 車・オートバイの通過音			
6. 使用機材	有　無	騒音計	騒音計＋記録計	騒音計＋記録計
7. 測定結果		N8	N9	N10
	L eq	58. 5	57. 8	73. 8
	L 5	63. 9	60. 6	78. 5
	L 10	61. 1	59. 4	76. 5
	L 50	53. 8	56. 4	70. 9
	L 90	49. 1	54. 8	67. 2
	L 95	48. 3	54. 5	66. 2
	ﾁｬｰﾄNO	なし	9	10
8. 備　考	1．測定点N８及びN９は建物内の３F，２Fより外部の騒音を測定。 測定は，室内でなく外部の騒音。 遠くの通りの自動車，オートバイの通過音が測定されている。 2．測定点N１０は Huu Nghi Hotel 近くの交差点通りの騒音である。 通行としては，自動車とオートバイであるが，オートバイの通行量が多い。騒音源としては自動車とオートバイであるが，走行音の他に絶えずクラクション音がある。			

騒音測定調査データーシート (5)

1. 測定日時	1997. 8. 25　10:40～13:00					
2. 気象条件	曇り					
3. 調査箇所	VINAKYOUEI					
4. 測定場所	VINAKYOUEI 工場内 N 11＝オフィス内の会議室より工場側の騒音を測定 N 12＝門の所から工場側の騒音測定 N 13＝加熱炉前 (見学者通路より) N 14＝NO5 Std 前(見学者通路より) N 15＝最終 Std 前(見学者通路より)					
5. 周辺状況	圧延状況 ： 線材を圧延中に騒音を測定					
6. 使用機材	有　無	騒音計	騒音計	騒音計	騒音計	騒音計
7. 測定結果		N 11	N 12	N 13	N 14	N 15
	L eq	67. 4	66. 7	79. 7	84. 8	85. 6
	L 5	69. 9	70. 6	82. 1	87. 5	86. 6
	L 10	69. 3	69. 5	81. 6	86. 1	86. 4
	L 50	66. 8	65. 3	79. 4	84. 2	85. 7
	L 90	65. 8	61. 8	77. 7	83. 7	83. 8
	L 95	65. 5	61. 7	77. 4	83. 5	83. 4
	ﾁｬｰﾄNO	なし	なし	なし	なし	なし
8. 備　考	1．今回測定は線材圧延中の測定で、棒鋼圧延中の冷却床の鋼材衝突音はこれよりレベルが高いと思われる。 2．工場は圧延ライン側に側壁がなく、音は遮音されていない状況。 3．工場敷地境界の騒音としては、 N 12 のレベルである。 ① 測定中に車の通過があったが特に大きな暗騒音はなく、 N 12 のレベルが工場敷地境界の騒音と考えられる。 ② この地域は工業地域でなく、周辺に民家が散在しており、敷地境界の騒音レベルとしては高い。これは、工場は圧延ライン側に側壁がなく音は遮音されていないこと、工場と敷地境界が接近していることによると思われる。 ③ 将来周辺に民家が集積してくると、特に夜間の騒音としては大きくクレームがでる可能性がある。					

Part 2

Section 1 Scope of Work (業務範囲 S/W)

SCOPE OF WORK
FOR
THE MASTER PLAN STUDY
ON
THE DEVELOPMENT
OF
STEEL INDUSTRY
IN
THE SOCIALIST REPUBLIC OF VIET NAM

AGREED UPON BETWEEN
THE MINISTRY OF INDUSTRY
OF
THE SOCIALIST REPUBLIC OF VIET NAM
AND
THE JAPAN INTERNATIONAL COOPERATION AGENCY

HANOI, JUNE 12, 1996

AKIRA, KOJIMA
LEADER,
PREPARATORY STUDY TEAM,
JAPAN INTERNATIONAL
COOPERATION AGENCY

TRAN MINH HUAN
GENERAL DIRECTOR,
DEPARTMENT OF
INTERNATIONAL COOPERATION,
MINISTRY OF INDUSTRY

PHAM CHI CUONG
VICE PRESIDENT,
VIET NAM STEEL CORPORATION

I INTRODUCTION

In response to the request of the Government of the Socialist Republic of Viet Nam (hereinafter referred to as "GOV"), the Government of Japan decided to conduct the Master Plan Study on the Development of Steel Industry in the Socialist Republic of Viet Nam (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programmes of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of Viet Nam.

The present document sets forth the scope of work for the Study.

II OBJECTIVE OF THE STUDY

The objectives of the Study are to formulate a comprehensive master plan for the development of steel industry up to the year of 2010 in Viet Nam and to conduct a pre-feasibility study on installation of a new steel plant with high priority.

III SCOPE OF THE STUDY

The Study will be conducted in two phases: Phase 1 will be devoted to the preparation of a comprehensive master plan for the development of steel industry in Viet Nam, and Phase II to a pre-feasibility study of a selected steelworks development project.

In the course of Phase I and based on the findings obtained therein, the Viet Nam side and the Japanese side will have discussions on the selection of a prospective steelworks development project on which a pre-feasibility study will be conducted in Phase II. This project is to be decided by the Viet Nam side by the end of Phase I at the latest.

PHASE 1 MASTER PLAN

1. Present Situation of National Economy
1-1. Economic situation of Viet Nam
1-2. Present situation by industrial sector

2. Review of National Policy
2-1. National development plan
2-2. Development plan by industrial sector
(1)Petro-chemical industry
(2)Chemical industry
(3)Heavy industry

(4)Textile industry
(5)Food and beverage industry

2-3. Development plan of economic and social infrastructure
(1)Power generation and Power transmitting net-work
(2)Transportation(road & railway construction, port& port facilities)
(3)tele-communication net-work
(4)water supply and drainage
(5)Buildings, housings, etc

2-4. Exploitation plan of natural resources (iron ore, coking/steam coal, crude oil, natural gas, etc.)
(1)Reserves, location, properties of ROM(run of mine)
(2)Geology, topography, climate of mines
(3)Exploitation plan of each mine
(4)Quality, quantity and price of mined products
(5)Production schedule of mined products

2-5. Current development plan for steel industry

2-6. The role of steel industry in Viet Nam economy

3. Present situation of steel industry in Viet Nam

3-1. Situation of raw materials and energy supply

3-2. Outline of Viet Nam Steel Corporation (hereinafter referred to as "VSC")

3-3. Outline of the existing steelworks (Thai Nguyen, Southern, Da Nang, and other major steelworks)
(1)Configuration of the major productive facilities and production capacity
(2)Products mix
(3)Production and shipment record for the past five years
(4)Organization and manpower allocation
(5)Financial situation

3-4. Product transportation and distribution system

4. Market study

4-1. Present situation and past record (for 5 years) of steel demand

4-2. Present situation and past record (for 5 years) of steel supply

4-3. Present situation of international steel market

4-4. Supply and demand forecast
(1)Demand forecast of steel products in each industrial sector
(2)Prospective supply of steel products on mid-term and long-term basis (taking expansion plans of existing plants and plans for newly installed plants under various joint venture projects into consideration)
(3)Import and export of steel products

4-5. Expected needs for production capacity and product mix

5. Study on the applicable technology to the iron and steelmaking process in conformity with the circumstances

5-1. Required raw materials and utilities for each iron and steelmaking process

5-2. Comparative study on the applicable iron and steelmaking processes and rough comparison of construction cost of each process
(1)Blast furnace process
(2)Direct reduction process
(3)Scrap-based electric steelmaking process
(4)Smelting reduction process
5-3. Suggested iron and steelmaking technologies and processes

6. Study on the sites where new steel production plants are to be constructed
6-1. Location and Topography
6-2. Infrastructure and utilities of the possible sites
(1)Transportation (road, railway, port & port facilities)
(2)Electricity
(3)Water
(4)Tele-communication
(5)Other infrastructure (township, hospital, school, etc.)
6-3. Procurement of raw materials and fuel
6-4. Availability of labor at each site
6-5. Formulation of criteria for site selection and comparative study on the possible sites
6-6. Suggested sites for the construction of new steel production plants

7. Introduction of the past experiences of Japan and other Asian countries in developing steel industry

8. Formulation of a comprehensive master plan for the development of steel industry
8-1. Optimum development strategies for steel industry
8-2. Stage-wise & region-wise steel industry development
8-3. Modernization of existing plants of VSC (Thai Nguyen, Southern and Da Nang)
8-4. Utilization of energy resources and raw materials
8-5. Technological upgrading
8-6. Measures for environmental protection
8-7. Human resources development
8-8. Improvement of transportation and distribution system
8-9. Measures for improving corporate management
8-10. Measures to be taken by government to promote steel industry
8-11 Rough estimation of cost required for implementation of the master plan

9. Conclusion and recommendations

PHASE 2 PRE-FEASIBILITY STUDY

10. Conceptual study for a selected steel plant
10-1. Optimization of production capacity

10-2. Product mix
10-3. Raw materials and energy conditions
10-4. Process flow
10-5. Major production facilities
10-6. Plot plan (General layout of the plant)

11. Impact on environment
11-1. Air
11-2. Water
11-3. Dust
11-4. Noise
11-5. Wastes

12. Total development cost requirements
12-1. Plant related infrastructure
12-2. Plant construction
12-3. Plant operation

13. Evaluation
13-1. Financial analysis
13-2. Economic analysis
13-3. Impact on Society

14. Overall conclusion and recommendations

IV WORK SCHEDULE

The Study will be carried out in accordance with the attached tentative work schedule.

V REPORTS

JICA shall prepare and submit the following reports in English to GOV in accordance with the attached tentative work schedule.

