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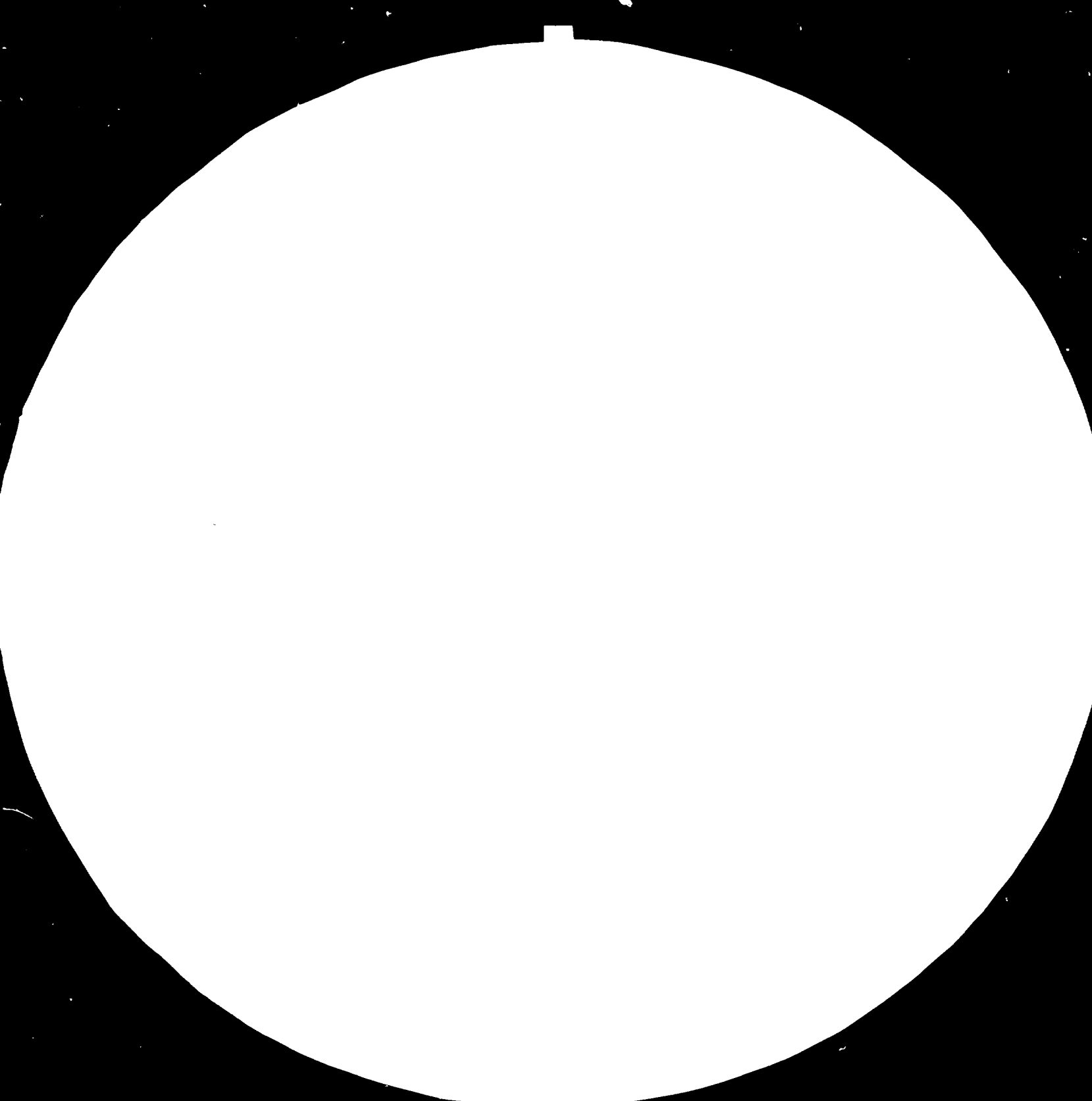

