

RAILWAY ELECTRIFICATION

1.0 HISTORY

1.1 With a view to reduce dependence on petroleum-based energy in railway transport, Indian Railways have been progressively switching over to electric traction, which also enables haulage of heavier loads at higher speeds, thus, increasing throughput. It is a pollution free system and with use of modern high horse power locomotives having regenerative braking, it becomes vastly energy efficient.

1.2 On Indian Railways, Electric traction was first introduced on 3rd February 1925 between Bombay VT to Kurla Harbour Line (16 Route Kilometres) on 1500 V DC system. During pre-independence period, it remained confined to 388 Route Kilometres around Mumbai area and it is only in post independence period that further electrification was taken up. By March 2005, electrification on Indian Railways had extended up to 17280 RKMs. This constitutes 27.33% of the total Railway Network and 36.56% of the BG system respectively.

2.0 PROGRESS (1925-2005)

Plan period wise progress of electrification is given below:

<u>Plan Period</u>	<u>RKM Electrified</u>	<u>RKM Cumulative</u>
Pre-Independence 1925-1947	388	388
1 st Plan 1951-56	141	529
2 nd Plan 1956-61	216	745
3 rd Plan	1678	2423
Annual Plan 1966-69	814	3237
4 th Plan 1969-74	954	4190
5 th Plan 1974-78	533	4723
Inter Plan 1978-80	195	4918
6 th Plan 1980-85	1522	6440
7 th Plan 1985-90	2812	9252
Inter Plan 1990-92	1557	10809
8 th Plan 1992-97	2708	13517
10 th Plan 1 st year 2002-03	455	16456
2 nd year 2003-04	504	16960
3rd year 2004-05	320	17280
4 th year 2005-06	350 (Target)	

With the progressive electrification, metro cities of **Delhi, Mumbai** and **Kolkata** have already been interconnected with electric traction, besides also connecting **Chennai to Delhi**. Even **Kolkata - Chennai** route is partially electrified and work is in progress between **Kharagpur** and **Barang**, which when completed will bridge the remaining gap.

Proportion of traffic as on 31.3.2004 on various modes of rail transport as per Indian Railways Year Book 2003-04 are as under: -

	<u>Electric</u>	<u>Diesel</u>
Goods	60.90 %	39.10 %
Coachin	47.60 %	52.40 %

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2.1 PROGRESS-IX PLAN (1997-2002)

During IX Five Year Plan, Rs. 1544.56 Cr have been incurred under RE Plan Head and **2484** route kilometres electrified, as indicated below against the target of 2300 RKM :

<u>Year</u>	<u>Electrification completed(RKM</u>	<u>Expenditure</u>
	<u>s)</u>	<u>Rs. in Crores</u>
1997-98	445	319.32
1998-99	617	328.73
1999-2000	405	320.34
2000-01	414	304.83
2001-02	603	271.34
TOTAL	2484	1544.56

With the work completed during IX Plan, the following **routes stand fully electrified:**

<u>S.No</u>	<u>Section</u>	<u>RKM</u>
1.	Bokaro-Barsuan/Kiriburu incl. Purulia-Kotshila	434

2.	Adra-Midnapur	155
3.	Jasidih-Danapur-Mughalsarai	455
4.	Simhachalam-Kottavalasa-Bhubaneswar	435
5.	Lucknow-Kanpur & Lucknow Circular Railway.	109
6.	Ambala-Kalka & Sirhind-Nangal Dam-Una	189
7.	Jalgaon-Dharangaon-Dondaicha	121
8.	Tiruldih-Ramgarh (Part of Chandil-Muri-Barkakana	89
9.	Tambram-Chengapattu-Tindivanam & Chengalpattu-Kanchipuram	131
10.	Vallatolnagar-Punkunnam-Ernakulam	112
	TOTAL	2230

2.2 PROGRESS - X PLAN (2002-2007)

Provision of Rs. 1500 cr. has been kept under the Plan Head "Railway Electrification" for electrification of 1800 RKM during the X Plan.

