"ARE EUROPEAN CAPITAL FLOWS CLIMATE-PROOF?"

An Assessment

of the

ROURKELA STEEL PLANT (RSP), INDIA

By Environics Trust
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Contents

PREFACE & ACKNOWLEDGEMENTS

There is a huge flow of capital across the world. European Export Credit Agencies provide financial support to their national companies to do business overseas in several sectors. Among these, the manufacturing sector based on extractive industries, has a deep and often irreparable impact on the ecosystems and communities. It is important for the State to make it mandatory upon the financiers and the ultimate beneficiaries of the profit to undertake detailed assessment on the climate, community and local environmental impacts of their investments. This case study looks into such impacts of the proposed expansion of the Rourkela Steel Plant in Orissa State, India, which is partly supported by the Dutch ECA Atradius DSB.

We are grateful to the community members and other friends who helped us find relevant information, often very difficult in short spans of time and to provide their deep insights, particularly Nicolas Barla, Executive Council Member of mines, minerals and PEOPLE (mm&P).

We are extremely grateful to Pieter Jansen of Both ENDS for reposing faith in our team to undertake this task and be a constant support and encouragement. We are thankful to our friend Wilfred D'Costa, General Secretary INSAF for connecting us with Both ENDS and to encourage us to do the assessment. We are grateful to Annelieke Douma for editorial comments and suggestions for improvement.

We hope that such investigations lead to a greater rigor in international capital flows in the era of rapid climate change.

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EXECUTIVE SUMMARY

Rourkela Steel Plant (RSP) is one of the flagship steel plants of the Steel Authority of India Limited (SAIL), located in the Indian state of Orissa. It currently has the capacity to produce 1.9 MT of steel p.a. – but plans to modernise and more than double its capacity to 4.2 MT. The plans involve modifying the existing units as well as building new ones. To that purpose SAIL obtained new loans worth more than Rs. 75 billion (more than €1 billion) in the period 2008-09. Various services, including the installation of mechanical components for a new blast furnace, project management and training are being supplied by a Dutch company, Danieli Corus BV. Atradius DSB has provided export credit insurance to Danieli Corus BV to cover just over €62.5 million through a guarantee with the State Bank of India[1].

The modernisation and expansion of the plant will enable some technological changes, which the company claims will reduce the CO_2 emissions per tonne of crude steel production. However, given the expansion of operating scale both the actual pollution load and greenhouse gas emissions will increase. RSP admits to increased emissions of about 2.5 tonnes/hr of major pollutants - Suspended Particulate Matter (SPM), Sulphur Oxides (SOx) and Nitrogen Oxides (NOx). Taking a, relatively low, global benchmark of 1.7 tonnes of CO_2 per tonne of crude steel[2], the likely carbon emission of the expanded plant is estimated to be around 7.14 MT CO2 per annum.

As part of the modernisation and expansion of the plant, RSP is installing a Linz-Donawitz gas[3] recovery system. This gas is said to replace an equivalent of fossil fuel used for power generation, thus aiming to reduce CO_2 emissions by 0.8% (8,536 tonnes per annum). This saving has allowed the project to be registered as a 'Clean Development Project' under the Clean Development Mechanism (CDM) of the Kyoto Protocol. However, the project has yet to deliver any Certified Emission Reductions (CERs)[4].

These calculations only cover the plant itself. The actual carbon footprint of the steel production in Rourkela should also include the emissions from the mining of the iron ore, its processing and transportation, and the disposal of hazardous waste (incineration, landfill, etc.). A proportion of the methane emissions from the Mandira Dam, which provides water for RSP, should also be included.

The Orissa State Pollution Control Board has classified the RSP as one of the state's 18 "Grossly Polluting Industries" based on its water pollution record[5]. RSP has a long history of polluting the two rivers that flow in the vicinity of the plant– the Koel and the Brahmini. The steel plant was recently admonished by the Supreme Court which ordered the initiation of criminal proceedings against the RSP officials responsible for increased pollution of these two rivers[6]. RSP's record with workers safety is also a matter of concern. In the first two months of 2010 only there have been two major accidents[7].

[1] Overview of 2009 policies issued by Atradius DSB, p.3 http://www.atradiusdutchstatebusiness.nl/Images/EKVpolissen%202009_tcm1008-130100.pdf
[2] Average emissions from modern steel production plants seem to be a bit less than 2 tons CO2 per ton crude steel; http://www.jfe-holdings.co.jp/en/investor/business-report/2009/pdf/31-32.pdf; http://www.koreaherald.co.kr/NEWKHSITE/data/html_dir/2010/02/04/201002040062.asp
[3] Gas generated during the process of steel making (basic oxygen furnace or BOF) containing oxides or carbon and nitrogen
[4] See: CDM pipeline of UNEP Risoe Centre, dd: 01-02-2010, http://cdmpipeline.org/publications/CDMpipeline.xls
[5] http://orissapcb.nic.in/industrystat.asp
[6] SC raps for pollution, Express News Service, 24 December 2009
[7] http://www.deccanchronicle.com/latest-news/6-injured-blast-orissa-steel-plant-272