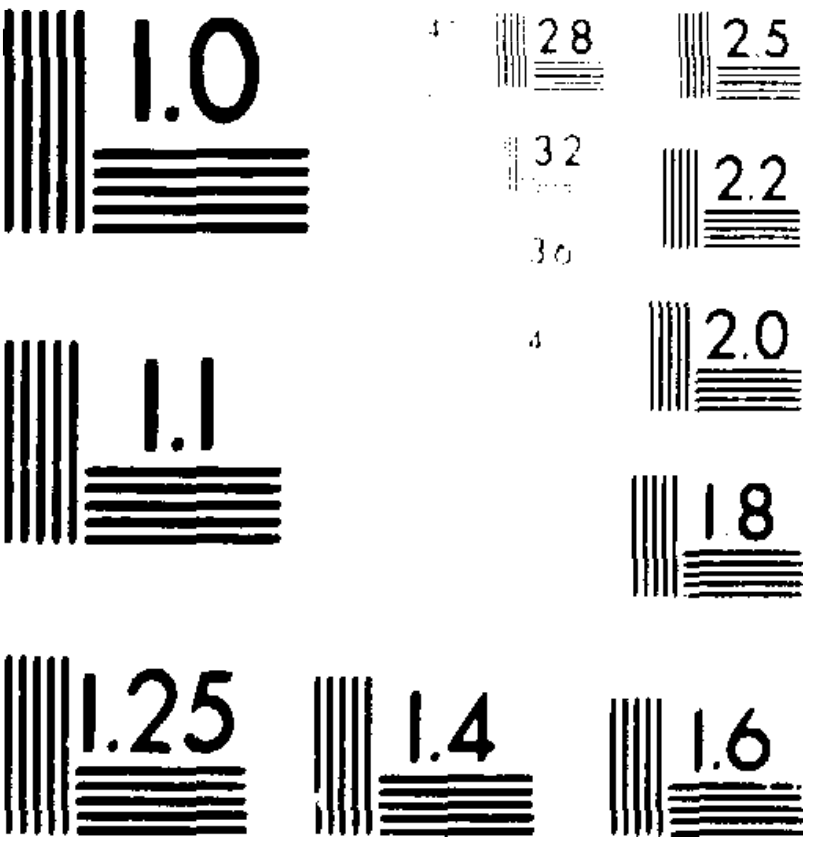

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DEVELOPMENT OF CAPITAL GOODS INDUSTRIES

DP/TUR/76/034

Technical Report No.VIII: Diesel Engine Industry in Turkey.

M.M.Luther

UNITED NATIONS DEVELOPMENT PROGRAMME IN TURKEY

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION

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by

M.M.Luther

Chief Technical Adviser

Capital Goods Development Project in Turkey

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CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY

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CHAPTER I

INTRODUCTION

1.1 Diesel engine industry was identified as one of the priority sub-sectors by SPO for Capital Goods Development Project. Medium-duty and light-duty diesel engines were dealt with at length in technical reports no.III and VI while tractors and tractor diesel engines were covered in report no. V. Special consideration was given in these reports to the following points:

i- previous projections of demand.

ii- demand in the economic environment now anticipated for the period 1983 - 90.

iii- capacity available and anticipated for diesel engines and user vehicles.

iv- level of integration achieved and anticipated.

1.2 Recommendations were made in these reports for filling up anticipated gaps, with special reference to Tumosan projects. In order to ensure full utilisation of installed capacity, recommendations took into account the minimum possible demand levels.

1.3 OBJECTIVE

In this report, conclusions and recommendations of previous three reports have been brought together to present a co-ordinated picture of diesel engine industry in Turkey.

1.4 BASIC DATA AND METHODOLOGY

1.4.1 For the sake of uniformity;

(i) 1966-80 park figures were used and double logarithmic regression methods applied in all cases of automotive vehicles to project park levels.

(ii) For replacements, a 12 year useful life of automotive vehicles and tractors was assumed in all cases and annual replacement demands were worked out on the basis of past sales.

(iii) Additional demand of tractors however has been calculated using parameters of agricultural income, relative price for tractors and bank credits.

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1.5. ACKNOWLEDGEMENT

The author is grateful to the State Planning Organisation for lending the services of Mr. Muzaffer Keleş of Teşvik ve Uygulama Dairesi(for the data in table 4 on capacity of private sector units) and of Mr. Ömer Özdemir,and to the General Manager of TÜMOSAN, who besides giving him the benefit of open and frank discussions, made available the invaluable advices of Mr. Ali Ünal who not only collected data but also helped in various ways in the finalisation of this report.