Ten (10) copies of the Inception Report
Ten (10) copies of the Progress Report I
Ten (10) copies of the Progress Report II
Fifteen (15) copies of the Interim Report
Ten (10) copies of the Progress Report III
Twenty (20) copies of the Draft Final Report
Thirty (30) copies of the Final Report

VI UNDERTAKINGS BY THE GOVERNMENT OF VIET NAM

1. To facilitate smooth conduct of the Study, GOV shall take the necessary measures:

1-1 To secure safety of the Japanese Study Team (hereinafter

referred to as "the Team").

1-2 To permit the members of the Team to enter, leave and sojourn in Viet Nam for the duration of their assignment therein, and exempt them from alien registration requirements and consular fees

1-3 To exempt the members of the Team from taxes, duties and any other charges on equipment, machinery and other materials brought into, and out of, Viet Nam for the conduct of the Study

1-4 To exempt the members of the Team from income tax and charges of any kind imposed on, or in connection with, any emoluments or allowances paid to them for their services for the implementation of the Study

1-5 To provide necessary facilities to the Team for remittance as well as utilization of the funds introduced into Viet Nam from Japan in connection with the implementation of the Study

1-6 To try to secure permission for entry into private properties or restricted areas for the implementation of the Study.

1-7 To secure permission for the Team to take all data and documents including photographs and maps related to the Study out of Viet Nam

1-8 To provide medical service as needed. Its expenses will be chargeable on the members of the Team.

2. GOV shall bear claims, if any arises, against the member of the Team resulting from, occurring in the course of, or otherwise connected with the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the Team members.

3. VSC shall act as a counterpart agency to the Team and also as a coordinating body in relation with other governmental and non-governmental organizations concerned for the smooth implementation of the Study.

4. VSC shall, at its own expense, provide the Team with the following in cooperation with other organizations concerned :

4-1 Available data and information related to the Study
4-2 Counterpart personnel
4-3 Suitable office space with necessary equipment in Hanoi
4-4 Credentials or identification cards

VII UNDERTAKINGS BY JICA

For the implementation of the Study, JICA shall take the following measures :

1. To dispatch, at its expense, a series of study teams to Viet Nam
2. To pursue technology transfer to the Vietnamese counterpart personnel in the course of the study.

VIII OTHERS

JICA and VSC shall consult with each other in respect of any matters that arise from, or in connection with, the Study.

TENTATIVE WORK SCHEDULE

Year	1996				1997											
Project Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Calendar Month	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12
Preparatory Work in Japan	□															
Work in Viet Nam		■	■		■	■			■	■	■					
Work in Japan			□	□			□	□	□			□	□	□		
Presentation of Draft Final Report															■	
Reports	△ IC/R		▲ P/R1			▲ P/R2		△ It/R				▲ P/R3		△ DF/R		△ F/R

IC/R : Inception Report
P/R : Progress Report
It/R : Interim Report

DF/R : Draft Final Report
F/R : Final Report

MINUTES OF MEETING
ON
THE SCOPE OF WORK
FOR
THE MASTER PLAN STUDY
ON
THE DEVELOPMENT
OF
STEEL INDUSTRY
IN
THE SOCIALIST REPUBLIC OF VIET NAM

HANOI, JUNE 12, 1996

AKIRA, KOJIMA
LEADER,
PREPARATORY STUDY TEAM,
JAPAN INTERNATIONAL
COOPERATION AGENCY

TRAN MINH HUAN
GENERAL DIRECTOR,
DEPARTMENT OF
INTERNATIONAL COOPERATION,
MINISTRY OF INDUSTRY

PHAM CHI CUONG
VICE PRESIDENT,
VIET NAM STEEL CORPORATION

The Preparatory Study Team (hereinafter referred to as "the Team") organized by the Japan International Cooperation Agency (JICA) and headed by Mr.Akira Kojima visited the Socialist Republic of Viet Nam from June 6 to June 15, 1996 for the purpose of discussing with the Vietnamese authorities concerned the Scope of Work (hereinafter referred to as "the S/W") for "The Master Plan Study on the Development of Steel Industry in the Socialist Republic of Viet Nam" (hereinafter referred to as "the Study").

During the stay of the Team in Viet Nam, a series of meetings were held between the Team and the Vietnamese authorities on the S/W. The list of attendants appears in the appendix.

The S/W was agreed and signed on June 12, 1996, and concerning it, both sides confirmed the following points:

1. Concerning the item III.6 of the S/W, Viet Nam side shall propose candidate sites for the comparative study through discussion with the Study team based on the existing data and information. The maximum number of the candidate sites shall be three (3).

2. Concerning the item VI.4-1 of the S/W, Viet Nam side assured that it shall provide data and information which belong to the governmental organizations free of charge.
   Viet Nam side requested that if the Study team requires data and information from consulting companies and service companies, the expense shall be paid by the Study team.
   Japanese side promised to convey this request to JICA headquarters.

3. Concerning the item VI.4-3 of the S/W, Viet Nam side requested that the Study team shall arrange necessary equipments such as copy machines, facsimile machines etc. Viet Nam side also requested that telephone and facsimile fees shall be paid by the Study team.
   Japanese side promised to convey these requests to JICA headquarters.

4. Steering committee (hereinafter referred to as "the Committee") shall be organized for the purpose of smooth and effective implementation of the Study. The participants in the Committee shall include, but not be limited to, the members of the following authorities and its secretariat shall be set up within VSC.
   The Chairman of the Committee shall be appointed by the first visit of the Study team to Viet Nam at the latest.

   (1) Ministry of Planning and Investment
   (2) Ministry of Industry

(3) Ministry of Science Technology and Environment
(4) Ministry of Construction
(5) Ministry of Transportation
(6) Viet Nam Steel Corporation

5. Japanese side explained that JICA was planning to accept two counterpart personnel for the training in Japan in order to make the technical transfer effective in the course of the Study.
The C/P trainees are expected to visit Japan during the second analytical work of the Study tentatively scheduled from March to April in 1997.

Section 2 Minutes of Meetings and Relevant Letter
(議事録ほか)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Minutes of Meeting between VSC and MP Team

1. Date and Place: December 4, 1996 at Conference room of VSC

2. Participants: Refer to Attachment.

3. Major Items of Discussion:

   (1) Confirmation of the results of meeting with Steering Committee on November 27, 1996
   (2) Confirmation of Progress Report I
   (3) Schedule Change of the Second Site Survey and Confirmation of the Revised Schedule
   (4) Confirmation of the First Seminar at the time of the Third Site Survey

4. Discussions and Conclusions:

   (1) Confirmation of the results of meeting with Steering Committee on November 27, 1996

   VSC and the Master Plan (MP) Team confirmed the results of the second meeting with Steering Committee which was held on Nov. 27, 1996 as per the attached minutes of meeting including the selection of three candidate sites decided by Steering Committee.

   (2) Confirmation of Progress Report I

   MP Team submitted and explained to VSC the Progress Report I. Both parties confirmed the contents of Progress Report I.

   (3) Schedule Change of the Second Site Survey and Confirmation of the Revised Schedule

   MP Team explained the schedule change of the second site survey. The original schedule was to visit Viet Nam in early January next year. However, according to the suggestion of JICA Tokyo the second site survey will be commenced after "TET" so that the survey be perfonned efficiently. MP Team stated that the second survey would start on Monday, February 17, 1997 and the submission of the Interim Report will be shifted from the original schedule of the end of March to the middle of May 1997 accordingly. The overall schedule of the "Study" would not be affected despite the above schedule change.
   VSC understood the explanation and accepted the revised schedule.

   (4) Confirmation of the First Seminar at the time of the Third Site Survey

   MP Team reconfirmed the necessity of holding the First Seminar at the time of "Interim Report Explanation" (the third site survey) which had been explained and discussed at the first meeting with Steering Committee. VSC confirmed that it was Steering Committee's intention that the Seminar be held as MP Team advised and it includes such item as "Development Pattern and Pogress of Steel Industry in the Developing Countries, particularly in Neighboring Countries". MP Team appreciated VSC's confirmation and promised to convey Steering Committee's intention to JICA Tokyo.

5. Related Documents:

   Minutes of Meeting (Steering Committee, November 27, 1996)
   Progress Report I
   Revised Schedule of the Second Site Survey

Confirmed by:

Phan Chi Cuong Vice President, VSC	Kenji Kobayashi Leader of MP Team, JICA

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Minutes of Meeting Between Steering Committee, VSC and MP Team

1. Date and place: Oct 23, 1996 at Conference room of VSC (2-nd floor)

2. Participants:

Steering Committee:	Mr. Nguyen Van Hoc (MPI),	Dr. Ho Ngoc Xiem (MOI)
	Mrs. Phan Thi Nhuong (MOI),	Mr. Vuong Dinh Cat (MOC)
	Mr. Le Van Thac (MOSTE),	Dr. Tran Van Quy (VSC)
VSC:	Mr. Phan Chi Cuong, and others	
JICA: (Tokyo)	Mr. Minoru Yamada	
(Viet Nam)	Mr. Hisatoshi Okubo	
MP Team:	Mr. Kenji Kobayashi,	Mr. Akira Teramae
	Mr. Tadahiko Nishi,	Mr. Akihiko Ochi
	Mr. Fuku Fukawa,	

3. Major Items of Discussion:
   (1) Contents of Inception Report and overall schedule of the Study
   (2) Applicable process technology
   (3) Criteria for site selection

4. Discussions and Conclusions:

   (1) For the purpose of smooth and effective implementation of the Study, Steering Committee, VSC and the Master Plan (MP) Team confirmed that MP Team should work under the coordination of VSC counterparts during their staying period in Viet Nam.
   If MP Team necessitates any data or information from the governmental agencies such as MPI, MOI, MOC, GSO, etc., VSC counterparts and their subordinate personnel will make efforts to obtain such data and information.

