

TRANSPORT SECTOR: ENERGY CONSUMPTION PATTERN IN SELECTED CITIES OF TAMILNADU, INDIA

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Abstract: Energy is the universal measure of all kinds of work and its consumption has an increasing trend worldwide. The combustion of fossil fuels like coal, petroleum oils and natural gas generates energy, which is mainly used for the improvement of the quality of life. These conventional fuels are depleted exponentially and so it is imperative to study the existing energy users, consumption patterns and demand especially in urban areas for utilizing the energy efficiently. In this connection, the present investigation is carried out in Madurai and Salem, the second and fifth largest and most densely populated cities in the state of Tamil Nadu, India. The energy consumers are identified in this city and they are categorized as transport sector. The energy demand of these sectors is quantified and the energy consumption for all these sectors is studied. The variations in energy utilization are assessed by adopting cluster sampling method and the results are discussed in this paper. As the energy demand and environmental deterioration are in increasing trend, it is concluded that the implementation energy consumption that includes the execution of energy conservation measures and utilization of renewable energy sources are essential not only to match the demand and supply of energy but also to safeguard the health and wealth of the inhabitants in Madurai and Salem Cities.

Keywords: Energy; transport; consumption

Introduction

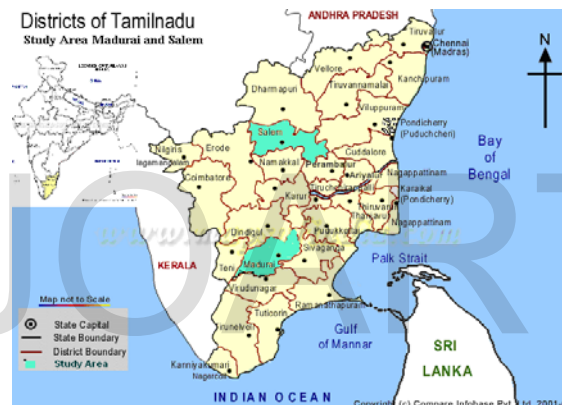
Infrastructure facilities are vital for the development of any country. The key interrelated areas include energy and transport. The transport sector accounts for 22 per cent of the total commercial energy consumption in India. In the transport sector, urban areas are characterized by huge transportation movements with a

chain interconnected activities. In the present chapter, it is an attempt to analyse the energy use pattern in transport sector and compare between two cities namely Madurai and Salem. For the purpose of analysis, the vehicle has been classified under rental and own.

Methodology

Designing a suitable methodology and selection of analytical tools are important for a meaningful analysis of any research problem. This section is devoted to describe the methodology, which includes choice of study area, sampling procedure, period of study, collection of data, method of analysis and tools of analysis

Choice of the study area



The area chosen for the present study are two cities namely Madurai and Salem which are second and fifth big cities in terms of population in Tamilnadu. Both the cities are corporations, which have major industries and trading centres. Another important feature is the significantly higher work force that the cities are supporting in the non-agricultural sector, 40 percent of this work force is occupied by this sector as against 45 to 55 percent in the respective districts. However, on the whole, the population, households, and workforce occupied in these two cities indicate the high-energy consumption in almost all the sector namely transport sectors. With this background, the energy consumption pattern was examined for the cities Madurai and Salem.

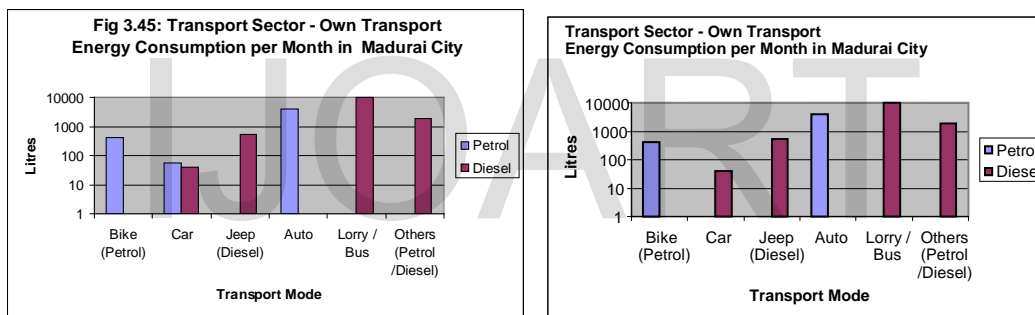
Sampling Procedure

Madurai city comprises of 72 wards. For the purpose of primary data collection, the Madurai city has been classified into four zones namely, North, East, South, and west zones. 100 bikes, cars, jeeps under transport sector were randomly selected from the four zones.