M.M.Luther 20.4.82

Chief Technical Adviser

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CHAPTER II

SUMMARY

2.1 Diesel engines as power units have a wide field of use. Primary uses are on agricultural tractors and on commercial vehicles including pick-ups, minibuses, buses, trucks and all types of heavy trucks. There are in addition, a number of peripheral uses among which the more important are marine vehicles, construction machinery and stationary applications in power generators and water pumps.

2.2 The importance for agriculture and transport sectors of local manufacture of diesel engines has been recognised in successive plans and this issue has occupied a prominent place in the development strategy of Turkey for the last fifteen years. The Government set up Tumosan in 1976 with the objective of establishing facilities for the manufacture of diesel engines, transmission units and agricultural tractors in the public sector.

2.3 Tumosan's investment is under way at two sites in Central Anatolia in Aksaray (Nigde) and Konya. Total investment to date is 6 billion TL (book value). Assembly production in tractor engine plant started in March 1981. Production of tractors is planned for the end of 1982. In other projects, namely light-and medium-duty diesel engines, transmissions and support projects (foundry, forge and central tooling

feasibility), however, there is little or no progress because of non-availability of funds.

2.4 Renewed forecast for diesel engines (greater than 50 HP) indicate that total domestic demand will be at an average level of 120 000 per annum in the 1983-86 period and will increase to above 180 000 by 1990. This level of domestic demand, together with export potential estimated at 10% of local market, is sufficient for local manufacture on an economical and internationally competitive basis.

2.5 Production of engines and transmissions aimed at integral manufacture of vehicles and tractors, is supported by several other factors:

i- It would enhance the value added and promote real technological growth both of which are low in the case of "assembly industries" dependent on large scale imports.

ii- These industries are rich in "external economies" in that the technical and management skills required by sub-suppliers would be an asset in developing other engineering industries.

iii- Export potential created by integrated production of trucks and tractors would more than offset the cost of imports and hence make this sector self-sufficient in foreign currency developing into a net export earner.

2.6 Present state of the automotive and tractor industries and of

Tumosan projects and private sector projects have been examined and recommendations put forward for this industry to develop as a healthy sector reaching 100% localisation by 1990.

2.6.1 TRACTOR ENGINES

The degree of integration is low in the present tractor industry in which eight firms (7 private and 1 government firm) operate. The total installed capacity is reported as 122 500 but actual production has been far short of this figure (maximum level reached is 37 000 tractor in 1976). An equally critical aspect is that of the degree of integration which varies greatly among manufacturers. Only three of the present producers (TOM, BMC and Turk Traktor- total capacity 39 500) have attained a fair degree of integration, and a fourth (Burtrak) is understood to be investing. All others are "assemblers" with almost no integration and hence heavily dependent on the availability of foreign exchange for CKD. Demand for tractors is expected to be between 65 000 and 85 000 units pa (including exports). Present practice of each manufacturer assembling its own engine from CKD and some local bought-out parts from sub-suppliers is uneconomical and would place a heavy foreign exchange burden on the economy of the country.

The only private sector for tractor engines is BMC with a capacity of 6000 units pa (for its own use). Tumosan should therefore expeditiously complete the first phase of its project to create a capacity of 50000 tractor engines pa on 2 shift basis. Simultaneously, however, steps will need to be taken by tractor manufacturers

to adapt Tumosan engines to their products. This will need Governmental action which may include phased reduction of imports of CKD engines.

2.6.2 LIGHT-DUTY ENGINES

There are presently eight firms (all private) that manufacture light-duty vehicles, minibuses and pick-ups. Minibuses are powered by gasoline engines, but two new diesel models have recently been introduced by TOE and Karsan. Pick-up situation is similar in that although two manufacturers have diesel models (BMC and TOE) a very large percentage in the market still has gasoline engines.

Developments in local market and trends in world automotive industry indicate that diesel powered vehicles are preferred for commercial use because of fuel economy and lower running costs. Hence diesel engines are expected to sell well if local manufacture meets quality, cost and delivery requirements of vehicle manufacturers.