A Brief Profile of Rourkela and the RSP	
Annual Rainfall	128.8 cm. Average
Temperature	46.3°C (Max.) in Summer 07° C (Min.) in Winter
Latitude	22°-12° North of the Equator
Longitude	84°-54° East of Meridian
Altitude	219 Mts above Sea Level
Area	200 Sq. Km. Approx..
Density of Population	2,500 per Sq. Km. Approx.
Sex Ratio	835 Female per 1000 male
Literacy	86.5% (1996)
Per Capita income	Highest in Orissa
Population (1991)	3,98,864 SC 35,687 ST 66,627
Population (2001)	4,84,292 (Township: 206,566, Rourkela:224,601)
Land Acquired for Project	19,772,69 Ha
Land Currently with the Project	6477.7 Ha
Land Required for Expansion	Nil
Persons Displaced by the Project	2465 families from 32 villages
Increased Emission from Expansion	9.48 MTPA
Total Carbon Emissions	16.54 MTPA

1. INTRODUCTION

Rourkela is one of the most important industrial cities in the Sundargarh district of the State of Orissa in India. It has a population of more than four hundred thousand people, many of them Adivasis belonging to different indigenous communities. The population density in the industrial complex is 3,288 persons per square kilometer. The Industrial complex is situated approximately 215-230 m above the mean sea level (msl). The city is spread over an area of 121.7-km^2 in close proximity of iron ore, dolomite, limestone and coal belts.

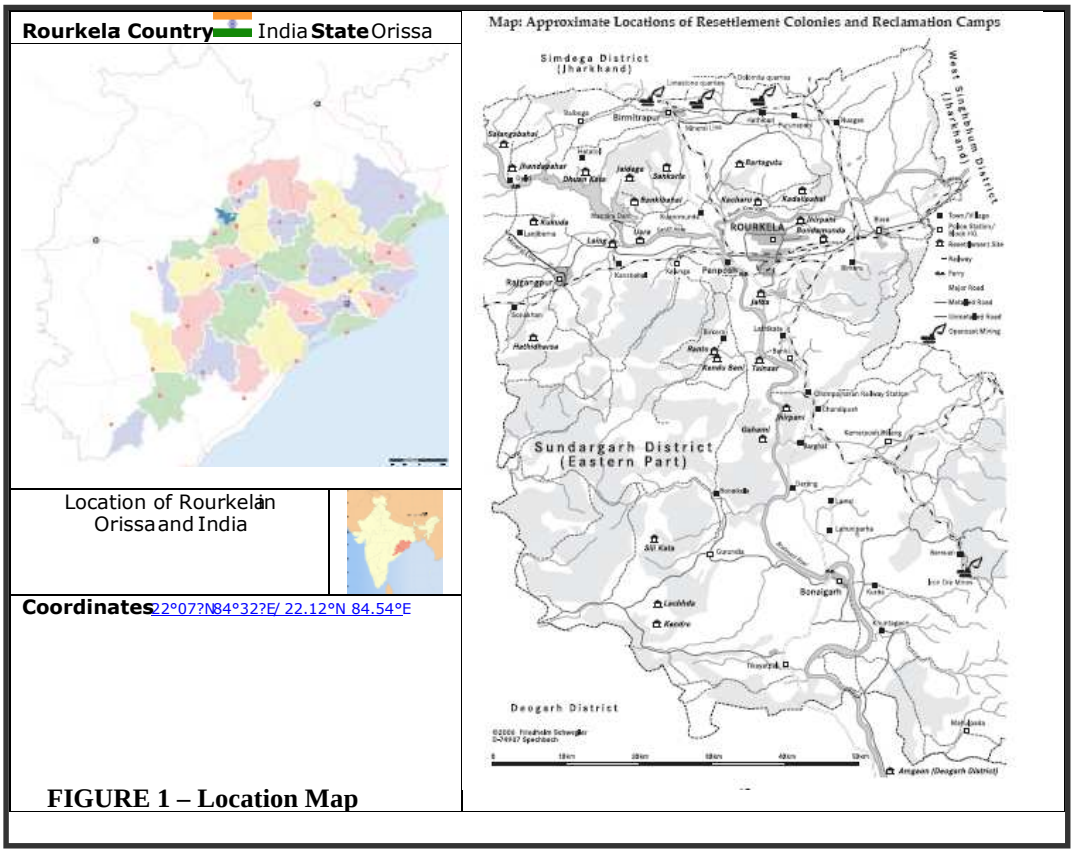


FIGURE 1 – Location Map

The region is surrounded by the Durgapur hill range. The perennial Koel River flows through this valley and meets another perennial river Sankh at Vedavyas on the outskirts of Rourkela. Beyond this, the river is known as Brahmani. Brahmini is one of the 14 major river systems in the country and is considered among the most polluted in parts[8]. Brahmini, Koel and Sankh rivers form the major drainage in the area.

The term Adivasi signifies 'first dwellers'. Oraons, Kisans, Mundas, Kharias, Bhuiyans and Gonds are the major Adivasi groups that inhabit the Sundargarh District. They have got their ancestral, social, cultural and spiritual links with the Adivasis of Chotanagpur region in the adjoining Jharkhand State. While the Oraons and Kisans form the part of the Dravidian linguistic family, the Munda and the Kharias belong to the Kolarian linguistic group. Single tribe inhabited villages invariably spoke their own Adivasi language. While the Kharias and the Mundas belong to the Proto-Australoid or Kolarian linguistic group, the Oraons and the Kisans spoke Kurukh, which falls in the Dravidian group of languages. In the mixed Adivasi villages, 'Sadri' was the common dialect of the village, while the individual families spoke their own Adivasi language at home. The language played a cementing role in the society however Hindi and Odiya have become the major languages spoken in the region now[9].