   (2) As for the site selection of the new steel production plant which is foreseen as necessary as the results of the Master Plan Study, Steering Committee confirmed that it will select three (3) sites among ten (10) possible sites according to the Criteria for Site Selection suggested by MP Team by the date of the next steering committee which is expected to be held during the week starting from Nov 25, 1996.

   (3) Steering Committee members were confirmed as above written. It was confirmed by the parties that the Steering Committee should have the highest decision-making function for the Study. The chairman of the Committee is Dr. Tran Van Quy.

   (4) Mr. Yamada of JICA Tokyo explained the "Counterparts Training Scheme" in Japan. As the trainees, one person each from VSC and MPI/MOI, total two persons, are expected to be received in Japan during Feb-Mar 1997. Steering Committee confirmed that it will select 2 persons by the date of the next Steering Committee.

5. Related Documents:
   Inception Report (Oct 1996, JICA)
   Criteria for Site Selection (MP Team)
   Steering Committee member list (VSC)

Confirmed by:

Tran Van Quy	Kenji Kobayashi
Chairman of Steering Committee	Leader of MP Team, JICA
Date:	Date:

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Attachment to the Minutes of Meeting between VSC and MP Team on December 4, 1996

Participants of the Meeting:

VSC:	Mr. Phan Chi Cuong, Vice President
	Mr. Nguyen Huu Tho, Deputy Director of Planning & Investment Dept.,
	Mr. Nguyen Trong Sang, Planning & Investment Dept. (Market study)
	Mr. Trinh Khoi Nguyen, Planning & Investment Dept. (Infrastructure)
	Mr. Dinh Van Tam, Planning & Investment Dept. (Iromaking)
MP Team:	Mr. Kenji Kobayashi,
	Mr. Akira Teramae,
	Mr. Kunio Otsuka,
	Mr. Tadahiko Nishi,
	Mr. Fuku Fukawa

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Minutes of Meeting Between Steering Committee, VSC and Master Plan Team

~~(Draft)~~

1. Date and place: March 5 and 6, 1997 at Conference Room of VSC (Second floor)

2. Participants:
   Refer to the Attachment.

3. Major Items of Discussion:
   (1) Site selection, Thach Khe iron ore and iron/steelmaking process
   (2) Process between continuous casting and hot strip mill equipment
   (3) Steel demand forecast up to the year of 2010 in Viet Nam

4. Discussions and Conclusions:

4.1 Site selection, Thach Khe iron ore and iron/steelmaking process

(1) Site selection
Three (3) candidate sites were carefully surveyed by Master Plan (MP) Team members. Three sites were selected by the Steering Committee on November 27, 1996 at the second meeting with them, i.e., Thach Khe area, Mui Ron and Dung Quat. The criteria for the evaluation was explained and the results of the evaluation were reported as follows:

- There was no significant difference between Thach Khe area site (Cua Sot/Thach Van) and Mui Ron site in terms of various evaluation items of the criteria; however, as for the Dung Quat site, port construction cost, land preparation cost (earth moving volume) and construction cost for water reservoir were evaluated less advantageous than those of the other two (actually three) sites.
- In this connection, MP Team suggested that one (1) site shall be selected by the time of the next opportunity of the meeting, i.e., by the timing of the Interim Report Explanation, among the sites surveyed at this time taking into consideration the evaluation results of MP Team.
- VSC and Steering Committee members agreed to this suggestion.

(2) Thach Khe iron ore and iron/steelmaking process
- MP Team explained that it made a comparative study on the proposed four (4) processes, that is, (i) BF/BOF process, (ii) DRI/EAF process, (iii) smelting reduction (SR) process, and (iv) scrap/EAF process, and that BF/BOF process and SR process would remain for the further study and two other processes would not be worthy for the further study due to raw materials and fuel conditions of Viet Nam.
- MP Team also explained that during the course of discussion with VSC people the common agreement was obtained to select BF/BOF process because of the production scale foreseen for the new integrated steelworks, more than 4.5 million tons a year, and actually operating SR process (COREX), that is only 2,000 t/day.
  MP Team suggested that the step-wise construction method should be examined since the construction cost of an integrated steelworks would be high and that the advanced construction of downstream processes be studied to reduce the initial investment. Under such condition, the construction of upstream processes would be realized sometime at a later stage.
  MP Team advised to restudy the upstream process selection at that stage taking into account then-established process technology and up-dated information of raw materials and fuels in Viet Nam.
- MP Team explained its concern about the quality of Thach Khe iron ore.
  Although the quality data of the iron ore is not officially obtained by MP Team, it might have the possibility of including some harmful elements to BF and/or SR operation such as Zn at a certain level (say 0.06%).

(Minutes of Meeting, March 5 & 6, continued)

MP Team stated that BF operation must limit the use of Thach Khe iron ore to the level of less than 10% of iron-bearing materials, if such level of Zn content is proven. This means that the annual use of Thach Khe iron ore will be about 500,000 tons and the major portion of iron source must be imported.

- VSC asked MP Team to study another process capable of using Zn containing iron ore. MP Team replied that DRI process can utilize such iron ore, however, DRI process is excluded from the further study due to the above stated reasons and suggested that the MP study would be proceeded with the assumption of using 10% of Thach Khe ore under the present state of lack of technical data, and that the usage of Thach Khe iron ore would be increased, if Zn content is proven to be less than such level.
- VSC and Steering Committee members agreed to this suggestion.

4.2 Process between continuous casting and hot strip mill equipment

MP Team explained salient points of the possible four (4) processes between continuous slab caster and hot strip mill, that is, (i) thin slab type compact strip production process (CSP), (ii) medium slab production process (MSP), (iii) conventional coil box mill (C/B), and (iv) conventional three-quarter hot strip mill (3/4).

The major points explained were as follows:

- CSP and MSP should be regarded as mini-mill type process and they will be possible to exist only when steelmaking facilities such as BOF or EAF are simultaneously constructed.
- Scrap based EAF is not worthy to study for the production of good flat steel products. In case of producing flat products via EAF process, HBI (or DRI) must be used as substantial raw material due to quality reason.
- The total construction cost required for an integrated steelworks will be a huge amount of investment, therefore, a step-wise construction method is recommended to save heavy initial investment. In case hot strip mill construction is to be realized prior to the construction of upstream processes (BF/BOF), slabs must be procured at international market. It was confirmed that the internationally available slab is normally standard thickness slab and that in such a case, CSP and MSP should be excluded from the further MP study.

After the above explanation and exchange of views with each other, it was agreed by the parties that the conventional coil box mill (C/B) should be selected as the most suitable process and that the JICA study be proceeded with this process.

4.3 Steel demand forecast up to the year of 2010 in Viet Nam

MP Team explained the basis of demand forecast for steel products up to the year of 2010. The obtained results were 3.5 million tons a year for the flat products and 2.9 million tons for the non-flat products; and the total amount was 6.4 million tons in 2010. MP Team stated that a new integrated steelworks would be planned based on the above figures deducting the production capacity foreseeable of the possible new joint venture mills. The parties confirmed the above statement.

5. Related Documents:

Progress Report II for the Steering Committee (Second Study Team) dated March 6, 1997

Confirmed by:

Pham Chi Cuong
Vice President
Viet Nam Steel Corporation
Date:

Kenji Kobayashi
Leader of MP Team, JICA
Date:

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Attachment to the Minutes of Meeting dated March 5and 6, 1997

List of Participants

Steering Committee:	Mr. Le Van Hoc (MPI)	Dr. Ho Ngoc Xiem (MOI)
	Mrs. Pham Thi Nhuong (MOT)	Mr. Le Van Thac (MOSTE)
	Dr. Tran Van Quy (VSC)	
Viet Nam Steel Corporation	Mr. Pham Chi Cuong:	Vice President
	Mr. Dao Duc Dinh:	Director of Planning & Investment
	Mr. Nguyen Huu Tho:	Deputy Director of Planning & Investment
	Dr. Dinh Huy Tam:	Director of Thach Khe Iron Ore Project
	Mr. Lam Kim Thanh:	Planning & Investment Dept.
	Mr. Bui Quang Huy:	Planning & Investment Dept.
	Mr. Nguyen Trong Sang:	Planning & Investment Dept.
	Mr. Nguyen Phuc:	Planning & Investment Dept.
	Mr. Trinh Khoi Nguyen:	Planning & Investment Dept.
	Mr. Dinh Van Tam:	Technical Dept.
JICA Viet Nam	Mr. Hiroshi Tsujino (March 6)	
JICA Master Plan (MP) Team:	Mr. Kenji Kobayashi	Mr. Akira Teramae
	Mr. Kunio Otsuka	Mr. Tadahiko Nishi
	Mr. Tetsuya Akahoshi	Mr. Hiroshi Shibata
	Mr. Michiru Nakagome	Mr. Yasuhiko Igawa
	Mr. Keiichi Katahira	Mr. Takayuki Ikeda
	Mr. Kazuhiko Kondo	Mr. Akihiko Iwatsuki
	Mr. Fuku Fukawa	

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Minutes of Meeting between Steering Committee, VSC and Master Plan Team

1. Date and Place: June 26, 1997 at Conference Room of VSC (Second Floor)

2. Participants: Refer to Attachment

3. Major Items of Discussion
   (1) Site selection
   (2) Process to be studied
   (3) Survey plan of the 4th study team
   (4) Plants to be incorporated in the new integrated steelworks