Capacity for engines presently available in private sector is 6000 units pa (diesel, BMC). It is understood Otosan has plans to enter this field with gasoline engines at a capacity of 10 000 pa in 2 shifts, (excluding 15 000 engines for Anadolpassenger cars), thus making a total anticipated capacity of 16 000 pa. As demand for light-duty vehicles is expected to reach a level between 45 000 and 65 000 units pa by 1990, there is ample scope for Tumosan to go ahead with the first phase of its project, that is 20 000

units pa on 2 shift basis,simultaneously,however,suitable steps will have to be taken by BMC and Otosan to realise production according to their installed capacity with necessary help and guidance from the Government.

2.6.3 MEDIUM-DUTY ENGINES

Demand is forecast to be between 34000 and 47000 and capacity anticipated in the private sector is a total of 21200 units pa (9200 existing with BMC and 12000 planned by Otosan) thus leaving a gap of 13 000 under minimum demand conditions and 26000 under favourable conditions.This size of unmet demand justifies only one more plant,be it Tumosan or a joint-sector project which,it is understood,is under consideration. The crucial aspect is that the aim of all manufacturers must be to achieve 100% local manufacture during the eighties, This indeed,should be an important condition to be set by the Government for approving any project.

As a fully integrated plant to produce 10-15000 engines may not be economical in this highly competitive industry,non-civilian uses for this range of engines (not included in demand estimates) should also be taken into account while taking decisions on capacity creation particularly since BMC and Otosan engines are not considered for such uses.

with the background of a joint-sector project being also under consideration for medium-duty vehicles, the Government should take a policy decision on implementing one of the following two alternatives:

Alt.1: The joint-sector project to manufacture 10-15000 engines by 1990 and ALSO to achieve full local integration by that time.

Alt.2: Tumosan to go ahead with its project for medium-duty engines but with following modifications:

i- initial capacity to be 10-12000 pa

ii- master plan to be retained at 24000 pa

iii- full integration to be achieved by 1990

iv- possible non-civilian uses should be taken into account.

2.6.4 HEAVY-DUTY ENGINES

There is room for only one manufacturer in this range and the private sector firm MAN who are entering the field for engines of over 180 HP should undertake to achieve 100% integration by 1990. Initial capacity of 7000 units pa, with provision to expand to 11000 of this project appears to be too high and a review of investment plans is recommended.

2.6.5 TRANSMISSIONS

There is at present no capacity for light-duty gearboxes and rear axles nor for heavy-duty boxes and axles. Tumosan's project provides for 57000 pa light and heavy duty gearboxes and 42000 light duty

rear axles. There is no provision for heavy-duty rear axles. Tumosan's project should be expeditiously pursued and in addition it should also cater for heavy-duty axles.

2.5.6 CASTINGS AND FORGINGS

Adequate and timely supply of castings and forgings is recognized to have a vital importance for the success of diesel engine industry. Shortfalls in terms of technology and capacity for intricate high quality castings and forgings are known even if this cannot be quantified, and an updated report of Tumosan's minimum needs should be prepared and processed.

CHAPTER III

DOMESTIC DEMAND

3.1 AUTOMOTIVE VEHICLES

3.1.1 PROJECTION OF VEHICLE PARKS

3.1.1.1 Double logarithmic regression analyses were carried out between park figures and GNP over the period 1966-80 for each of the four types of automotive vehicles, namely minibuses, pick-ups, trucks and buses. Data used and regression equations obtained are shown in appendices 1 and 2, respectively. In all four cases explanatory variables were significant and coefficients of determination were suitably high for use in projecting.

3.1.1.2 For projecting vehicle parks, two patterns of GNP growth were considered. In the first pattern GNP was taken to grow at a constant rate of 3.5% all through the period 1981-90 and this was taken to represent minimum demand conditions. In the second pattern, GNP growth rate was taken at 3% for the year 1981 and was increased by 0.5% each year until 1985 and then was kept constant at 6% from 1986 onwards. These two patterns of GNP growth are given in appendix 3.

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3.1.1.3 Vehicle parks predicted by this method are given in appendix 4 for both alternatives. It may be noted that minibus population has the highest coefficient of elasticity with respect to GNP and a 3½% rise in GNP results in a 7.21% rise in minibus park. Pick-ups, trucks and buses have lower elasticity coefficients, in decreasing order, and hence smaller percentage growths are projected as shown at the foot of the table in appendix 4.