[8] Orissa State Water Plan, 2004
[9] Rourkela and After, sarini,2006

In 1954, the first notifications for acquisition of land required for the Rourkela Steel Plant and the adjoining township were issued. In 1955, German planners and engineers visited the site. The Government of Orissa acquired 19,722.69 acres of land, and 2,465 families of 32 villages were displaced for the Plant Construction. In the year 1957-58, the Mandira Dam was constructed on river Sankha to facilitate water supply to Rourkela Steel Plant. For the Mandira Dam Project, 11,923.98 acres of most fertile land were acquired, and 941 families of 31 villages were uprooted. Thus a total area of more than 30,000 acres of tribal land has been acquired for the purpose of the Rourkela Steel Plant, Fertilizer Plant, Steel Township, Fertilizer Township and Mandira Dam Project and a Marshalling yard and a railway junction.

The arrogance that accompanied construction of such large industries at the time can be seen in the case of Rourkela from a Press note issued by Orissa Government in 1955 which states; "In particular Government wish to warn the local population against being led away by false propaganda of interested parties, who do not have the interest of the people of the State [at] heart but who merely wish to cause disruption and dislocation to the smooth progress of work, to the detriment of the National Development Plans and to bring into disrepute the people of Orissa. Government therefore, earnestly hope that no attention would be paid to such false and malicious propaganda"[10]. The context was that the local people were complaining about the lack of sensitivity in resettlement and total disruption of their livelihoods *"One day, lorries appeared in our village and we were told by the officers to pack our belongings and board the vehicles. They did not give us much time…We were brought to Lachhda and were given temporary shelters with only some leaves as roofs. This did neither protect us from sun nor from rains. During the rainy season, the floor was completely wet and muddy…*With these bitter words a 60 years old lady described her experience of the "resettlement"[11].

The people who lost homestead land and native places were relocated in resettlement localities like *Jalda, Jhirpani and Bondamunda*. The Government land beyond the river Koel was distributed among the people who lost their land for the purpose of the steel plant. They were allotted small pieces of rocky land that gave them sustenance for hardly three months.
Different companies all over the world with contractors and labourers flocked to Rourkela and were engaged in constructing the steel plant. Consequently, workers and business community followed. Thousands of technical personnel from West Germany came to Rourkela. There have been severe demographic changes as mostly outsiders occupy the jobs as they require skills which the local people did not possess. The tribal population of

FIGURE 2 – Physical Features Around RSP

Rourkela Steel City approximately has been reduced from 85 per cent to 10 per cent

[10] Government of Orissa, Industries Department, PRESS NOTE *[Dated 27.6.1955]*
[11] Adivasis of Rourkela, sarini occasional papers, 2006

within a span of 50 years in and around the vicinity of the industrial complex. Grabbing of land is a big threat to the survival of the tribal community as many adivasis have had to migrate into interior villages or to major towns in search of livelihoods. In 1959, the first blast furnace of Rourkela Steel Plant was inaugurated in the presence of the then President of India, Dr. Rajendra Prasad. By 1961 the construction activities were completed. At present RSP is having 6477.7 ha of land under its possession (3460.7 ha for plant operations and 3017 ha for township). The RSP is a part of the Steel Authority of India, largely owned by the Government of India with nearly 45 Billion INR (approx 749 million EUR[12]) of Paid-Up Capital[13].

RSP is an integrated plant primarily meant for producing steel through the LD (Linz-Donawitz) process or BOF (Basic Oxygen Furnace) route[14] and has most of the raw material processing onsite. The offsite raw material sources include captive mines, fuel supply agreements with Coal India and its subsidiaries. The proposed expansion of RSP to attain a production capacity of 4.2 million tonnes per annum would involve the erection of several new units as well as discarding the existing or outdated machinery to combat environmental pollution using modern environmental technological upgrades.

The proposed expansion will be taking place within the existing plant premises. Thus no additional land is required for the proposed expansion. SAIL's products captures the domestic market in the finished[15] and semi finished products category and finished products are also supplied to international markets capturing South Asia, East Asia and Pacific Region, European market (UK, Germany, France, Belgium, Italy, Spain, Netherlands, Portugal), African region and neighbouring countires of India. The exported products comprise of Billets, Wire Rods, Plates and Coil products. During the year 2008-09, SAIL exported around 250,000 tonnes steel during 2008-09, reportedly lower by about 48%. During the last financial year i.e. March 2009, SAIL reported export sales of Rs. 807.58 [approx. 134 million EUR], a substantial drop in export sales by about 52% whereas the domestic market sales increased marginally over 8% during March 2009.

2. FINANCING THE ROURKELA STEEL PLANT

In 1953, the Government of India held consultations with German steel companies. In the 1950s, the public sector corporation Hindustan Steel Limited (HSL) had purchased a complete steel plant from 36 German companies (among them leading German companies like Mannesmann and Krupp) with roughly 3,000 subcontractors, but without sufficient coordination of the numerous supplies. Unfortunately, the HSL was not able to pay in cash as was originally considered. In 1958 German ECA KfW, with the support of the German Federal Government, took over the promissory notes to prolong the Indian obligations to pay. To avoid default on payments, from 1958 onwards, the German Government gave loans to secure these kind of core sector undertakings which was originally started by the private sector.