4. Discussion and conclusion
   (1) The 1st seminar on June 25, 1997
   VSC and Steering Committee members stated that the 1st seminar conducted jointly by JICA/MOI/VSC was successfully held on June 25, 1997 and the lecture "Economic Consideration on Steel Industry in Developing Countries" addressed by Dr. Hiromoto Toda, Managing Director ,Japan Iron and Steel Federation,was highly appreciated by the attendants of the Seminar.
   (2) Interim Report
   The Interim Report of " the Master Plan Study on the Development of Steel Industry in Viet Nam" was explained by the Master Plan(MP) Team during June 23-26, 1997 and accepted and well understood by VSC and Steering Committee members.
   (3) Site selection
   After the exchange of views from technical, economic and political points of view, Steering Committee members proposed "Mui Ron" as the site for new integrated steelworks. MP team explained that it would need some lead-time to prepare preliminary layout drawings of the site in order to discuss with VSC counterparts at the occasion of the 4th site survey which is scheduled for August 11, 1997 and thereafter, and requested Steering Committee members and VSC counterparts that they should inform MP Team by July 15, 1997 of the possible change of the proposed site due to political or some other reasons.
   (4) Process to be studied
   It was reconfirmed that the BF/BOF and conventional slab casting + coil box type hot strip mill process should be studied in Phase II as stated in the Minutes of Meeting of March 5 and 6, 1997.
   (5) Survey plan of the 4th study team
   MP Team explained the proposed schedule of the 4th site survey based on " Survey Plan of the 4th Study Team" and requested VSC counterparts their cooperation in advance for the arrangements to be required for the 4th site survey. VSC agreed to the above request.
   (6) Plants to be incorporated in the new integrated steelworks
   MP Team asked VSC counterparts the possibility of eliminating construction of up-stream process plants due to profitability and financial reasons. VSC replied that an integrated production process based on iron ore should be studied as a prerequisite, since the self sufficiency of steel products should be secured as a basic policy of Viet Nam's industrialization policies.

MP Team understood the above reply of VSC and confirmed that the final configuration of the production process should be BF/BOF, conventional slab casting plant and hot/cold rolling mills with the full production capacity equipped with necessary coating plants, however, that the case study will be made taking into account the step-wise construction to see the difference of IRR according to the phasing of construction timing of related plants.

5. Related Documents
   (1) The Master Plan Study on the Development of Steel Industry in the Republic of Viet Nam(Interim Report)
   (2) Excerpts of the above report
   (3) Survey Plan of the 4th Study Team

Confirmed by

Pham Chi Cuong	Kenji Kobayashi
Vice President	Leader
Viet Nam Steel Corporation	MP Team of JICA

Date: June 27,1997

Attachment to the Minutes of Meeting dated June 26, 1997

List of Participants

Steering Committee:	Mr. Le Van Hoc (MPI)
	Dr. Ho Ngoc Xiem (MOI)
	Mrs. Pham Thi Nguong (MOT)
	Mr. Le Van Thac (MOSTE)
	Dr. Tran Van Quy (VSC)
Viet Nam Steel Corporation:	Mr. Pham Chi Cuong (Vice President)
	Mr. Nguyen Huu Tho (Deputy Director of Planning & Investment)
	Mr. Bui Quang Huy (Planning & Investment Dept.)
	Mr. Nguyen Phuc(Planning & InvestmentDept.)
	Mr. Trinh Khoi Nguyen(Planning & Investment Dept.)
	Mr. Nguyen Trong Sang(Planning & Investment Dept.)
	Mr. Dinh Van Tam(Technical Dept.)
JICA Viet Nam :	Mr. Hiroshi Tsujino
JICA Tokyo:	Mr. Minoru Yamada
JICA Master Plan Team:	Mr. Kenji Kobayashi
	Mr. Akira Teramae
	Mr. Kunio Otsuka
	Mr. Tetsuya Akahoshi
	Mr. Michiru Nakagome
	Mr. Keiichi Katahira
	Mr. Kazuhiko Kondo
	Mr. Akihiko Ochi
	Mr. Fuku Fukawa

VIETNAM STEEL CORPORATION
Address: 35 Lang Ha Str., Dong Da Dist., Hanoi.
Tel. 856 1798 Fax: 856 1815

To : JICA HANOI REP. OFFICE
Attn.: Mr. MASARU TODOROKI
Resident Representative
Ref. Request for studying Dung Quat-Site

Hanoi 11th August, 1997

Dear Sirs;

Thank you for your kind attention and support rendered to VSC in promoting Steel Industry in Vietnam.

As you already know, to realize the Agreement signed between the Ministry of Industry (MOI) and Japan International Cooperation Agency (JICA) on JICA's assistance to Vietnam in preparation of Master Plan for development of Steel Industry up to 2010, including preparation of Pre-Feasibility Study (PFS) for establishment of Integrated Steel Plant with capacity of 3 - 4.5 million ton per year, JICA study Team already surveyed, in cooperation with VSC, 10 candidate sites for selecting appropriate one to locate proposed integrated steel plant. From 10 sites surveyed, JICA Study Team proposed VSC 3 sites namely Thach Khe, Mui Ron and Dung Quat, with the most favorable conditions so that VSC can adopt one of them.

Vietnam Steel Corporation already asked JICA Study Team to prepare PFS for Integrated Steel Plant with MUI RON site condition.

However, according to the information we've got recently, Japanese Government might grant ODA fund to Vietnam for development of Infrastructure of Dung Quat area. In order to consider whether we can mobilize infrastructure developed with Japanese ODA fund at Dung Quat serving for our proposed steel plant so that we can save certain amount of initial investment, Vietnam Steel Corporation hereby propose JICA, apart from studying Mui Ron site conditions, to arrange additional survey for Dung Quat site so that JICA can give its advice to our Government to select right location to construct our first integrated steel plant in Vietnam.

We understand that our request would cause some delay of the original time schedule for the study.

However, we believe that such delay would not affect to the total scheme of our Master Plan and PFS schedule.

We do hope JICA will support our suggestion.
With thanks and best regards.

HO NGHIA DZUNG
President/VSC

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Minutes of Meeting Between Steering Committee, VSC and Master Plan Team

1. Date and place: September 4 & 5, 1997 at Conference Room of VSC (Second floor)

2. Participants:
   Refer to the Attachment.

3. Major Items of Discussion:
   (1) Meeting with VSC counterparts on September 4, 1997
   - Explanation of Progress Report III and exchange of views
   (2) Meeting with Steering Committee members and VSC counterparts on September 5, 1997
   - Concept of Stepwise Construction
   - Concept of General Layout
   - Summary of 4th Survey
   - Additional Survey for Dung Quat

4. Discussions and Conclusions:

4.1 Meeting with VSC counterparts on September 4, 1997

Progress Report III was explained by Master Plan (MP) Team.

The major points of explanation were as follows:

(1) Explanation of general and individual survey schedule

(2) Concept of general layout

Preliminary layout drawings at Mui Ron site were explained by MP Team.

(3) Concept of stepwise construction schedule

Stepwise construction in three (3) steps was introduced and each of the steps was explained. Namely, Step 1 is to construct hot and cold strip mills at first by importing slabs. Step 2 is to construct one unit of BF and two units of converter vessels to feed semi-products (slabs) to hot and cold strip mills. Step 3 is the final phase where the final plant configuration is to be completed.

Emphasized issues were the importance of slab import with stable supply, good quality and reasonable price, and advanced construction of product berth.

The concept explained by MP Team was understood by VSC. However, stepwise construction plan and timing of each step will be confirmed by Board of Management (BOM) of VSC and informed to JICA MP Team by the end of September 1997.

(4) Confirmation with VSC relating to the pre-conditions for Pre-F/S

Confirmed items and data obtained through interview survey in the following areas were explained by MP Team and confirmed by both parties that these items and data should be the preconditions of the Pre-Feasibility Study to be undertaken in Japan by MP Team.

- Conditions of raw materials and semi-products
- Demand mix, size and steel grade mix
- Basis of planning for production processes
- Financial and economic analysis method
- Site description

The product width for hot and cold strip mills was confirmed to be less than 1,600mm (5-foot mill) and 1,300mm, respectively.

(5) Environmental preservation

The concept of introducing environmental preservation equipment was explained by MP Team so as to minimize the initial investment amount, however, MP Team stated that it would restudy to introduce the desulphurization equipment to the main exhaust gas system of sintering plant, since the major SOx source from an integrated steelworks.

(Minutes of Meeting, September 4 & 5, continued)

is considered to be sintering plant. VSC understood this statement.

(6) Concept of plant management and organization to compute total manpower requirement.
It was confirmed that the total manpower to be estimated for the integrated steelworks should be based on the organization chart explained by MP Team and that the central maintenance shops to be provided in the integrated steelworks should also be based on the explanation made by MP Team.

(7) Non-flat rolling
Discussion was made whether or not non-flat rolling plants be installed inside the integrated steelworks as part of the steelworks plants. MP Team explained the advantages of installing quality bar mill and wire rod mill inside the integrated steelworks, however, it was confirmed by both parties that the non-flat rolling plants should be constructed somewhere outside the integrated steelworks to minimize the initial capital investment.