2.2.1 Section initially proposed to be taken up for electrification during X Plan

<u>SN</u>	<u>Section</u>	<u>Rly</u>	<u>RKM</u>	<u>Estimated Cost (Rs. in Cr.)</u>	<u>ROR (%)</u>	<u>Remarks</u>
1.	Zafrabad-Moradabad	NR	558	404.35	30.4	To complete electrification of MGS-LKO-MB
2.	Pune-Wadi-Guntakal	C, SC	641	391.72	22.1	To complete electrification of last leg of Golden Quadrilateral
3.	Sanatnagar-Wadi	SC	180	115.59	15.3	
4.	Itarsi-Allahabad	WC/NC	603	398.82	24.2	Alternate Route to Kolkata
5.	Bina-Kota	WC	303	137.55	26	To Bridge two electrified routes
	Total		2285	1448.03		

2.2.2 During first 3 years of X Plan achievements and expenditure are as under:

<u>Year</u>	<u>Expenditure (Rs. In crs)</u>	<u>RKM Electrified</u>
2002-03	251.97	455
2003-04	205.73	504
2004-05	183.58	320
Total	641.28	1279
2005-06	160.00	350

(Outlay)

(Target)

2.2.3 Break up of funds allocation during 2005-06 is as under:

CORE/Allahabad	Rs. in Crores
RE Plan Head	103.08
DEPRVN	56.50
Zonal Railways	
RE Plan Head	0.42
Total	160.00

2.2.4 **SECTION ENERGISED ON 25 KV DURING 2004-05 :-**

Sections energized during 2004-05 are given below: -

<u>Project</u>	<u>Section</u>	<u>RKM</u>
Chennai	Shertalai-Kayankulam	69
	Chengancheri-Kayankulam-Quilon	81
Bhubaneswar	Kapilas Road-Kendrapada and Salegaon-Nergundi	15
	Kendrapada-Jakhapura	33
	Kapilas Road-Haridaspur	25
	Khurda Road-Puri	41
	Ranital-Bhadrak	11
Surat	Bhestan Neyol Bye Pass Line	04
Ambala	Roorkee-Dausani	14
	Laksar-Muazzampur Narain	27
	Total	320

2.2.5 **Commercial services** on electric traction have been introduced on the following sections during the year 2004-05: -

<u>Project</u>	<u>Section</u>	<u>RKM</u>
Chennai	Kanchipuram-Takkolam	21
	Renigunta-Nandalur	86
Bhubaneswar	Balasore-Bhadrak	61
	Khurda Road – Puri	41
	Total	209

2.2.6 **TARGETS-YEAR 2005-06 :-**

As per Budget pronouncement, following sections are **planned to be energised** during 2005-06:

<u>Project</u>	<u>Gr.No</u>	<u>Section</u>	<u>RKM</u>
Ambala	89B	Najibabad-Moradabad	95
Bhubaneswar	104	Talcher-Angul	12

Kolkata	123	Krishnanagar-Berhampur	86
Chennai	119	Paravur-Trivandrum	52
	125	Tirupati-Pakala-Katpadi	105
Total			350

Besides the above 350 RKM, 38 RKM of Villupuram-Pondicherry section has also been targeted for completion during 2005-06.

3.0 Sections Surveyed

The sections on which cost-cum-feasibility survey has been carried out along with updated cost and ROR are as given below :

SN	Section	Year of completion of survey	Rly.	RKM	App. cost (crs)	ROR %	UPDATION 2000	
							App. cost (Rs. cr.)	ROR%
1.	Jalandhar-Jammu Tawi	1994	NR	228	146.00	11.69	121.52	22.59
2.	Itarsi-Allahabad	1994	WC & NC	603	364.98	18.50	398.82	24.22
3.	Mughalsarai-Varanasi-Allahabad	1995	NR	142	69.46	2.52	-	-
4.	Koraput-Vizianagaram	1996	ECo R	288	161.70	21.56	-	-
5.	Bina-Kota	1994	WC	303	113.49	22.01	137.55	26.03
6.	Kengeri-Mysore	1994	SR	126	39.03	1.94	-	-
7.	Pune –Wadi-Gutakal	1997		641	370.02		391.71	22.09
	i) Pune-Solapur		CR	263	149.98	15.91	-	-
	ii) Solapur-Wadi		SCR	150	87.96	20.16	-	-
	iii) Wadi-Guntakal		SCR	228	132.08	21.73	-	-
8.	Pagidipalli-Nadikudi-Nallapadu	1998	SCR	255	100.03	3.12	-	-
9.	Sanatnagar-Wadi	1998	SCR	180	115.59	15.28	-	-
10.	Katwa-Azimganj	2000	ER	78	53.18	13.89	-	-
11*.	Moradabad-Lucknow-Mughalsarai via Sultanpur.	1999	NR	626	454.31	19.12	454.31	30.44
12.	Delhi-Shahdara-Shamli-Saharanpur	1990	NR	151	30.74	3.28	-	-