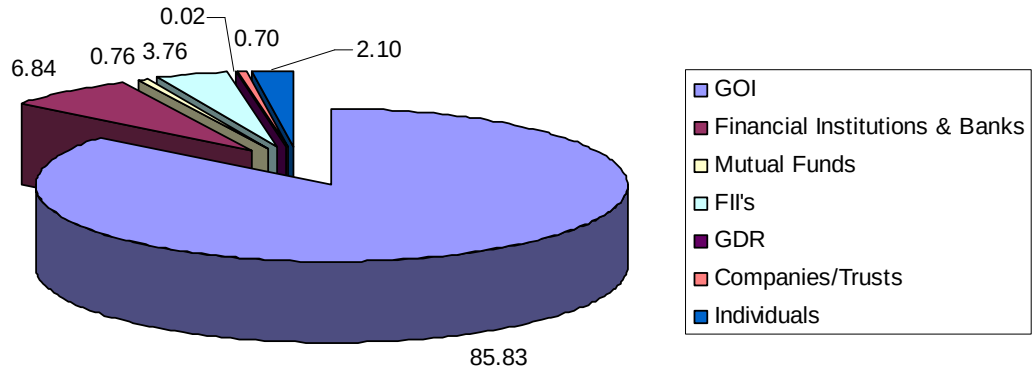
The first expansion project post-liberalisation[16] between 1992 and 1995 included the co-financing of the German portion of supplies and services by British Steel Consultants and M.N Dastur for the modernisation and expansion of the integrated steel plant RSP. The success of the project - particularly regarding its economic and technical aims - is exemplified by SAIL's impressive financial result during FY ending March 2009, with an

[12] 1 EUR = 60.1146 INR as on 20.04.2010
[13] The total amount of shareholder capital that has been paid in full by shareholders
[14] Basic oxygen steelmaking is a method of primary steelmaking in which carbon-rich molten pig iron is made into steel. The LD-converter is named after the Austrian placenames Linz and Donawitz (a district of Leoben). The vast majority of steel manufactured in the world is produced using the basic oxygen furnace. Blowing oxygen through molten pig iron lowers the carbon content of the alloy and changes it into low-carbon steel.
[15] Rourkela Steel Plant's 2008-09 production of saleable steel stood at 1.9 million tonnes (98.74%) in flat products category. Source: Performance Highlights, SAIL, FY2010
[16] http://www.kfw-entwicklungsbank.de/EN_Home/Ex-post_Evaluation_at_KfW/Ex-post_evaluation_reports/PDF-Dokumente_E-K/kurz_indien_rourkela.pdf

overall net profit of around Euro 1.28 billion. RSP is the third largest in terms of saleable steel production (Bokaro and Bhilai being the first two).

In 2007, the Board sanctioned the expansion of the RSP capacity to about 4.2 MT/y by the year 2010 (more than double its current capacity of 1.9 MT of steel p.a). To that purpose SAIL obtained new loans worth more than Rs. 75 billion (more than 1 billion

CHART 1 **Shareholding Pattern (% of equity held)**



Note: Individuals include employees and NRI's.
Total Capital Employed – 41.30 billion INR [689 million EUR]

EUR) in 2008-09. Various services, including the installation of mechanical components for a new blast furnace, project management and training are being supplied by a Dutch company, Danieli Corus BV. Atradius DSB has provided export credit insurance to Danieli Corus BV to cover just over 62.5 million EUR through a guarantee with the State Bank of India.[17]

In 2008, it started placing orders and the project was to be completed in early 2010. However, in June 2009 the expected completion date was March 2012. The expansion project was originally estimated to cost Rs 78 Billion INR (~1.7 billion EUR). The cost has escalated to 120 Billion INR (~2.7 billion EUR).

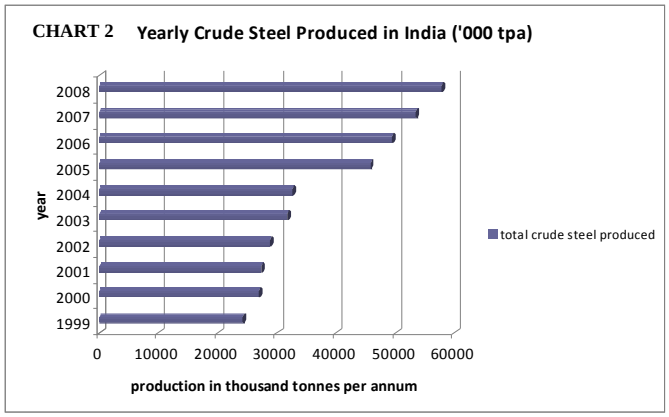
The increased capacity will be modifying existing units as well as building new ones:

- Rebuilding of existing Coke Oven Batteries # 1,3 & 4 introduction of New Coke Oven battery of 67 ovens, 7 m tall
- Additional New Blast Furnance –No. 5 of capacity 4060 m^3 and phasing out existing Blast Furnance No. 1& 2
- New sinter machine (SP-3) of 1 x 360 m^2
- 1X 150t converter and 2X150t ladle furnace and new third slab caster in Steel Melting Shop-II
- Additional Plate mill of capacity 1.8MT, up gradation of existing Hot Strip Mill to around 1.8 Mt/yr
- 1350mm 6High single stand reversing cold mill
- New Anneal and pickle line
- Other associated auxiliary facilities shall also be put up to optimize water and energy consumption.

[17] Overview transactions supported by Atradius DSB, available at: http://www.atradius.com/nl/dutchstatebusiness/overheid/afgegevenpolissen/

Thus from the beginning RSP and its periodic expansion has benefited from various European Financial Institutions in terms of credit and insurance in the process of expansion. The Dutch Atradius support is an important element in the current process.