4.2 Meeting with Steering Committee members and VSC counterparts on September 5, 1997

Major items explained by MP Team were as follows:

(1) Concept of stepwise construction
(2) Concept of general layout for Mui Ron site
(3) Summary of the 4th survey
(4) Objectives and schedule of additional survey for Dung Quat site

The parties confirmed the following points:

(1) Stepwise construction presented by MP Team should be the basis of financial evaluation.
(2) Earlier construction of BF and related upstream plants should also be examined.
(3) Main raw materials such as iron ore, coal should be imported in principle.
In this connection, a question was raised by MOI representative concerning stable procurement of raw materials abroad. MP Team explained the Japanese example of importing raw materials from foreign countries by investing mines abroad from long-term viewpoints.
(4) Hot strip plant should be of 5-foot mill to reduce initial capital investment and cold strip plant should have the mill to produce max. 1,300mm wide products.
(5) In Dung Quat area, no mini-mill project based on EF process is envisaged regardless the project of the integrated steelworks.

5. Related Documents:

(1) Progress Report III (Fourth Study Team) dated September 5, 1997
(2) Agenda for Steering Committee

Confirmed by:

Pham Chi Cuong
Vice President
Viet Nam Steel Corporation
Date: Sept 5, 1997

Kenji Kobayashi
Leader of MP Team, JICA
Date Sept. 5, 1997

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Attachment to the Minutes of Meeting dated September 4 and 5, 1997

List of Participants

Steering Committee: (September 5)	Mr. Le Van Hoc (MPI)	Dr. Ho Ngoc Xiem (MOI)
	Mrs. Pham Thi Nhuong (MOT)	Mr. Vuong Dinh Cat (MOC)
	Dr. Tran Van Quy (VSC)	
Viet Nam Steel Corporation	Mr. Nguyen Huu Tho:	Deputy Director of Planning & Investment
	Mr. Lam Kim Thanh:	Planning & Investment Dept.
	Mr. Bui Quang Huy:	Planning & Investment Dept.
	Mr. Nguyen Trong Sang:	Planning & Investment Dept.
	Mr. Nguyen Phuc:	Planning & Investment Dept.
	Mr. Trinh Khoi Nguyen:	Planning & Investment Dept.
	Mr. Dinh Van Tam:	Technical Dept.
JICA Viet Nam	Mr. Hiroshi Tsujino (September 5, 1997)	
JICA Master Plan (MP) Team:	Mr. Kenji Kobayashi	Mr. Seiji Kataoka
	Mr. Tadahiko Nishi	Mr. Tetsuya Akahoshi
	Mr. Michiru Nakagome	Mr. Hiroshi Shibata
	Mr. Keiichi Katahira	Mr. Takayuki Ikeda
	Mr. Kazuhiko Kondo	Mr. Kaku Hashimoto
	Mr. Hiroshi Miyauchi	

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Minutes of Meeting Between Steering Committee, VSC and Master Plan Team

1. Date and place: October 14, 1997 at Conference Room of VSC (Second floor)

2. Participants:
   Refer to the Attachment.

3. Major Item of Discussion:

   Summary of 5th site survey (Dung Quat)

4. Discussions and Conclusions:

   JICA Master Plan (MP) Team explained the results of 5th site survey jointly conducted with JICA Port Development Group at Dung Quat area based on the Progress Report IV.

   The major points of explanation and discussions were as follows:

   (1) Facts and findings newly obtained through site survey were summarized in the Attachment and the topics of the interview with the local Authority people were explained as well.

   (2) Preliminary idea of the steelworks' general layout was introduced by MP Team based on the above information. MP Team stated that it would proceed with the pre-feasibility study in Japan and conduct a comparative study on the site evaluation in accordance with the ideas described in item 4 of the Progress Report IV.

   (3) MOC representative stated that the prioity of selecting the location of the site should be suggested in the draft final report only from the technical points of view.
   MP Team replied that it would take note of the above suggestion.

   (4) MP Team asked that the sharing rule of construction cost of common infrastructural facilities such as waterbreaking dike or the like among the other plant(s) and the government. After the exchange of views, it was confirmed by the parties that MP Team would clearly indicated in its draft final report the items included in its estimate to avoid any missing items of capital cost estimate.

5. Related Documents:
   (1) Progress Report IV dated October 14, 1997

Confirmed by:

Dr. Tran Van Quy
Chairman
Steering Committee

Board of Management
Vietnam Steel Corporation
Date: 15 Oct. 1997

Kenji Kobayashi
Leader of MP Team, JICA

General Manager
Technical Cooperation Division
Nippon Steel Corporation
Date: 15 Oct 1997

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

Attachment to the Minutes of Meeting dated October 14, 1997

List of Participants

Steering Committee:	Mr. Le Van Hoc (MPI)	
	Mrs. Pham Thi Nhuong (MOT)	
	Mr. Vuong Dinh Cat (MOC)	
	Dr. Tran Van Quy (VSC)	
Viet Nam Steel Corporation	Mr. Trinh Khoi Nguyen:	Planning & Investment Dept.
	Mr. Bui Quang Huy:	Planning & Investment Dept.
	Mr. Nguyen Trong Sang:	Planning & Investment Dept.
	Mr. Nguyen Phuc:	Planning & Investment Dept.
	Dr. Phan Duc Lap:	Technical Dept.
JICA Master Plan (MP) Team:	Mr. Kenji Kobayashi	
	Mr. Tetsuya Akahoshi	
	Mr. Hiroshi Shibata	
	Mr. Noboru Takahisa	
	Mr. Hiroshi Miyauchi	

Minutes of Meeting between Steering Committee, VSC and JICA Study Team

1. Date and place: January 15, 1998 at Conference room of VSC (2nd floor)

2. Participants: Refer to the Attachment.

3. Major Items of Discussion:
   (1) Confirmation of the second seminar
   (2) Exchange of views relating to the promotion of the construction of an integrated steelworks
   (3) Final report preparation and its treatment
   (4) Others

4. Discussions and Conclusions:

(1) The parties confirmed that the second seminar jointly held by VSC/MOI and JICA on January 13, 1998 was successfully conducted and that the presentation made by Mr. Kobayashi, the leader of JICA study team, on the master plan for the development of steel industry in Viet Nam and the results of pre-feasibility study was well understood by the participants of the seminar, and further that the special key note speech addressed by Dr. Hiromoto Toda, the Managing Director of Japan Iron and Steel Federation-JISF, on the various aid schemes of Japan and international organizations and specific features and examples of development patterns of steel industry in developing countries was also well appreciated by the participants of the seminar.

(2) Exchange of views relating to the promotion of the construction of an integrated steelworks
   (a) VSC asked JICA study team's views on the following three points:
      i) Modernization policy of the existing small steel plants
      ii) Relation between joint venture flat rolling mini-mill which is under planning and the integrated steelworks of JICA study project for flat production
      iii) Potentials of the integrated steelworks location other than the present candidate sites of Mui Ron and Dung Quat

   (b) JICA study team replied to the above three items as follows:
      i) The existing small steel plants should be modernized step by step taking into consideration of the effectiveness of investment, i.e., it should be concentrated on the effective modernization projects including rationalization of small scale steel mills. Modernized equipment installed in some joint venture mills, such as Vinakyoei, VSC-POSCO and Vinausteel would show the direction of modernization, absorbing the production capacity of the existing mills. In this case, however, how to secure

employment would be a crucial problem. This is an inevitable path to modernize the existing facilities.

ii) If scrap based mini-flat rolling mill is realized, the essential portion of JICA master plan and the contents of pre-feasibility study would have to be reviewed, since there would be no need of installing two units of hot strip mill up to the year 2010. Investment for two hot strip mills is regarded as double investment in this case. The plan to operate a reversing cold mill in the southern Viet Nam by 2001 will be an effective investment to satisfy market need and the investment for a new integrated steelworks will be effectively utilized by supplying hot coils to the reversing cold mill.

iii) Deep sea port construction is required for the integrated steelworks to accommodate large size ore vessels, since ore and coal must be imported. From this point of view, the most appropriate site should be selected.

(3) Final report preparation and its treatment

i) Amendment to the draft final report
The draft final report was accepted by the steering committee and VSC, however, VSC stated to forward its request of clarification, addition or correction relating to the draft final report by 27th day of January 1998 by means of facsimile transmission.
JICA study team replied that it would incorporate VSC's request into the Final Report as far as possible by viewing the time schedule and reflecting the basic concept of the Scope of Work agreed on June 12, 1996. VSC agreed to this reply.

ii) Treatment of Final Report and its Excerpts Edition
JICA and JICA study team stated that any JICA reports are, in principle, treated as the documents to be disclosed to the public. JICA study team asked VSC's agreement to that principle of treating documents.
VSC understood the general rule of JICA's treatment of its document, however, VSC stated that it will give a definite answer in a written form to JICA Viet Nam office by 27th day of February 1998 after consultation with the ministries concerned, clearly indicating the nature of treatment, disclosure or non-disclosure including the conditions of non-disclosure, if such non-disclosure obligation is required, such as the portions of the report which require non-disclosure obligation, duration of non-disclosure obligation, e.g. three years or other terms, treatment of the Excerpts edition as to whether or not the Excerpts edition can be freely disclosed publicly, etc.

JICA study team understood the above VSC's reply in principle, and added that the permanent non-disclosure obligation will not be accepted by JICA and further stated that

in case such reply is not given by the above date, the JICA's general rule of disclosing the documents publicly will be applied to this case. JICA study team further requested VSC to send by facsimile transmission one copy of VSC's reply concurrently to JICA study team in Tokyo (Nippon Steel). VSC understood the above additional comments and agreed to the request.

(4) JICA study team stated that one specialist, under the JICA scheme, will be dispatched by the end of March this year and asked VSC's cooperation in receiving the specialist by providing necessary conveniences such as office space and other related facilities. VSC understood the situation and promised to provide such conveniences.