13.	Ghaziabad-Saharanpur	1990	NR	161	38.27	8.35	-	-
14.	Daund-Manmand	2002	CR	237	Shelved			
15.	Coimbtore-Udagmandalam	2002	SR	79	40.12 with AC 49.36 with AC-DC			

* **Moradabad-Lucknow-Utraitia (338 RKM) has been included in the Rail Budget 2005-06**

4.0 PROPOSALS FOR ELECTRTIFICATION

4.1 BLUE PRINT

Sections covered under Blue Print are as under:

<u>SN</u>	<u>Route</u>	<u>RKM</u>
1	Pune-Wadi-Guntakal	641
2	Nandalur-Guntakal	222
3	Mughalsarai-Utraitia-Moradabad via Sultanpur and Unchahar	896
4	Bina-Kota	303
5	Shakurbasti-Bhatinda-Suratgarh	429
6	Lingampalli-Wadi	161
	Total	2652

4.2 PROPOSALS FOR ELECTRIFICATION OTHER THAN BLUE PRINT RECEIVED FROM ZONAL RAILWAYS

There are eight proposals totaling to 1888 RKM, which have been received from the different Zonal Railways in Board's office.

S.N	Section	Railway	RKM	Cost (Rs in crores)
1.	Kanpur-Jhansi	NCR	220	75.96
2.	Ghaziabad-Moradabad	NR	141	87.52
3.	Villupuram-Tiruchchirapalli	SR	178	87.81
4.	Jalandhar-Jammu Tawi-Baramulla	NR	568	272.27
5.	Koraput-Rayagada-Vizianagaram	ECOR	288	169.44
6.	Katni-Allahabad	WC	325	163.05
7.	Indore-Ujjain and Dewas-Maksi	WR	115	36.45
8.	Bakhtiarpur-Rajgir	ECR	53	31.81
	Total		1888	924.41

4.3 SECTIONS PROPOSED BY TRAFFIC DIRECTORATE (NOTE NO.

SN	Route	RKM
1.	Ghaziabad-Moradabad	141
2.	Korapur-Rayagada-Vizianagaram	288
3.	Katni-Allahabad	325
4	Andal-Sainthia	71
5	Karepalli-Bhadrachalam-Mangur Section sidings and sidings at Ramagundam	88
6	Garwa Road-Chopan-Singrauli-Katni	441
7	Gondia-Nagbhir-Ballarshah	251
8	Daitari-Keonjhar-Banspani	120

DL Over all	49	13	2	0	64	Shed 6	0	6	15	15	30
DL Dept-wise	77	20	3	NA	100	100	NA	100	50	50	100
SL Over All	40	16	8	0	64	6	0	6	12	18	30
SL Dept wise	63	24	13	NA	100	100	NA	100	40	60	100

6.0 LINE HAUL COST:

Line haul cost (BG) for last five years of Diesel and Electric traction are shown as under:

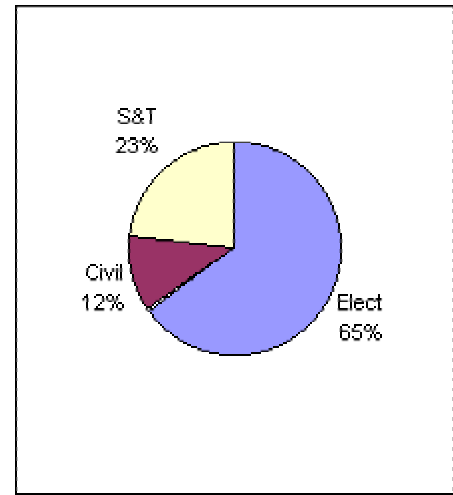
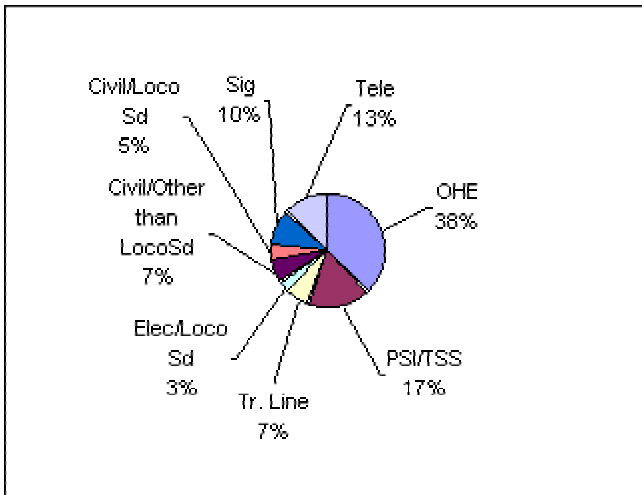
For Freight