3. IMPACTS FROM A CLIMATE CHANGE PERSPECTIVE



The Indian Steel Industry relies largely on carbon based fuels which forms a substantial part of its energy requirements. It is thus responsible for extensive carbon emissions. The global benchmark for carbon intensity is 1.7 tonnes/tcs (tonnes of carbondioxide per tonne of crude steel produced) whereas it is estimated that the intensity rises to an average of 2.99 tonnes/tcs[18] in India[19]. The specific energy consumption is 6.9GCal/tcs (consumption in gigacalories per tonne of crude steel) which is mostly due to energy consumption of the Blast Furnace route of steel making. The production of crude steel has been on a steady rise since 1999 to an annual growth rate of crude steel production of around 8% (Chart 2 data from Steel Statistical Yearbook (2009), World Steel Association).

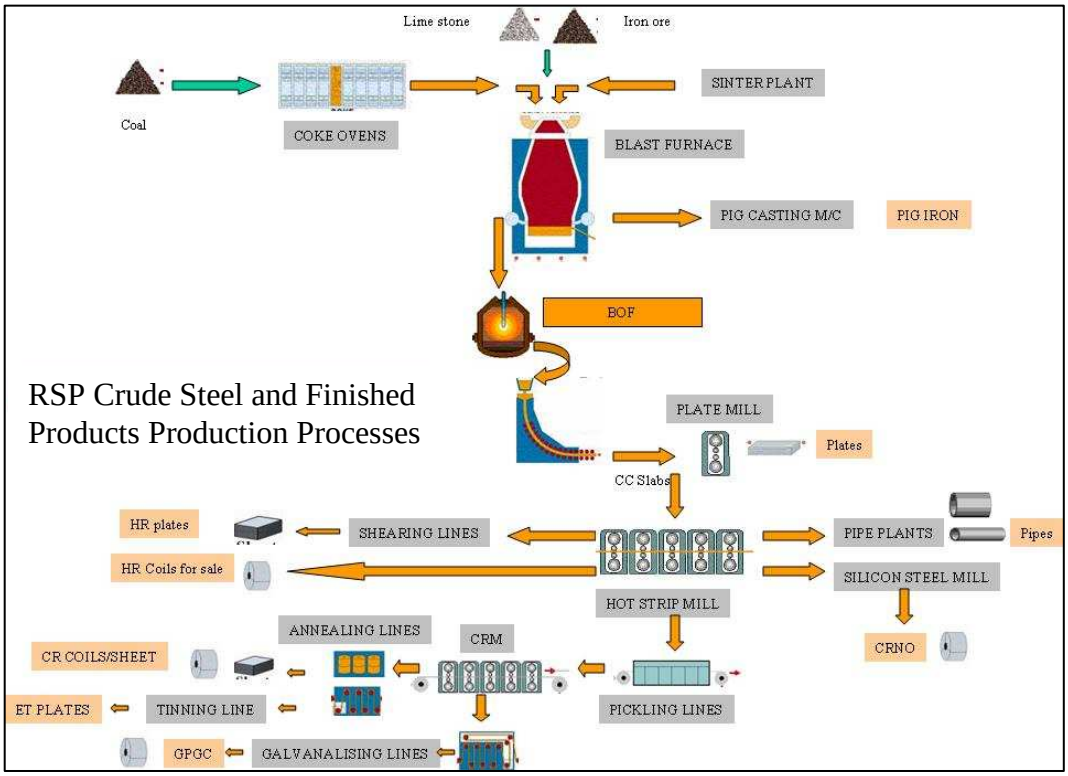


FIGURE 3 - RSP PROCESS FLOW [Source: www.sail.co.in]

3.1 RSP power requirements

[18] Singhal K.K, ED, SAIL, Energy Efficiency in Steel Industry and Clean Development Mechanism (CDM), International Convention on Clean, Green & Sustainable Technologies in Iron & Steel Making, Bhubaneshwar

[19] During 2007-08 period, CO_2 emissions from steel industry in India formed 15% of the direct industrial emissions [161 million tones]. Once equated against the production during the same period the specific CO_2 emissions almost comes closer to the average as mentioned above – 2.95 tCO_2/tcs

RSP's power requirements comes from three fronts: the steel plant processes itself, two captive power plants, and its residential colony. The annual overall energy consumption is 24388.20 Giga Calories. The company purchased 445 MkWh (million kilowatt hours) electricity annually[20]. Captive Power Plant I of 50 MW and Captive Power Plant II of 110 MW, supplements the energy requirements of the RSP setup. In the expansion phase, it is proposed to increase the grid capacity by another 40 MW increasing it to 110MW. The peak capacity requirement would be 295 MW (185MW in-house generation and the remaining 110 MW from GRIDCO (Grid Corporation of Orissa Ltd). The company sources its fuel for power plants mostly from the Mahanadi Coalfields Limited (MCL) and has entered into a Fuel Supply Agreement[21] to acquire coal 1,344 tonnes of B/C/D grade coal over the next five years. The other supply routes are from Central Coalfields Limited, Bharat Coking Coal Limited, Eastern Coalfields Limited and South Eastern Coalfileds Limited which are all Coal India subsidiaries.