Confirmed by:

Tran Van Quy
Chairman of Steering Committee
Date: 16. Jan 1998.

Kenji Kobayashi
Leader of MP Team, JICA
Date: 16 - JAN - 1998

Attachment to the Minutes of Meeting dated January 15, 1998

Participants of the Meeting:

Steering Committee:	Mrs. Pham Thi Nhuong (MOT), Mr. Vuong Dinh Cat (MOC) Mr. Le Van Thac (MOSTE), Dr. Tran Van Quy (VSC)
VSC:	Mr. Pham Chi Cuong, Vice President Mr. Dao Duc Dinh, Director of planning & Investment Dept. Mr. Nguyen Huu Tho, Deputy Director of Planning & Investment Dept. Mr. Nguyen Trong Sang, Planning & Investment Dept. Mr. Trinh Khoi Nguyen, Planning & Investment Dept. Mr. Dinh Van Tam, Technical Dept. Mr. Nguyen Phuc, Planning & Investment Dept. Mr. Bui Quang Huy, Planning & Investment Dept.
JICA Tokyo:	Mr. Satoshi Nakamura
JICA study team:	Mr. Kenji Kobayashi, Mr. Kunio Otsuka, Mr. Michiru Nakagome, Mr. Kazuhiko Kondo, Mr. Seiji Kataoka Mr. Tetsuya Akahoshi Mr. Keiichi Katahira Mr. Hiroshi Miyauchi
Observer	Mr. Hiroshi Shibata, Mr. Akihiko Ochi

Section 3 Records of Schedule for Survey Team
(現地調査スケジュール)

追加案件現地調査 団員構成及びスケジュール表(General Schedule of the supplementary Study Team)

Group	No.	Name (Assignment)		Oct. '93 5 Sun	6 Mon	7 Tue	8 Wed	9 Thu	10 Fri	11 Sat	12 Sun	13 Mon	14 Tue	15 Wed	16 Thu	Fri	Sat	Sun
A	1	KOBAYASHI/Kenji (Leader MSC)		H/H	H	H	H/D	D/SITE	SITE	SITE	SITE/H	H	H	H	H/H			
D	4	AKAMOSHI/Tatsuya (Infra' MSC)		H/H	H	H	H/D	D/SITE	SITE	SITE	SITE/H	H	H	H	H/H			
D	5	SHIBATA/Hiroshi (Utilities MSC)		H/H	H	H	H/D	D/SITE	SITE	SITE	SITE/H	H	H	H	H/H			
C	12	TAKAHISA/Noboru (Environment MSC)		H/H	H	H	H/D	D/SITE	SITE	SITE	SITE/H	H	H	H	H/H			
A	15	MITAMURA/Hiroshi (Interpreter JDS)		H/H	H	H	H/D	D/SITE	SITE	SITE	SITE/H	H	H	H	H/H			
			A		JICA/EMY VSC	MEETING PORT PRO. VSC	DUNG QUAT	MEETING PEOPLE'S COMMITTEE	DUNG QUAT JOINT SURVEY	DANANG TO HA NOI		MEETING PORT PRO. VSC	ST' RNG C'MT	VSC JICA/EMY	MARITA			
			D		JICA/EMY VSC	MEETING PORT PRO. VSC	DUNG QUAT	MEETING PEOPLE'S COMMITTEE	DUNG QUAT JOINT SURVEY	DANANG TO HA NOI		MEETING PORT PRO. VSC	ST' RNG C'MT	VSC JICA/EMY				
			C		JICA/EMY VSC	MEETING PORT PRO. VSC	DUNG QUAT	MEETING PEOPLE'S COMMITTEE	DUNG QUAT JOINT SURVEY	DANANG TO HA NOI		MEETING PORT PRO. VSC	ST' RNG C'MT	VSC JICA/EMY				
			—		HA NOI		DUNG QUAT			HA NOI					—			

H/D:HA NOI/DANANG　　D/SITE:DANANG/SITE　　C/M: GENERAL MEETING　　H: HANOI　　D:DANANG　　ST' RNG C'MT:STEERING COMMITTEE

SITE : DUNG QUAT　　JICA/EMY:JICA/EMBASSY　　PORT PRO.:JICA PORT PROJECT

Mr. A				Y	Y	Y	Y										
Mr. B				Y	Y	Y	Y										

第4次現地調査 団員構成及びスケジュール表(General Schedule of the 4th Study Team)

JICA MP TEAM

Group	No.	Name (Assignment)		Aug '97 10 Sun	11 Mon	12 Tue	13 Wed	14 Thu	15 Fri	16 Sat	17 Sun	18 Mon	19 Tue	20 Wed	21 Thu	22 Fri	23 Sat	24 Sun	25 Mon	26 Tue	27 Wed	28 Thu	29 Fri	30 Sat	31 Sun	Sep '97 1 Mon	2 Tue	3 Wed	4 Thu	5 Fri	6 Sat	7 Sun	8 Mon	9 Tue	10 Wed	11 Thu	12 Fri	13 Sat
A	1	KOBAYASHI/Kenji (Leader HSC)		H/N	H GM	H	H	H	H	H	H	H	H	H/ site	Site	Site	Site /S	S	S	S	S	S	S/N	H	H	H IM	H	H	H SC	H	H	H	H	H	H	H/N
B	2	KATAOKA/Seiji (Management HSC)		H/N	H GM	H	H	H	H	H	H	H	H	H/ site	Site	Site	Site /S	S	S	S	S/H	H	H IM	H	H	H IM	T	H	H SC	H	H	H	H	H	H	H/N
C	3	NISHI/Tadahiko (Demand TCI)								H/N	H	H	H	H/ site	Site	Site	Site /S	S	S	S	S	S	S/H	H	H	H IM	H	H	H SC	H/N						
D	4	AKAMOSHI/Tetsuya (Infra' HSC)		H/N	H GM	H	H	H	H	H	H	H	H	H/ site	Site	Site	Site /D	D/S	S	S	S	S	S/H	H	H	H IM	H	H	H SC	H	H	H	H	H	H	H/N
D	5	SHIBATA/Hiroshi (Utilities KSC)								H/N	H	H	H	H/ site	Site	Site	Site /D	D/S	S	S	S	S	S/H	H	H	H IM	H	H	H SC	H/N						
E	6	NAKAGOME/Michiru (Ironmaking HSC)								H/N	H	H	H	H/ site	Site	Site	Site /S	S	S	S	S/H	H	H IM	H	H	H IM	T	H	H SC	H/N						
E	7	SAKO/Hirososhi COR/Cokes KSL)								H/N	H	H	H	H/ site	Site	Site	Site /S	S	S	S	S/H	H	H IM	H/N												
E	8	KATAHIRA/Keiichi (Steelmaking HSC)								H/N	H	H	H	H/ site	Site	Site	Site /S	S	S	S	S/H	H	H IM	H	H	H IM	T	H	H SC	H/N						
F	9	KONDO/Kazuhiko (Plat Rolling MKK)								H/N	H	H	H	H/ site	Site	Site	Site /S	S	S	S	S	S	S/H	H	H	H IM	H	H	H SC	H/N						
F	10	HASHIMOTO/Taku (Cold Rolling & Coating HSC)								H/N	H	H	H	H/ site	Site	Site	Site /S	S	S	S	S	S	S/H	H	H	H IM	H	H	H SC	H/N						
F	11	IKEDA/Takayuki (Non flat Rolling Sml)								H/N	H	H	H	H/ site	Site	Site	Site /S	S	S	S	S	S	S/H	H	H	H IM	H	H	H SC	H/N						
G	12	TAKAHISA/Noboru (Environment HSC)		H/N	H GM	H	H SC	H	H	H	H	H	H	H/ site	Site	Site	Site /S	S	S	S	S/H	H	H IM	H/N												
H	13	IWATSUKI/Akihiko (Cost analysis HSC)								H/N	H	H	H	H/ site	Site	Site	Site /S	S	S	S	S/H	H	H IM	H/N												
A	14	OCHI/Akihiko (Coordinator HSC)		H/H	H GM	H	H SC	H	H	H	H	H	H	H/ site	Site	Site /H	H/N																				
A	15	MIYAUCHI/Hiroshi (Interpreter JDS)		H/N	H GM	H	H SC	H	H	H	H	H	H	H/ site	Site	Site	Site /S	S	S	S	S	S	S	S/H	H	H	H IM	H	H	H SC	H	H	H	H	H	H	H/N
			A		GM	VSC	SC	VSC	VSC	H	H	VSC	VSC	H/STE	SITE	SITE	STE/S	S	S	S	S	S	S	S/H	H	VSC	IM	VSC	VSC	SC	H	H	VSC	VSC	VSC	VSC	VSC	H/N
			B		GM	VSC	SC	VSC	VSC	H	H	VSC	VSC	H/STE	SITE	SITE	STE/S	S	S	S	S/H	VSC	IM	H	H	VSC	IM	VSC	VSC	SC	H	H	VSC	VSC	VSC	VSC	VSC	H/N
			C									VSC	VSC	H/STE	SITE	SITE	STE/S	S	S	S	S	S	S	S/H	H	VSC	IM	VSC	VSC	SC	H/N							
			D		GM	VSC	SC	VSC	VSC	H	H	VSC	VSC	H/STE	SITE	SITE	STE/D	D/S	S	S	S	S	S	S/H	H	VSC	IM	VSC	VSC	SC	H	H	VSC	VSC	VSC	VSC	VSC	H/N
																															H/N	MR SHIBATA						
			E									VSC	VSC	H/STE	SITE	SITE	STE/S	S	S	S	S/H	VSC	IM	H	H	VSC	IM	VSC	VSC	SC	H/N							
																								H/N	MR SAKO												
			F									VSC	VSC	H/STE	SITE	SITE	STE/S	S	S	S	S	S	S	S/H	H	VSC	IM	VSC	VSC	SC	H/N							
			G									VSC	VSC	H/STE	SITE	SITE	STE/S	S	S	S	S/H	VSC	IM	H/N													
			H		GM	VSC	SC	VSC	VSC	H	H	VSC	VSC	H/STE	SITE	SITE	STE/S	S	S	S	S/H	VSC	IM	H/N												