Year	Diesel Rs/000GTKM	Electric Rs/000GTKM
1998-99	76.98	76.04
1999-2000	87.94	79.36
2000-01	103.90	82.33
2001-02	107.37	77.24
2002-03	110.44	77.35

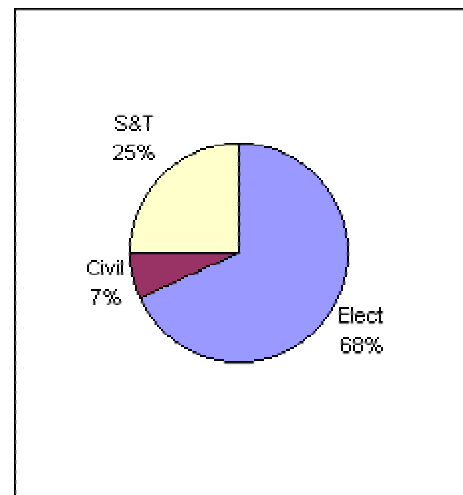
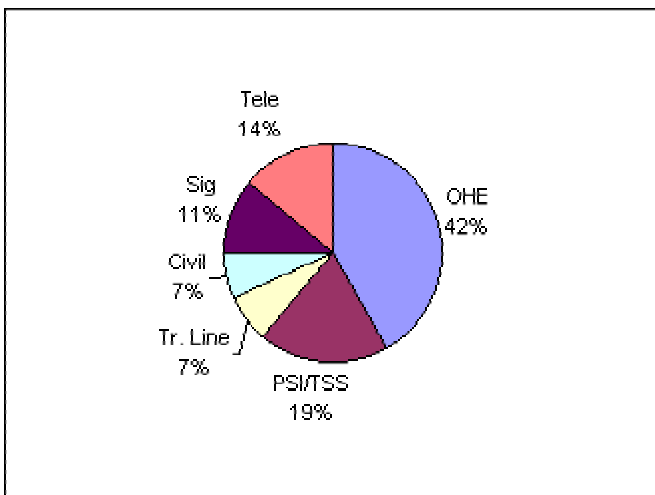
For coaching Mail/Express/ordinary trains

Year	Diesel Rs/000GTKM	Electric Rs/000GTKM
1998-99	129.78	137.20
1999-2000	127.6	134.25
2000-01	159.25	142.29
2001-02	153.72	146.26
2002-03	166.50	160.93

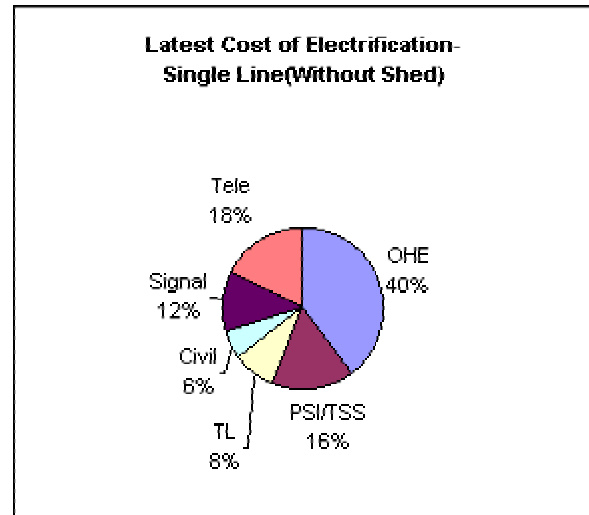
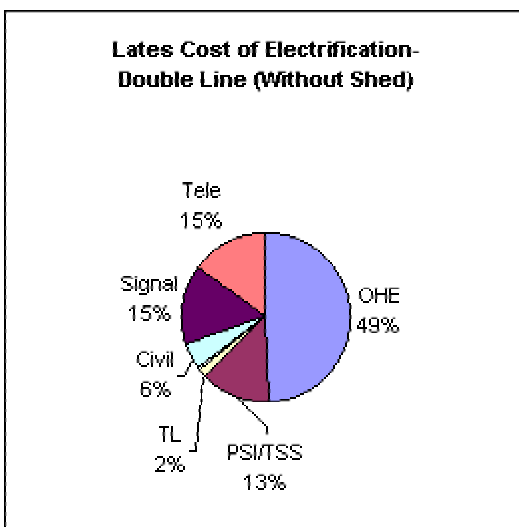
Bifurcation of Cost of Electrification-With Shed (Old)