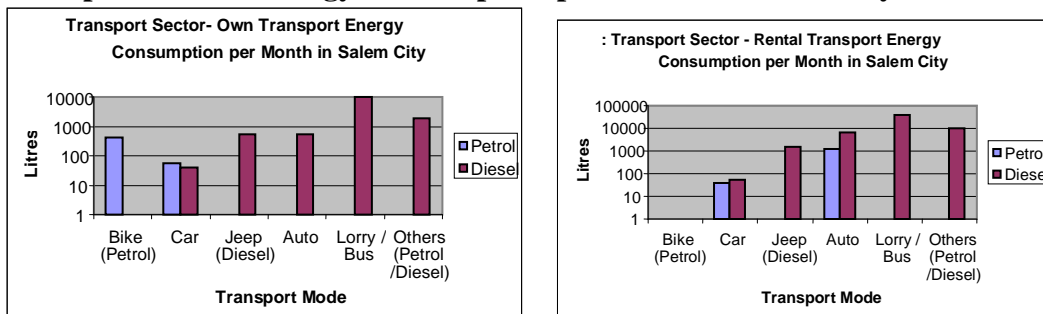
Salem city comprised of 60 wards. For the purpose of primary data collection, Salem city was classified into four zones namely east (zone 1), west (zone 2), North (zone 3) and South (zone 4). Wards 1 to 28 are in east zone, 4 to 31 are in west zone, 9 to 44 are in north zone, 45 to 60 in south zone. 100 bikes, cars, jeeps under transport sector were randomly selected from the four zones.

The number of vehicles and energy consumption for transport sector in Madurai and Salem cities are given in Table 3.89 and 3.90

Transport Sector: Energy Consumption per Month in Madurai City



Transport Sector: Energy Consumption per Month in Salem City



From the table 3.89, it has been observed that in the case of rental transport using petrol as source of energy in Madurai, maximum of 4400 litres is used in auto and 37 litres is used in car whereas in the case of rental transport using diesel as source of energy, maximum of 36480 litres is used in lorry / bus, followed by 9510 litres is used in other vehicles, 1525 litres is used in auto, 1524 litres is used in jeep and 52 litres is used in car respectively. Further, it also shows that in the case of own transport using petrol as source of energy in Madurai, maximum of 3950 litres is used in auto followed by 404 litres is used in bike and 54 litres is used in car whereas in the case of own transport using diesel as source of energy, maximum of 9600 litres is used in auto followed by 1800 litres is used in other vehicle 525 litres is used in jeep and 40 litres is used in car respectively.

From the table 3.90, it has been informed that in the case of rental transport using petrol as source of energy in Salem, maximum of 1250 litres is used in auto and 37 litres is used in auto whereas in the case of rental transport using diesel as source of energy, maximum of 38400 litres is used in lorry / bus, followed by 9510 litres is used in other vehicles, 6346 litres is used in auto, 1524 litres is used in jeep and 52 litres is used in car respectively. Further it also shows that in the case of own transport using petrol as source of energy, maximum of 404 litres is used in bike and 34 litres is used in car whereas in the case of own transport using diesel as source of energy, maximum of 9600 litres is used in lorry / bus followed by 1800 litres is used in other vehicle 525 litres is used in jeep 520 litres used in auto and 40 litres is used in car respectively.

The number of vehicles and energy consumption (mega joules) for transport sector in Madurai and Salem cities are given in Table 1 and 2

Table 1: Transport Sector: Energy Consumption per Month in Madurai City

(in Mega Joules)

Mode of transport	Rental				Own			
	Number of Respondents	Petrol (l)	Number of Respondents	Diesel (l)	Number of Respondents	Petrol (l)	Number of Respondents	Diesel (l)
Bike (Petrol)	NU	NU	NU	NU	24	12928	NU	NU
Car	3	1184	4	1851.2	4	1728	2	1424
Jeep (Diesel)	NU	NU	5	54254.4	NU	NU	1	18690
Auto	10	140800	3	54290	7	126400	NU	NU
Lorry / Bus	NU	NU	19	1298688	NU	NU	5	341760
Others (Petrol /Diesel)	NU	NU	9	338556	NU	NU	3	64080
Total	13	141984	40	1747640	35	141056	11	425954