H/STE: HANOI/SITE
STE/S: SITE/SOUTH

GM: GENERAL MEETING
T: THAI NGUYEN

S:SOUTH H: HANOI
D:DAXANG

IM: INTERNAL MEETING

H/N: HANOI/NARITA SC: STEERING COMMITTEE

Survey Plan of the 3rd. Study Team Jun 23, 1997 by Teramae

Date		Schedule	Remarks
Jun 22, 1997		Leave for Viet Nam	
Jun 23, 1997		a.m. Official visit (JICA, Embassy,Government officqs) p.m. 14:00-16:00 Meeting with VSC(Schedule) ~~16:00~~ Meeting with Japanese trading companies	
Jun 24, 1997		a.m. 8:30-11:30 Meeting with VSC(Interim report) p.m. 14:00- Preparation for the seminar (VSC counterparts and JICA Team)	
Jun 25, 1997		Seminar 1. Dr. Toda: Economic consideration on steel industry in developing countries 2. JICA Team: Interim report (at ARMY GUEST HOUSE in Hanoi)	
Jun 26, 1997		a.m. 9:00-11:30 Steering Committee p.m. 14:00-16:00 Meeting with VSC (Survey plan of 4th study team)	Dr. Toda Thai Nguyen Steelworks Party (in evening)
Jun 27, 1997		a.m. 9:00-11:30 Final meeting with VSC p.m. Offical visit (JICA, Embassy)	
Jun 28, 1997		Leave for Japan	

General Schedule of The Second Study Team

GR-OUP	NO	NAME (ASSIGMENT)	Items	Feb, 1997																	Mar, 1997																		
				12 Wed	13 Thu	14 Fri	15 Sat	16 Sun	17 Mon	18 Tue	19 Wed	20 Thu	21 Fri	22 Sat	23 Sun	24 Mon	25 Tue	26 Wed	27 Thu	28 Fri	1 Sat	2 Sun	3 Mon	4 Tue	5 Wed	6 Thu	7 Fri	8 Sat	9 Sun	10 Mon	11 Tue	12 Wed	13 Thu	14 Fri	15 Sat	Sun	Mon	Tue	Wed
	1	Kobayashi/Kenji - (Leader NSC)	Feb 17 G.M./ Feb 18 Demand Supply (VSC)/Feb 19-21 Process(VSC)/Feb 27-28 HCMC / Mar 6 S.C.					N/H	H GM	H	H	H	H	H	H	H	H	H/S	S	S	S	S/H	H	H	H	H S.C.	H	H	H	H	H	H	H	H	H/N				
	2	Teramae/Akira - (Management NSC)	Feb 17 G.M./ Feb 18 Demand Supply (VSC)/Feb 19-21 Process(VSC)/Feb 24-25 Thai Nguyen Feb 27-28 Nha be(HCMC) / Mar 6 S.C.					N/H	H GM	H	H	H	H	H	H	H/T	H/T	H/S	S	S	S	S/H	H	H	H	H S.C.	H	H	H	H	H	H	H	H	H/N				
A	3	Otsuka/Kunio - (Econo' TCI)	Feb 17 G.M./ Feb 18 Demand Supply (VSC)/Feb 19-20 Process(VSC)/Feb 21-25 User (Hanoi)/ Feb 27-28 User (HCMC) / Mar 6 S.C.					N/H	H GM	H	H	H	H	H	H	H	H	H/S	S	S	S	S/H	H	H	H	H S.C.	H	H/N											
A	4	Nishi/Tadahiko - (Demand TCI)	Feb 17 G.M./ Feb 18 Demand Supply (VSC)/Feb 19-20 Process(VSC)/Feb 21-25 User (Hanoi)/ Feb 27-28 User (HCMC) / Mar 6 S.C.					N/H	H GM	H	H	H	H	H	H	H	H	H/S	S	S	S	S/H	H	H	H	H S.C.	H	H	H	H	H	H	H	H	H/N				
B	5	Akahoshi/Tetsuya - (Infra' NSC)	Feb 17 G.M./ Feb 18-19 Q/A/Feb 20-21 Thach Khe/Feb 24-25 Dung Quat/ Feb 27-28 Phu My(HCMC) / Mar 6 S.C.					N/H	H GM	H	H/TK	TK	TK	V/D	D	DQ	DQ	D/S	S	S	S	S/H	H	H	H	H S.C.	H	H/N											
B	6	Shibata/Hiroshi - (Utility KSC)	Feb 17 G.M./ Feb 18-19 Q/A/Feb 20-21 Thach Khe/Feb 24-25 Dung Quat/ Feb 27-28 Phu My(HCMC) / Mar 6 S.C.					N/H	H GM	H	H/TK	TK	TK	V/D	D	DQ	DQ	D/S	S	S	S	S/H	H	H	H	H S.C.	H	H/N											
C	7	Igawa/Yasuhiko - (Natural R'ce KSL)	Feb 17 G.M./ Feb 18 Demand-Supply (VSC)/Feb 19-21 Process(VSC)/Feb 24-25 Thai Nguyen/ Mar 6 S.C.					N/H	H GM	H	H	H	H	H	H	H/T	H/T	H	H	H	H	H	H	H	H	H S.C.	H	H/N											
C	8	Nakagome/Michiru - (Ironmaking NSC)	Feb 17 G.M./ Feb 18 Demand-Supply (VSC)/Feb 19-21 Process(VSC)/Feb 24-25 Thai Nguyen/ Mar 6 S.C.					N/H	H GM	H	H	H	H	H	H	H/T	H/T	H	H	H	H	H	H	H	H	H S.C.	H	H/N											
C	9	Sako/Hironobu - (DR KSL)	Feb 17 G.M./ Feb 18 Demand-Supply (VSC)/Feb 19-21 Process(VSC)/Feb 24-25 Thai Nguyen					N/H	H GM	H	H	H	H	H	H	H/T	H/T	H	H	H	H/N																		
D	10	Katahira/Kenichi - (Steelmaking NSC)	Feb 17 G.M./ Feb 18 Demand Supply (VSC)/Feb 19-21 Process(VSC)/Feb 24-25 Thai Nguyen Feb 27-28 Nha be(HCMC) / Mar 6 S.C.					N/H	H GM	H	H	H	H	H	H	H/T	H/T	H/S	S	S	S	S/H	H	H	H	H S.C.	H	H/N											
D	11	Kondo/Kazuhiko - (Flat-Rolling NKK)	Feb 17 G.M./ Feb 18 Demand Supply (VSC)/Feb 19-21 Process(VSC)/Feb 24-25 User (Hanoi)/ Feb 27-28 User (HCMC) / Mar 6 S.C.					N/H	H GM	H	H	H	H	H	H	H	H	H/S	S	S	S	S/H	H	H	H	H S.C.	H	H/N											
D	12	Ikeda/Takayuki - (N-F Rolling SMI)	Feb 17 G.M./ Feb 18 Demand Supply (VSC)/Feb 19-21 Process(VSC)/Feb 24-25 Thai Nguyen Feb 27-28 Nha be(HCMC) / Mar 6 S.C.					N/H	H GM	H	H	H	H	H	H	H/T	H/T	H/S	S	S	S	S/H	H	H	H	H S.C.	H	H/N											
D	13	Iwatsuki/Akihiko - (Cost anal' NSC)	Feb 17 G.M./ Feb 18 Demand Supply (VSC)/Feb 19-21 Process(VSC)/Feb 27-28 HCMC					N/H	H GM	H	H	H	H	H	H	H/T	H/T	H/S	S	S	S	S/H	H	H	H	H S.C.	H	H/N											
	14	Ochi/Akihiko - (Coordinator NSC)						N/H	H GM	H	H	H	H	H	H	H/N																							
	15	Fukawa/Fuku - (Interpreter JOS)	Feb 17 G.M./ Feb 18 Demand Supply (VSC)/Feb 19-21 Process(VSC)/Feb 27-28 HCMC / Mar 6 S.C.					N/H	H GM	H	H	H	H	H	H	H	H	H/S	S	S	S	S/H	H	H	H	H S.C.	H	H	H	H	H	H	H	H	H/N				
								A	G.M				user			user	user		user	user			I.M. MP	VSC	VSC	S.C.						VSC Prog [illegible]							
								B	VSC	VSC	TX	TX	TX		D	DQ	DQ		S	S																			
								C			VSC	VSC	VSC			Thai	Thai		H	H																			
								D			VSC	VSC	VSC			Thai	Thai		SSC	SSC																			

H/T: Hanoi /Thai Nguyen H/S: Hanoi/South S:South D:Da Nang TK:Thach Khe DQ:Dung Quat D/S: Da Nang/South S.C.: Steering Committee

GROUP	Items	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
		Fri	Sat	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Sun	Mon	Tue	Wed
Leader							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]						[illegible]							
A							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]													
B							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]			[illegible]			[illegible]	[illegible]	[illegible]	[illegible]													
C							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]													
D							[illegible]	[illegible]	[illegible]	[illegible]	[illegible]			[illegible]	[illegible]		[illegible]	[illegible]			[illegible]	[illegible]	[illegible]	[illegible]													