Bifurcation of Cost of Electrification-Without Shed (Old)



Bifurcation of Cost of Electrification-Without Shed (Latest)



7.0 PROJECTS AS APPEARING IN PINK BOOK* (RE) 2005-06

(Rs. in crores)

<u>SN</u>	<u>Section</u>	<u>Year of Incl.</u>	<u>Estmtd cost</u>	<u>Expen . upto Mar, 2005</u>	<u>Outlay for 2005-06</u>	<u>RKM</u>	<u>Balanc e RKM On 1.4.2005</u>	<u>Target of Completion</u>
Projects under CORE								
1.	Sonnagar-Patratu	1990-91	183.17	181.57	0.0001	29 1	0	Completed
2.	Bokaro Barsuan&Purulia-Kotshila	1991-92	291.81	285.40	6.40	43 4	0	Completed
3.	Delhi-Ambala-Ludhiana	1991-92	299.01	298.61	0.40	31 4	0	Completed
4.	Renigunta-Guntakal	1992-93	168.34	73.77	32.00	30 8	222	Work completed upto Nandalur further to be taken up by RVNL
5.	Ambala-Moradabad	1992-93	223.73	201.83	20.40	27 4	111	Dec. 2005
6.	Chandil-Muri-Barkakana	1992-93	55.26	48.81	3.00	11 9	0	Completed
7.	Kharagpur-Bhubaneswar	1995-96	325.18	305.68	19.50	54 0	123	Dec.2005 except Cuttack-Paradeep
8.	Khurja-Meerut-Saharanpur	1996-97	89.21	0.10	0.0001	20 7	207	Pended
9.	Ludhiana-Amritsar	1997-98	114.83	112.97	0.80	13 6	0	Completed.
10.	Udhna-Jalgaon	1997-98	144.43	130.91	4.20	30 6	0	Completed.
11.	Bhubaneshwar-Kottavalasa incl. KhurdaRoad-Puri	1997-98	322.71	283.47	5.00	47 0	0	Completed
12.	Tambram-Villupuram & Chengalpattu-Arakkonam	1999-00	41.36	39.06	1.00	19 7	7	Completed except Takkolam-Arakkonam (7 RKM)
13.	Ernakulam-Trivandrum	1999-00	162.32	149.99	10.92	32 0	68	Dec. 2005
14.	Patna-Gaya	1999-00	36.44	31.42	0.75	92	0	Completed.
15.	Mughalsarai-Zafrabad	1999-00	49.96	1.00	0.0001	68	68	Awaiting procedural clearances
16.	Krishnanagar-Lalgola	2000-01	63.83	15.87	20.00	12 8	128	Jun. 2006
17.	Circular Railway Around LKO Area incl. Malhaur-Safedabad-Barabanki	2000-01	39.71	38.04	0.50	53	0	Completed
18.	Delhi Sarai Rohilla-Gurgaon	2001-02	12.00	0.50	0.0001	30	30	Awaiting procedural clearances
19.	Sitarampur-Mughalsarai	81-82/ 91-92	392.49	391.36	0.41	56 2	0	Completed
20.	Kanpur-Lucknow	1997-98	60.63	59.28	0.20	74	0	Completed
21.	Bangalore-Chennasandra Loop via Yashwantpur	2005-06	21.44	0	18.46	46	46	March, 2007

	Yelahanka Baiyyappanhal Loop via Hebbal							
22.	Moradabad-Lucknow-Utratia	2005-06	209.20	0	15.64	338	338	March, 2008

Projects under Zonal Railway								
1.	Kusunda-Jamuniatand	1997-98	16.42	16.00	0.42	23	0	Completed

Projects under MTP Plan Head								
1.	Ranaghat-Gede	1997-98	32.35	29.20	1.00	44	-	Completed
2.	Ranaghat-Bongaon	1997-98	17.98	15.48	0.25	34	-	Completed
3.	Barasat-Hasnabad	1998-99	37.70	27.88	0.33	52	-	Completed