Source: Survey Data

Table 2: Transport Sector: Energy Consumption per Month in Salem City

(in Mega Joules)

Mode of transport	Rental				Own			
	Number of Respondents	Petrol (l)	Number of Respondents	Diesel (l)	Number of Respondents	Petrol(l)	Number of Respondents	Diesel (l)
Bike (Petrol)	NU	NU	NU	NU	24	12928	NU	NU
Car	3	1184	4	1851.2	4	1728	2	1424
Jeep (Diesel)	NU	NU	5	54254.4	NU	NU	1	18690
Auto	5	40000	12	225918	NU	NU	3	18512
Lorry / Bus	NU	NU	20	1367040	NU	NU	5	341760
Others (P/D)	NU	NU	9	338556	NU	NU	3	64080
Total	8	41184	50	1987619	28	14656	14	444466

Source: Survey Data

NU- Not in Use

From the table 1, it has been revealed that in the case of rental transport using petrol as source of energy in Madurai, maximum of 140800 mega joules is used in auto and 1184 mega joules is used in car whereas in the case of rental transport using diesel as source of energy, maximum of 1298688 mega joules is used in lorry / bus, followed by 38556 mega joules is used in other vehicles, 54254.4 mega joules is used in jeep, 54190 mega joules is used in auto and 1851.2 mega joules is used in car. Further, it also shows that in the case of own transport using petrol as source of energy, maximum of 1264000 mega joules is used in auto followed by 12928 mega joules is used in Bike and 1728 mega joules is used in car whereas in the case of own transport using diesel as source of energy, maximum of 341760 mega joules is used in lorry / bus followed by 64080 mega joules is used in other vehicle 18690 mega joules is used in jeep and 1424 mega joules is used in car respectively.

It has been inferred from the 2, that in the case of rental transport using petrol as source of energy in Salem, maximum of 40,000 mega joules is used in Auto and 1184 mega joules is used in car whereas in the case of rental transport using diesel as source of energy, maximum of 1367040 mega joules is used in lorry / bus followed by 338556 mega joules is used in other vehicle, 225918 mega joules is used in Auto, 5425.4 mega joules is used in jeep and 1851.2 mega joules is used in car respectively. Further, it also shows that in the case of own transport using petrol as source of energy in Salem, maximum 12928 mega joules is used in bike and 1728 mega joules is used in car whereas in the case of own transport using diesel as source of energy, maximum of 341760 mega joules is used in lorry / bus, followed by 64080 mega joules is used in other vehicle, 18690 mega joules is used in jeep, 18512 mega joules is used in auto and 1424 mega joules is used in car respectively.

The number of vehicles and energy expenditure for transport sector in Madurai and Salem cities are given in Table 3 and 4

Table 3: Transport Sector: Energy Expenditure per Month in Madurai City

	Rental				Own			
	No of Respondents	Petrol purchase cost (RS)	No of Respondents	Diesel purchase cost (RS)	No of Respondents	Petrol purchase cost (RS)	No of Respondents	Diesel purchase cost (RS)
Bike (petrol)	NU	NU	NU	NU	24	18988	NU	NU
Car	3	1739	4	1664	4	2538	2	1280
Jeep (Diesel)	NU	NU	5	48768	NU	NU	1	16800
Auto	10	206800	3	48800	7	185650	NU	NU
Lorry/Bus	NU	NU	19	1167360	NU	NU	6	307200
Others (petrol/Diesel)	NU	NU	9	304320	NU	NU	3	57600
Total	13	208539	40	1570912	35	207176	11	382880

Source: Survey Data

Table 4: Transport Sector: Energy Expenditure per Month in Salem City

	Rental				Own			
	No of Respondents	Petrol purchase cost (RS)	No of Respondents	Diesel purchase cost (RS)	No of Respondents	Petrol purchase cost (RS)	No of Respondents	Diesel purchase cost (RS)
Bike (petrol)	NU	NU	NU	NU	24	18988	NU	NU
Car	3	1739	4	1664	4	2538	2	1280
Jeep (Diesel)	NU	NU	5	48768	NU	NU	1	16800
Auto	5	58750	12	203072	NU	NU	3	16640
Lorry/Bus	NU	NU	20	1228800	NU	NU	5	307200
Others (petrol/Diesel)	NU	NU	9	304320	NU	NU	3	57600
Total	8	60489	50	1786624	28	21526	14	399520