3.2 Carbon Footprint Calculation

The emissions from Rourkela Steel Plant (existing as well as expansion) have been estimated using the IPCC methodology[22] with the emission factors (EF) derived from the IPCC 2006 report. It is not based on RSP specific process based emissions which is a daunting task and is beyond the scope of this report. The Environment Impact Assessment has been considered as the base for secondary data. The EIA describes the various components in the existing as well as the expansion phase. We have used the integrated plant's unit wise production as the basis for the calculations (the material input for the steel production during one year, assumed in the EIA report for Rourkela Steel plant). GHG gases, CO_2 and CH_4 have been factored into the emission inventory as IPCC Tier I method concentrates on these two GHGs. The material input to RSP's steel production process will see a tremendous increase. This increase is summarized below:

Table 1 – Quantification of Process wise Products for Steel Production

Process	Product / Input to further process	Existing Production (MT/annum)	Expansion Production (MT/annum)	Net Increase (expansion) (MT/annum)
Coke Oven	Coke Prod.	1.29	2.1	0.81 [62.79]
Blast furnance	Iron Making	1.77	4.5	2.73 [154.24]
Sinter Plant	Sinter for BF	2.56	6.76	4.2 [164.06]
BOF (SMS)	Steel	1.66	4.2	2.54 [153.01]
Rolling Mills	Saleable Steel	1.62	3.88	2.26 [139.51]
Plate Mill		0.38	2.135	1.75 [461.84]
Hot Strip Mill		1.46	1.85	0.39 [26.71]
Silicon Steel Mill		0.07	0.255	0.18 [264.29]
Lime & Dolomite Plant		0.023	0.51	0.48 [2117.39]
H_2SO_4	Coke oven	0.015875	n.a.	
Ammonium Sulphate	Coke oven	0.01232	n.a.	
Tar Distilled	coke oven	0.012393	n.a.	
DRI		0	0.141	

Note: Figures in parenthesis is the respective percentage increase of raw material production or input for achieving the production of 4.2 MTPA steel. Source: Table 2.3, Chapter 2 of EIA/EMP Report for Proposed Expansion of Rourkela Steel Plant from 1.9 to 4.2 MTPA Crude Steel, Prepared by MECON Limited

[20] EIA/EMP Report for Proposed Expansion of Rourkela Steel Plant from 1.9 to 4.2 MTPA Crude Steel – Prepared by MECON Limited (A Government of India Enterprise)
[21] http://mahanadicoal.nic.in/fsae.pdf
[22] see Annexure I on Methodlogy and Calculations

The modernisation and expansion of the plant will enable some technological changes, which – according to the company – will reduce the CO_2 emissions per tonne of crude steel production. However, given the expansion of the operating scale the actual pollution load and greenhouse gas emissions will both increase. RSP admits to increased emissions of about 2.5 tonnes/hr of major pollutants such as Suspended Particulate Matter (SPM), Sulphur Oxides (SO_x) and Nitrogen Oxides (NO_x). Taking a, relatively low, average emission of 1.7 tonnes of CO_2 per tonne of crude steel, the likely carbon emission of the expanded plant is estimated to be around 7.14 MT CO_2 per annum. However working specifically on the expanded power use and calculating the steel plant's emission of CO_2 and CH_4 using IPCC's Tier I method the total equivalent CO_2 per annum would be as high as 17.04 MT CO_2 per annum and the increase due to expansion would be 9.1 MT CO_2 per annum[23].

4. SOCIAL AND ENVIRONMENTAL IMPACTS

The establishment of the plant, since the beginning has been detrimental to several displaced people. However, in 1964 the German Federal Ministry for Economic Cooperation apparently realised that things had gone seriously wrong as to the human resources situation in Rourkela's immediate environment and sent a group of experts to investigate and to make proposals for remedy and improvements. The report submitted to the German government in 1964 concluded that the Indian Government including the then state owned steel company "Hindustan Steel Ltd." had done little to assist the local population. Since the local communities were not trained to meet with the changes in the environment and received meager compensation their conditions have become worse. The Orissa State Pollution Control Board has classified the RSP as one of the state's 18 "Grossly Polluting Industries" based on its water pollution record. RSP has a long history of polluting the two rivers that flow in the vicinity of the plant– the Koel and the Brahmini.

Table 2 - RSP among the Grossly Polluting Industries according to the OSCB

Sl.	Name of the Industry	Category	Effluent Recipient Tributary	Concerned River
1.	Steel Township Rourkela	Urban Body	Koel River	Brahmani
2.	Fertilizer Plant, SAIL, Rourkela	Nitrogenous Fertilizer	Guradih Nallah	Brahmani
3.	Rourkela Steel Plant, Rourkela (Coke oven byproduct effluent)	Iron and Steel	Guradih Nallah	Brahmani
4.	Fertilizer Township Rourkela	Urban Body	--	Brahmani

Hearing a petition filed against the Rourkela Steel Plant (RSP), the Supreme Court in a recent order[24] took the management to task and snubbed the Orissa State Pollution Control Board (OSPCB) for not adequately utilising its statutory powers to check environmental pollution. The indictment, among other things, ordered initiation of criminal proceedings against the RSP officials responsible for the rising pollution level in the river Brahmani and the Koel. The order also advised the SAIL management to seriously think about setting up a fly ash-based cement plant to minimise air pollution caused by the captive power plants of RSP. The judgment also referred the matter to the Orissa High Court to monitor if the RSP management is adhering to the interim orders passed to curb pollution. One of the members of the Employees Association says "*RSP has over the years adhered to some guidelines to bring down air, water and soil pollution but much more needs to be done - industrial effluents directly enter the river Koel as the Bankia treatment plant is defunct*". Further, some effluents are released directly to the

[23] See Annexure I for detailed calculations
[24] SC raps for pollution, Express News Service, 24 December 2009

river Brahmani through the Gurari nullah[25]. It was also being alleged that dust catchers, dust extractors and other dust control equipment are not properly working and the RSP management is resorting to commissioning of sub-standard pollution control equipment.