3.1.2 ESTIMATION OF REPLACEMENT DEMAND

3.1.2.1 Replacement demand was calculated from past sales of vehicles (appendix 5) assuming a useful life of 12 years for all four types of vehicles. Three-year moving averages were taken to allow for variation of useful life.

3.1.3 TOTAL DOMESTIC DEMAND

3.1.3.1 Domestic demand has been obtained by the addition of replacement demand figures onto park increase figures calculated from predictions of vehicle parks. Domestic demand projections for each of the four types of vehicles are given in appendices 6-9, for the period 1983-90.

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3.1.4 DISTRIBUTION OF DOMESTIC DEMAND INTO HP RANGES

3.1.4.1 Light Duty Engines (60-80 HP)

Minibuses and pick-ups were treated together and, as explained in detail in report no 6, 70% of pick-up demand and 33.3% of minibus demand was allocated to 60-65 HP range. The remainder of the demand is to be met by an engine of 75-80 HP. Light duty vehicle demand thus distributed is shown in appendix 10.

3.1.4.2 Medium Duty Engines (85-170 HP)

3.1.4.2.1 Distribution of Truck Demand

3.1.4.2.1.1 Appendix 11 shows truck production in the last ten years by manufacturing firms and by types of vehicles. 8-ton trucks are produced by six firms and make up 82% of all trucks manufactured. The reason for this was that permissible axle load in Turkey was 8 tons until recently and hence 8-ton trucks were in wide use as the largest capacity single-axle truck. Permissible axle load was increased to 10 tons in November 1980 and it is expected that 10-ton trucks will take a larger share of the market in future. This will of course, be at the expense of 8-ton trucks while the small 3½-ton trucks will probably keep their share of 15%. This was taken into account in distributing truck demand into pay-load ranges and the share of 10-ton trucks was taken as 5% in the years 1983 and 1984 and was increased 3% every year until 1990. Truck

demand thus distributed into HP ranges is shown in appendix 12 for favourable and minimum demand conditions until 1990.

3.1.4.2.1.2 Use of diesel engines by trucks of different capacities is of the following order:-

3½ T. pay load --- Approximately 85 HP
8 T. pay load --- Approximately 130 HP
10 T. pay load --- Approximately 170 HP

3.1.4.2.2 Distribution of Bus Demand

3.1.4.2.2.1 Local manufacturers of buses use engines of 130-192 HP power range. Engines on lower side of this range are installed on municipality buses while those on higher side are used for coaches. Air-conditioned coaches which require even higher engine power of about 210 HP are not produced locally. With the increase of permissible axle load from 8 to 10 tons, it is expected that future demand for bus engines will move towards 170-210 HP range both for bus and coach applications.

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3.1.4.2.2.2 Midibuses have gained an important place in passenger transport in recent years and thus need to be taken into account. Production of buses and midibuses, shown in appendix 13, indicate that on the average midibuses made up 21% of production (in numbers). Assuming that midibuses will keep their place in passenger carrying sector it is reasonable to allocate 20% of total demand to midibuses.

3.1.4.2.2.3 Bus demand is distributed between HP ranges as in appendix 14, 85 HP engine being for midibuses and 170-210 HP range for municipality buses and coaches.

3.1.5 LIGHT-DUTY DIESEL ENGINES (60-80 HP)

3.1.5.1 Domestic Demand Anticipated

Domestic demand anticipated under favourable conditions averages 35 670 vehicles per annum in the four-year period 1983-86 and increases to 62 911 for the period 1987-90, as indicated in appendix 10. This demand can be met by two diesel engines, one of 60-65 HP output, the other 75-80 HP, and, on an average, 60% of total demand in any one year is

./..

expected to be for the smaller engine.

3.1.5.2 Minimum Domestic Demand

Minimum level of domestic demand, appendix 10, is estimated to average 28 368 in the 1983-86 period and to increase to 40 371 in 1987-90 period.