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STATUS

OF

RAILWAY ELECTRIFICATION

AS ON

01.04.2005

6.3 DETAILS OF MILESTONE PROJECTS AS IDENTIFIED IN 2001-02, 02-03:

RAILWAY ELECTRIFICATION LAST MILE PROJECTS FOR 2001-02						
(Figures in Crores of Rupees)						
SN	Name of the Project	Cost	Org. outlay 2001-02	Addl. Allotment (Rs.170cr)	Outlay 2001-02	Target
a	b	c	d	e	f	g
1	Bokaro Steel City-Muri-Hatia-Bondamunda-Mimlagarh-Kiriburu /Barsuan incl. Purulia-Kotshila.	269.8	15	44.2	59.2	Mar-03
2	Kharagpur-Bhubaneswar incl. Talcher-Paradeep	317.36	15	42.68	57.68	Mar-03
3	Amabala-Moradabad	152.21	10.1	24.83	34.93	Mar-03
4	Bhubaneswar-Kottavalasa	319.63	25.3	40.26	65.56	Mar-02
5	Sitampur-Mughalsarai	363.36	23.98	3.2	27.18	Completed
6	Lucknow Circular Railway incl. Malhaur-Safedabad-Barabanki	33.34	8.4	14.83	23.23	Jun-02, upto Safedabad
Total		1446.59	97.78	170	267.78	

TOTAL LAST MILE PROJECTS FOR 2002-03 WHERE ADDL. FUNDS REQUIREMENT								
(Figures in Crores of Rupees)								
SN	Name of the Project	RKM	Anticipated cost	Likely Exp. till 3/2002	Year of approval	Fund allotted for 2002-03	Addl. Requirement	Target
CARRIED FORWARD FROM 2001-02								
1	Kharagpur-Bhubaneswar incl. Talcher-Paradeep	540	317.36	192.45	95-96	21.57	40	Mar-03
2	Bhubaneswar-Kottavalasa	470	319.63	275.45	97-98	30	14	Main Project complete. Funds reqd to complete Khurda Rd-Puri section by Mar-03.
3	Lucknow Circular Railway	56	33.34	17.99	2000-01	6	5	Work to be completed up to Barabanki by 02.10.02.
ADDITIONAL PROJECTS IDENTIFIED FOR 2002-03								
4	Patna-Gaya	92	36.44	0.00	99-00	5	20	Mar-03
5	Ernakulam-Trivandrum	320	161.76	20.58	99-00	15	25	Mar-04
6	Ludhiana-Amritsar	136	98.19	37.53	97-98	21	20	Mar-04
7	Udhna-Jalgaon	306	140.99	108.90	97-98	30	0	Mar-03
8	Tambaram-Chengalpattu-Villupuram & Chengalpattu-Arakkonam	197	38.44	24.47	99-00	11	0	Mar-03
						Total	124	

6.2 ELECTRIFICATION PROJECTS UNDER MTP PLAN HEAD

PHYSICAL PROGRESS							
SN	Name of Project	RLY	RKM Total	RKM energized till Mar-05	RKM Balance on 1.4.05	RKM Targeted for 2005-06	Target for Completion
1	Ranaghat-Gede	ER	44	44	0	0	Completed
2	Ranaghat-Bongaon	ER	34	34	0	0	Completed
3	Barasat-Hasnabad	ER	52	52	0	0	Completed

FINANCIAL PROGRESS							
SN	Name of Project	RKM	Cost (Rs.cr)	Likely exp. upto 31.03.05 (Rs.cr)	Outlay for 2005-06 (Rs.cr)	Throw Forward beyond 31.03.06 (Rs.cr)	Target for completion
1	Ranaghat-Gede	44	32.35	29.20	1.00	2.15	Completed
2	Ranaghat-Bongaon	34	17.98	15.48	0.25	2.25	Completed
3	Barasat-Hasnabad	52	37.70	27.88	0.33	9.49	Completed

RKMs ELECTRIFIED

- 1. Railway-wise**
- 2. State-wise**
- 3. Year-wise**

**ELECTRIFICATION STATUS
STATE-WISE**

**PROJECT DETAILS
AT A GLANCE**

2.3 SECTIONS COVERED IN THE BLUE PRINT OF ELECTRIFICATION (2003-04): -

<u>SN</u>	<u>Route</u>	<u>RKM</u>
1	Pune-Wadi-Guntakal	641
2	Nandalur-Guntakal	222
3	Mughalsarai-Utraitia-Moradabad via Sultanpur and Unchahar	896
4	Bina-Kota	303
5	Shakurbasti-Bhatinda-Suratgarh	429
6	Lingampalli-Wadi	161
	Total	2652

2.3.1 SECTIONS SANCTIONED FOR ELECTRIFICATION OUT OF BLUE PRINT

Electrification of Moradabad-Lucknow-Utraitia (338 RKM) has been included in Budget 2005-06 which comes under Blue Print.