With regard to the pollution, a local resident expressed concern over the fact that cumulative impacts of the industries in the region have not been even considered. This is grave as the Sundargarh district has nearly 50 sponge iron plants contributing to air pollution.

At a time when the total project cost for modification–cum-expansion was estimated at 76.71 bln INR (~1.28 bln EUR), the capital outlay for environmental control measures was pegged at 6.14 bln INR (~0.1 bln EUR) by RSP. The key elements of these investments are:

Purpose	**Billion INR**
Air Pollution Control Systems	3.00
Water Conservation & Pollution Control	2.15
Solid/Hazardous Waste Management System (Including cost of dust & ash pond/dump storage with bunds)	0.96
Green belt development	0.03

RSP's record with workers safety is also a matter of concern. In just the first two months of 2010 there have been two major accidents[26] with people getting injured.

5. CONCLUSIONS AND RECOMMENDATIONS

It is clear from the above analysis that the support of Atradius DSB for the expansion of RSP is neither climate friendly or sensitive to the local communities. It is also abundantly clear that the huge costs of expansion, now touching nearly double the original estimate, was not used as an opportunity to address some of the long-standing grievance of the communities.

Financial Institutions should refrain from looking narrowly at the segment of finance they are involved with and to conveniently assume that the investments they bring in are climate neutral or environmentally sound.

We recommend that the historical, downstream and upstream impacts and future implications of the modernization and expansion of steel plants be thoroughly investigated and analysed before an investment decision is made.

We also suggest that methods are developed and adapted to specific projects for a cradle-to-grave approach in the manufacturing sector. This should form the basis of project design and at every stage the effort should be to mitigate current and historical impacts and emissions.

Unless climate, community and local environmental impacts are not fundamentally addressed in the establishment and expansion of such projects we will be adding on to the already huge climate-burden with very little rationalization possible in future.

[25] A small stream

[26] http://www.deccanchronicle.com/latest-news/6-injured-blast-orissa-steel-plant-272

Annexure 1: Methodology and Calculations

The calculations of the emissions are conservative, as it does not capture the downstream and upstream climate implications, which a life-cycle analysis can provide. Apart from the steel production direct emissions, there are several indirect emissions like;

- Electricity purchased by RSP from GRIDCO
- Operation of Mines for Iron Ore and other minerals[27]
- Transportation of Coal and other minerals to onsite
- Storage of fuel minerals
- Land owned by SAIL and being put to more intensity of developing for expansion
- Coal handling plant (fertilizer plant of RSP)
- Coke oven battery

Part I: Captive Power Plants

The emissions from the Coal Power Plant are calculated using the **Central Electricity Authority Method.[28]**. So for the purpose of calculations the operating heat rate is taken as 2800[29] kCal/kWh. Specific CO_2 Emission (in kg/kWh)= [4.187[30] * Emission Factor *oxidation factor{i}][31] * [Station Gross Heat Rate in kcal/kWh {ii}]

This method relies on the performance of the thermal power station in terms of its station heat rate. Station heat rate determines the performance which depends on the Gross Calorific Value of fuel(s) used as well as the consumption of fuel(s) to produce one unit of energy. The thermal stations are designed on specific heat rate values whereas the varying quality of fuel, electro mechanical parameters results in a deviation from the designed value and generally operates at a higher heat rate thereby reducing the efficiency i.e. if a plant operates closely to the designed heat rate, better would be the efficiency and lesser would be the emissions as the desired heat rate is achieved with designed fuel input. With all the other parameters being constant, GSHR becomes the variable parameter which for the current case has been arrived at by relying on CEA's recently analysed values for eastern region.

Table 3 – Emissions from Captive Thermal Power Plants			
	Factor {i} [4.187*emission factor*oxidation factor]	SGHR {ii}	CO2 kg/kWh {i*ii}

[27] Raw Material Source

District	Mineral	Lease Area Name	Lease area	Starting period
Sundergarh	Iron Ore	Toda RF	77.940	1980
	Iron Ore	Toda RF	25.981	1975
	Iron Ore	Barsuan-Kalta	2486.38	1960
	Limestone & Dolomite	Getitangar	153.51	1980
	Limestone & Dolomite	Purnapani	230.53	1980
	Bauxite	Tantra	117.44	1969
Keonjhar	Iron & Manganese	Bolani	1586.36	1962
	Iron Ore	Bolani	1321.45	1960

[28] http://www.cea.nic.in/e&c/Final%20Enviornmental%20scheme%2024.09.2009.pdf
[29] Operating heat rate for the eastern region of 2738.5 kCal/kWh which exceeds its design heat rate by 347 kCal/kWh
[30] Emission factor = 92.5gCO2/MJ for Coal (on GCV basis)
[Emission factor given by Initial National Communication of Ministry of Environment and Forest]
[31] Oxidation Factor = 0.98[31]
[31] http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.htm

Specific CO2 emissions	0.000379552	1850	0.702
		2000	0.759
		2400	0.911
	Based on CEA thermal Performance average for eastern India	2800[32]	1.063
Considering the existing situation; CPP I – 50MW; CPP II – 100 MW Plant Downtime = 1 month or 720 hrs [assumption]: Overall operating hours = 8040, say 8000 hrs Electricity generated = 160 MW*8000 hrs = 1286400000 kWh From table above, specific CO2 emissions = 1.063 kg/kWh **Thus overall emission load = [electricity generated*specific CO_2 emission from table above] 1.36 million tonnes [existing level CPPs only, excluding GRIDCO]**			

Using equivalents already available from Studies and Emission inventory by CEA also we arrive at a similar amount for the CPP which is described below.