3.1.6 MEDIUM-DUTY ENGINES (85-170 HP)

3.1.6.1 Domestic Demand Anticipated

3.1.6.1.1 Total domestic demand for medium-duty diesel engines is estimated to gradually increase from a level of 17 500 in the year 1983 to 45 000 by 1990, the average annual demand for 1983-86 period being 24 952 and for 1987-90 period 42 858, appendix 15. Bus and midibus applications take a share of about 10% in domestic demand and, as the share of construction machinery applications is very low (below 1%), the remainder of demand is all for use on trucks ranging from 3½ to 10 tons in pay-load. Four types of engines are required to meet this demand. One of 85 HP for small trucks, midibuses and construction machinery, another of 130 HP for 8 ton trucks and medium-duty construction machinery, the third for 10 ton trucks and of about 170 HP. The

fourth type, in 170-210 HP power range is required for buses and coaches. Major portion of demand is for 130 HP engines, but 170 HP range is expected to increase its market share in future as a result of the increase of permissible axle load from 8 to 10 tons in 1980.

3.1.6.2 Minimum Domestic Demand

Minimum level of domestic demand, appendix 16, is estimated to average a value of 20 478 per annum for 1983-86 period and to increase to 30 727 in 1987-90 period.

3.1.7 HEAVY-DUTY ENGINES

3.1.7.1 Demand Anticipated

Desiyab study (1977) foresaw domestic demand for heavy-duty engines as in (appendix 17).

3.2 DIESEL ENGINES FOR TRACTOR INDUSTRY

3.2.1 Domestic Demand Anticipated

3.2.1.1 Domestic demand for farm tractors is anticipated to be around 50 000 pa in the year 1983 and to gradually increase to a level of 87 000 pa by the year 1990, appendix 18 . This

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leads to an average park growth rate of 6% and tractor park of the country rises from the present level of 400 000 to 530 000 in 1990.

3.2.1.2 The cultivated area of the country, 24 million ha, corresponds to one third of the whole country and is thus unlikely to significantly increase in the near future. The total number of tractors required to effectively farm this land is estimated to be around 900 000. When the park saturates at this level, and the average tractor life improves to 12 years from the present level of 11 years, 75 000 replacement tractors per annum will be required to sustain the park. With possible increases in the use of tractors for industrial purposes and for construction works, this could rise to the level of 80 and 85 000 pa. -(At a constant supply of 75 000 tractors per annum to the farm sector the optimum park of 900 000 may be reached by the year 2000).

3.2.1.3 Farm tractors have a good chance of export to the Islamic countries. Export possibilities should be a minimum of 10% of the domestic demand. Hence, production plans for tractors should be made for about 55 000 in 1983 and should be increased to the level of 96 000 in 1990.

3.2.1.4. Long term tractor production plans of the country hence that of tractor engines, taking into account both the demand forecast for the years ahead and the level of replacements required at saturation point . should be made for 96 000 tractors per year (export included).

3.2.2. Minimum Domestic Demand

Based in past trends the growth pattern for agricultural income has been assumed conservatively at a constant 2.6% for 1981-96 period and 3% for 1987-90 period. Minimum demand levels calculated on this basis, appendix 18, indicate an annual average of 51 000 for 1983-86 and 59 000 for 1987-90. Under these conditions the tractor fleet grows by 120 000 to about 520 000 by the year 1990 and the average growth rate for the fleet obtained is 3.5%.

CHAPTER IV

EXPORTS

4.1. There is a considerable potential for exports of commercial vehicles and tractors in the Islamic group of countries,particularly the Middle East. The optimal geographical situation of Turkey to the Islamic markets is an advantage and these export markets should be fully utilized.

4.2. It is important that local manufacturers should make the best use of this potential because with exports,apart from getting themselves a place in foreign markets,they will also partially offset the cost of KD parts to be procured from licensors for their own manufacture and could thus become self-sufficient with respect to foreign exchange.

4.3. More detailed notes on collaboration agreements are given in chapter VII. Considerable efforts will be needed to set up an effective marketing organisation to get a foothold in foreign markets and this will include not only organisational steps by manufacturers but also help and assistance by the Government during bilateral trade negotiations with potential customer countries.

4.4. A detailed analysis of Middle East and African markets has not been undertaken but it is felt that all manufacturers,including Tumosan,should undertake the responsibility of realising a minimum export level of 10% of their capacity. Exports could be either as separate engines to such developing countries as Saudi Arabia and Iran which have started automotive assembly industries,or indirectly in vehicles and tractors to be exported. Since domestic demand for vehicles and tractors reaches around 180 000 per annum by 1990s,this will mean that a reasonable total export target of 18 000 per annum should be set.