FIRST TEAM SITE SURVEY SCHEDULE

2-Oct-96 NSC

GROUP	NO	NAME (ASSIGMENT)	Oct '96 20 Sun	21 Mon	22 Tue	23 Wed	24 Thu	25 Fri	26 Sat	27 Sun	28 Mon	29 Tue	30 Wed	31 Thu	Nov '96 1 Fri	2 Sat	3 Sun	4 Mon	5 Tue	6 Wed	7 Thu	8 Fri	9 Sat	10 Sun	11 Mon	12 Tue	13 Wed	14 Thu	15 Fri	16 Sat	17 Sun	18 Mon	19 Tue	20 Wed	21 Thu	22 Fri	23 Sat	24 Sun	25 Mon	26 Tue	27 Wed	28 Thu	29 Fri	30 Sat	Dec '96 1 Sun	2 Mon	3 Tue	4 Wed	5 Thu	6 Fri	7 Sat	8 Sun	
	1	Kobayashi/Kenji - (Leader NSC)	NRT/H	H	H	H	H	H			H	H/T	H/T	H/H	H/H			H/TK	TK	TK/O	O	O	O/S	S	S	S	S	S			S	S	S	S/H	H			H	H	H	H	H			H	H	H	H	H	NRT			49
	2	Teramae/Akira - (Management NSC)	NRT/H	H	H	H	H	H			H	H/T	H/T	H/H	H/H			H/TK	TK	TK/O	O	O	O/S	S	S	S	S	S			S	S	S	S/H	H			H	H	H	H	H			H	H	H	H	H	NRT			49
A	3	Otsuka/Kuno - (Econo' TCI)															NRT/H	H/O	O	O	O	O	O/S	S	S	S	S	S			S	S	S	S/H	H			H	H	H	H	H			H	H	H	H	H	NRT			35
	4	Nishi/Tadahiro - (Demand TCI)	NRT/H	H	H	H	H	H			H	H/T	H/T	H/H	H/H			H/O	O	O	O	O	O/T	S	S	S	S	S			S	S	S	S/H	H			H	H	H	H	H			H	H	H	H	H	NRT			49
B	5	Akahoshi/Tatsuya - (Inira' NSC)								NRT/H	H	H/T	H/T	H/H	H/H			H/TK	TK	TK/O	O	O	O/S	S	S	S	S	S			S/H	H	H	H	H			H	H/	H	H	H			H	H/									35
	6	Shibata/Hitoshi - (Utility KSC)								NRT/H	H	H/T	H/T	H/H	H/H			H/TK	TK	TK/O	O	O	O/S	S	S	S	S	S			S/H	H	H	H	H			H	H/	H	H	H			H	H/									31
C	7	Igawa/Yasuhiko - (Natural R'ce KSL)								NRT/H	H	H/T	H/T	H/H	H/H			H/TK	TK	TK/H	H/T	H/T	H/S	S	S	S	S	S			S/H	H	H	H	H			H	H/	H	H	H			H	H/									31
	8	Nakagome/Michiru - (Ironmaking NSC)								NRT/H	H	H/T	H/T	H/H	H/H			H/TK	TK	TK/H	H/T	H/T	H/S	S	S	S	S	S		H/ NRT	S/H	H	H	H	H			H	H/	H	H	H			H	H/									28
	9	Sako/Hironobu - (DR XSL)								NRT/H	H	H/T	H/T	H/H	H/H			H/TK	TK	TK/H	H/T	H/T	H/S	S	S	S	S	S			S/H	S/ H NRT																								24
D	10	Katahira/Kenichi - (Steelmaking NSC)														NRT/H		H/TK	TK	TK/O	O	O	O/S	S	S	S	S	S			S	S	S	S/H	H			H	H	H	H	H			H	H	H	H	H	NRT			28
	11	Takahisa/Noboru - (Environment NSC)														NRT/H		H/TK	TK	TK/O	O	O	O/S	S	S	S	S	S			S	S	S	S/H	H			H	H	H	H	H			H	H	H	H	H	NRT			28
E	12	Kondo/Kazuhiro - (Flat-Rolling NKK)								NRT/H	H	H/T	H/T	H/H	H/H			H/TK	TK	TK/O	O	O	O/S	S	S	S	S	S			S	S	S	S/H	H			H	H/ NRT																31
	13	Ikeda/Takayuki - (N-F Rolling SMI)								NRT/H	H	H/T	H/T	H/H	H/H			H/TK	TK	TK/O	O	O	O/S	S	S	S	S	S			S	S	S	S/H	H			H	H/ NRT																31
	14	Och/Akihiko - (Coordinator NSC)	NRT/H	H	H	H	H	H			H	H/T	H/T	H/H	H/H			H/TK	TK	TK/O	O	O/H	H/ NRT																														21
	15	Fukawa/Fuku - (Interpreter JDS)	NRT/H	H	H	H	H	H			H	H/T	H/T	H/H	H/H			H/TK	TK	TK/O	O	O	O/S	S	S	S	S	S			S	S	S	S/H	H			H	H	H	H	H			H	H	H	H	H	NRT			49

O GENERAL MEETING WITH STEERING COMMITTEE MEMBER

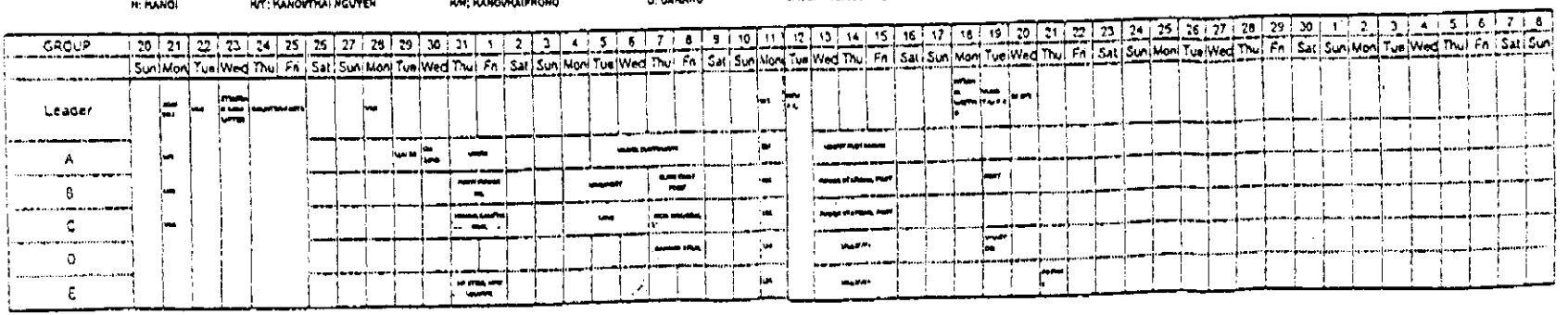
O GENERAL MEETING WITH VSC

O GEN RAL MEETING WITH SSC

O INTERNAL TEAM MEETING

WORK FORCE STEERING COMMITTEE

H: HANOI H/T: HANOI/THAI NGUYEN H/H: HANOI/HAIPHONG O: DANANG O/S: DANAG/SOUTHERN S: SOUTHERN TK: THACH KHE



Sheet1

The sixth site survey schedule of JICA's team for the Viet Nam Master Plan

1. Period of the survey
   January 11 (Sunday) to 17 (Saturday)

2. Details of the schedule

Jan. 11 (Sun.)	Travel from Japan to Viet Nam
Jan. 12 (Mon.)	Visiting governmental officials of Viet Nam and Japanese authorities Discussion with VSC on overall schedule and preparation for the Seminar
Jan. 13 (Tue.)	Seminar
Jan. 14 (Wed.)	Technical discussion with VSC of the Draft Final Report Free or reserved for the future discussion
Jan. 15 (Thu.)	Final Meeting with Steering Committee members Reserved for further discussion
Jan. 16 (Fri.)	Confirmation of minutes of the meeting and free discussion with VSC Visiting governmental officials of Viet Nam and Japanese authorities
Jan. 17 (Sat.)	Travel from Viet Nam to Japan

3. Team make-up

1) Mr. kenji Kobayashi (Leader)
2) Mr. Seiji Kataoka
3) Mr. Kunio Otsuka
4) Mr. Tetsuya Akahoshi
5) Mr. Michiru Nakagome
6) Mr. Keiichi Katahira
7) Mr. Kazuhiko Kondo
8) Mr. Hiroshi Miyauchi (Interpreter)

9) Dr. Hiromoto Toda (Special Lecturer)
10) Mr. Satoshi Nakamura (JICA Officer)

4. Supporter of the team
1) Mr. Akihiko Ochi
2) Mr. Hiroshi Shibata

Programme of the Seminar

Revised 24 Dec., 1997

1. Date : January 13 (Tuesday), 1998

2. Time : 09:30 - 16:30

3. Detailed schedule:

(1) Opening Ceremony	9:30-10:05	(35 minutes)
1) Opening		5 minutes
2) Welcome Address of Viet Nam side		15 minutes
3) Address of Japanese side		15 minutes
(2) Technical report by JICA team	10:15-12:15	(120 minutes)
Mr. Kobayashi Kenji		
Mr. Kunio Otsuka		
Lunch Time	12:15-13:30	(75 minutes)
(3) Key note speech by Dr. Hiromoto Toda	13:30-15:00	(90 minutes)
(4) Discussion	15:00-15:30	(30 minutes)