Table 4 – Emissions from Captive Power Plants and Grid Supply					
No.	Components	Value	Unit	Source	
	A	B	C	D	E
1	RSP Power purchased	445	MKWh	EIA report	
2	CO2 emission factors	0.95	kg/KWh	MOSPI/NEERI Study	
3	GRIDCO Supply	70	MW	EIA report	
4	Annual Operations	8000	hours	Assumption	
	Emissions	**Direct Emissions**		**Indirect Emissions**	
	Existing Level	**CPP I**	**CPP II**	**GRIDCO**	Existing peak demand
5	Capacity (MW)	50	110	70	230
6	CEA Assumptions at unit level[33] (tonne CO_2/MW)	1.19	1.05	0.95	
7	Emissions[34] (gross) at annual operations (tCO_2)	[B4*B5*B6] 476000	[B4*C5*C6] 924000	[B4*D5*D6] 532000	
8	Gross Direct/Indirect emissions (tCO_2)	**1400000**		**532000**	
	Expansion Level				Expansion Peak Demand
9	GRIDCO	-	-	40	295
10	Emissions (gross) at annual operations tCO_2	-	-	**304000**	

CPP emissions are 1.4 million tonnes of CO_2 per annum when considered at 1.19 tCO_2/MWh for a 67.5 MW plant [CEA] and 1.05 tCO_2/MWh for a 120 MW plant which is very close to the above figure of 1.06 in the last calculations. In the expansion phase, an additional 40 MW is to be added from the grid so the equivalent emissions would be 0.3 million tonnes of CO_2 per annum. **Total thermal power plant (direct) emissions = 1.36 or 1.4 million t CO_2 per annum. The total direct and indirect emissions (both captive power plants and electricity purchased from GRIDCO at current levels) = 1.36 + 0.53 OR 1.4 + 0.53 = *1.89 OR 1.93 million t CO_2 per annum, SAY 1.9 MILLION T CO_2 PER ANNUM.***

[32] Annexure 13.1 – Analysis of Operational Station Heat Rate of Thermal Power Stations during 2007-2008 (Performance Review of Thermal Power Stations 2007-2008, Section 13)

[33] http://www.cea.nic.in/planning/c%20and%20e/government%20of%20india%20website.htm

[34] Emissions = Capacity of CPP I/II * Operating hours per year * Emission factors as per CEA at unit level

Whereas the emissions in addition to the above will increase BY 0.30 MILLION TONNES OF CO_2 IN THE EXPANSION PHASE.

Part II: IPCC Method of Calculating based on Specific Functional Parts of the Industry and Relevant Emission Factors

Table 5 – Increase in Production and Relative Emission Factors from IPCC						
Functional Part	Existing Production	Expansion Production	% Increase	Emission Factors (tCO_2)		
	million tonnes/ annum			CO_2	CH_4	N_2O
Coke Oven	1.29	2.1	62.79	0.56	0.0000001	
Blast furnace	1.77	4.5	154.24	1.35		
Sinter Plant	2.56	6.76	164.06	0.2	0.00007	
BOF (SMS)	1.66	4.2	153.01	1.46		
Rolling Mills	1.62	3.88	139.51			0.00004
DRI	0	0.141		0.7		

IPCC suggests three methods to calculate carbon emissions and has named them as Tier I, II & III. Tier I method i.e. production based emission factors proposed 'processes' and 'steel making methods' as two essential elements in calculating the emissions. The emission factors are provided against each of the processes i.e. sinter, coke oven, iron production, direct reduced iron and pallets and steel making methods i.e. Basic Oxygen Furnance, Electric Arc Furnance and Open Hearth Furnance. The choice of this method was made as the other two methods i.e. Tier II method rely on process materials which is not available for all categories whereas Tier III method is based on aggregated plant specific emissions estimates or the application of the Tier II equations at a plant specific level which is not available.

Based on the available emission factors which takes into account a significant proportion of the plant the emission loads are as follows:

Table 6 – Summary of Emissions at current and expansion phase.					
S.No.	**Functional Part**	**Cumulative Emissions CO_2 (without expansion)**	**Cumulative Emissions CO_2 (with expansion)**	**Emissions CH_4 (without expansion)**	**Emissions CH_4 (with expansion)**
		Million t CO_2			
		A	**B**	**C**	**D**
1	Coke Oven	0.7224	1.176	0.000000129	0.00000021
2	Blast furnace	2.3895	6.075		
3	Sinter Plant	0.512	1.352	0.0001792	0.0004732
4	BOF (SMS)	2.4236	6.132		
5	DRI		0.0987		
6	Electricity (CPP's and Grid Supply)	1.9	2.2		
7	**Total (1 to 6)**	**7.94**	**17.04**	**0.000179329**	**0.00047341**

Therefore the additional footprint of the Rourkela Expansion would be [B7-A7] 17.04 – 7.94 = 9.1 million tonnes per annum.