4.5. It should be ensured that there is no restriction in license agreements between Turkish manufacturers and foreign licensors concerning exports of products manufactured in Turkey.

4.6. Another area which should be closely examined is the possibility of supply of half-wroughts particularly those items which are labour-intensive like casting and forgings to licensors and their associates.

CHAPTER V

CAPACITY FOR PRODUCTION OF VEHICLES AND ENGINES

5.1 LIGHT DUTY ENGINES FOR AUTOMOTIVE VEHICLES

5.1.1 Vehicle Production

5.1.1.1 There are presently 8 firms that manufacture light-duty vehicles, minibuses and pick-ups. Installed capacity for the manufacture of minibuses is 10 500 and that for pick-ups 30 000, thus making a total of 40 500 for light-duty vehicles, as given in table 1. Comparison with t[illegible] 2 indicates that vehicle production capacity is sufficient to meet demand until 1986 under favourable conditions and since capital investment for vehicle production (excluding engines and transmissions) is not substantial, it has been assumed that vehicle production capacity will be expanded when needed and will not constitute a constraint on demand of diesel engines. Under minimum demand conditions, expansion may not be needed. (Ref Table 3)

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TABLE: 1

PRODUCTION CAPACITY FOR LIGHT-DUTY VEHICLES

FIRM	INSTALLED CAPACITY		
	MINIBUS	PICK - UP	TOTAL
OTOSAN	5.000	7.000	12.000
CHRYSLER	-	6.000	6.000
BMC	-	5.000	5.000
TOE	1.000	2.000	3.000
ÇELİK MONTAJ	-	4.000	4.000
ÇİFTÇİLER	-	6.000	6.000
OTOBOS KAROSERİ	1.000	-	1.000
KARSAN	3.500	-	3.500
	10.500	30.000	40.500

Source : Ministry of Industry and Technology

TABLE: 2

ANTICIPATED DEMAND AND SUPPLY FOR LIGHT - DUTY ENGINES (FAVOURABLE CONDITIONS)

YEARS	DEMAND (Units per year)			Vehicle Production Capacity (Minibus pick-up) see table 1	ENGINE MANUFACTURING CAPACITY				PLANNED PRODUCTION OF ENGINES			
	DOMESTIC	EXPORT	TOTAL		Existing (BMC)	Planned (OTOSAN) xx	Recomm. for TOMOSAN	TOTAL	Existing (BMC)	Planned (OTOSAN) xx, xxx	Planned TOMOSAN	TOTAL
1983	22.910	2.290	25.200	40.500	6.000	10.000	-	16.000	2.750	4.000	-	6.750
1984	28.733	2.870	31.603	40.500	6.000	10.000	20.000	36.000	3.500	6.000	5.000	14.500
1985	35.943	3.595	39.538	40.500	6.000	10.000	20.000	36.000	4.250	7.500	10.000	21.750
1986	47.776	4.780	52.556	40.500[x]	6.000	10.000	20.000	36.000	5.000	10.000	15.000	30.000
1987	54.797	5.480	60.277	40.500[x]	6.000	10.000	20.000	36.000	5.250	10.000	20.000	35.250
1988	60.219	6.020	66.239	40.500[x]	6.000	10.000	20.000	36.000	6.000	10.000	20.000	36.000
1989	60.017	6.000	66.017	40.500[x]	6.000	10.000	20.000	36.000	6.000	10.000	20.000	36.000
1990	60.881	6.090	66.971	40.500[x]	6.000	10.000	20.000	36.000	6.000	10.000	20.000	36.000
Avg(1983-86)	33.841	3.384	37.225	40.500	6.000	10.000	15.000	31.000	3.875	6.875	10.000	20.750
Avg(1987-90)	58.993	5.900	64.893	40.500	6.000	10.000	20.000	36.000	5.813	10.000	20.000	35.813
Avg(1983-90)	46.418	4.642	51.060	40.500	6.000	10.000	17.500	33.500	4.844	8.438	15.000	28.282

x Capital investment for vehicle production (excluding engines and transmissions) is not substantial and its expansion therefore is not likely to be a constraint on demand.

xx Gasoline engines. Total installed capacity will be 20.000. Figures show anticipated application for light-duty pick-ups and minibuses after allowing 10.000 units for passenger cars.

xxx Light-duty applications was taken as one half of total production planned, the remaining half being for passenger cars.