Source: Survey Data

NU- Not in Use

It has been observed from the Table 3, that in the case of rental transport using petrol as source of energy in Madurai, maximum of 206800 is spent in auto and Rs. 1739 is spent in car whereas in the case of rental transport using diesel as source of energy, maximum of Rs.1167360 is spent in lorry / bus followed by Rs.304320 is spent in other vehicle, Rs.48800 is spent in auto, Rs.48768 is spent in jeep and Rs.1664 is spent in car. Further, it also shows that in the case of own transport using petrol as source of energy, Rs.185650 is spent in auto followed by Rs.218988 is spent in bike and Rs.2538 is spent in car whereas in the case of own transport using diesel as source of energy maximum of Rs.30720 is spent in lorry / bus, followed by Rs.57600 is spent in other vehicle, Rs.16800 is spent is jeep and Rs.1780 is spent in car respectively.

It has been revealed from the table 4, that in the case of rental transport using petrol as source of energy in Salem, maximum of Rs.58750 is spent in auto and Rs.1739 is spent in car whereas is the case of rental transport using diesel as source of energy, maximum of Rs.1228100 is spent in lorry / bus, followed by Rs.304320 is spent in other vehicle, Rs.203072 is spent in auto, Rs.48768 is spent in jeep and Rs.1664 is spent in car. Further, it also shows that in the case of own transport using petrol as source of energy in Salem, maximum of Rs.18988 is spent in bike and Rs.2538 is spent is car whereas in the case of own transport using diesel as source of energy, maximum of Rs.30700 is spent in lorry / bus followed by Rs.57600 is spent is other vehicles Rs.16800 is spent in Jeep, Rs.16640 is spent in auto and Rs.1380 is spent in car respectively.

TABLE 5: ANOVA TEST: Transport Sector

In order to examine the variation in member of vehicle used and consumption energy for vehicles in transport sector between Madurai and Salem, ANOVA test was carried out. The computed results are given in table 5,

Table 5: TRANSPORT SECTOR ANOVA TEST

Particulars	Madurai and Salem	Sum of squares	df	Mean Square	F	sig
Transportation: Lorry/Bus	Between Group	.005	1	.005	.019	.892
	Within Groups	12.240	47	.260		
	Total	12.245	48			
Transportation: Motor Cycle /Bike/Petrol/ Month	Between Group	.000	1	.000	.000	1.000
	Within Groups	7714.667	46	167.710		
	Total	7714.667	47			
Transportation: Car Petrol / Month	Between Group	.000	1	.000	.000	1.000
	Within Groups	120.000	12	167.710		
	Total	120.000	13			
Transportation: Car Diesel / Month	Between Group	.000	1	.000	.000	1.000
	Within Groups	266.667	10	10.000		
	Total	266.667	11			
Transportation: Jeep Diesel/ Month	Between Group	.000	1	.000	.000	1.000
	Within Groups	454915.000	10	45491.500		
	Total	454915.000	11			
Transportation: Auto Petrol / Month	Between Group	152897.970	1	152897.970	2.992	.103
	Within Groups	817692.308	16	51105.769		
	Total	970590.278	17			
Transportation: Auto Diesel/ Month	Between Group	54186.729	1	54186.729	.651	.429
	Within Groups	1665440.362	20	83272.018		
	Total	1719627.091	21			
Transportation: Others Diesel / Month	Between Group	.000	1	.000	.000	1.000
	Within Groups	4042850.000	22	183765.909		
	Total	4042850.000	23			

Source: Computed

It is inferred from table 5, that there is no evidence in variation in number of vehicles used and consumption of energy in transport sector between Madurai and Salem cities.

Conclusion:

In Transport Sector, the analysis of energy use pattern in transport sector revealed that own transport has used a maximum of petrol for auto and car whereas rental transport has used a maximum of diesel for lorry and buses in Madurai city. In Salem city, petrol and diesel are used maximum for own and rental transport.

The ANOVA test revealed that there is no evidence of significant variation in energy consumption between Madurai and Salem cities.

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