TABLE: 3
ANTICIPATED DEMAND AND SUPPLY FOR LIGHT - DUTY ENGINES (MINIMUM DEMAND CONDITIONS)

YEARS	DEMAND (Units per year) DOMESTIC	EXPORT	TOTAL	Vehicle Production Capacity (Minibus pick-up) see table 1	ENGINE MANUFACTURING CAPACITY Existing (BMC)	Planned OTOSAN xx	Recomm. for TOMOSAN	TOTAL	PLANNED PRODUCTION OF ENGINES Existing (BMC)	Planned (OTOSAN) xx, xxx	Planned TOMOSAN	TOTAL
1983	22.132	2.210	24.342	40.500	6.000	10.000	-	16.000	2.750	4.000	-	6.750
1984	25.656	2.560	28.216	40.500	6.000	10.000	20.000	36.000	3.500	6.000	5.000	14.500
1985	30.003	3.000	33.003	40.500	6.000	10.000	20.000	36.000	4.250	7.500	10.000	21.750
1986	35.675	3.570	39.245	40.500	6.000	10.000	20.000	36.000	5.000	10.000	15.000	30.000
1987	40.442	4.040	44.482	40.500[x]	6.000	10.000	20.000	36.000	5.250	10.000	20.000	35.250
1988	43.269	4.325	47.594	40.500[x]	6.000	10.000	20.000	36.000	6.000	10.000	20.000	36.000
1989	40.171	4.020	44.191	40.500[x]	6.000	10.000	20.000	36.000	6.000	10.000	20.000	36.000
1990	37.601	3.760	41.361	40.500[x]	6.000	10.000	20.000	36.000	6.000	10.000	20.000	36.000
Avg(1983-86)	28.368	2.835	31.203	40.500	6.000	10.000	5.000	31.000	3.875	6.875	10.000	20.750
Avg(1987-90)	40.371	4.036	44.407	40.500	6.000	10.000	20.000	36.000	5.813	10.000	20.000	35.813
Avg(1983-90)	34.370	3.436	37.805	40.500	6.000	10.000	20.000	33.500	4.844	8.438	15.000	28.282

x Note: Capital investment for vehicle production (excluding engines and transmissions) is not substantial and its expansion therefore is not likely to be a constraint on demand.

xx Gasoline engines. Total installed capacity will be 20.000, Figures show anticipated application for light duty pick-ups and minibuses after allowing 10 000 units for passenger cars.

xxx Light- duty application was taken as one half of total production planned, the remaining half being for passenger cars.

5.1.2 Engine Production

5.1.2.1 Minibuses of local manufacture are powered by gasoline engines. Only one manufacturer (Otokar) uses diesel engines, but two new diesel models have recently been introduced to the market by TOE and Karsan. TOE works in collaboration with International Harvester and Karsan with Peugeot. Pick-up situation is similar in that although two manufacturers have diesel models (BMC and TOE), a very large percentage in the market still has gasoline engines. Developments in local market and trends in world automotive industry indicate, however, that diesel powered vehicles are preferred for commercial vehicles because of lower running costs including fuel economy. Hence if diesel engines become locally available, they are expected to sell well. It is assumed that local manufacture will meet quality, cost and delivery requirements of vehicle manufacturers.

5.1.2.2 Vehicle manufacturers using gasoline engines assemble their own engine from CKD and bought-out parts procured from sub-suppliers. But, because each manufacturer requires only a small number of engines, modern production facilities are not available and main components have to be imported consuming large sums of foreign currency. Situation with diesel engine users is much the same

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except BMC firm which has attained a fair degree of localisation. BMC is expected to reach a capacity of 12 000 nos p.a. of 52 HP engines by 1988, [illegible]d of this it is presumed that 6000 will be for tractors and balance 6000 for their [illegible]ck-up production. Annual anticipated production is shown on Table 4.

5.1.2.3 A new manufacturer of 65 HP light-duty gasoline engines (Otosan) is reported to be inves[illegible] st[illegible] production in 1983 for an installed capacity of 20 000 engines per annum expected to be reached by 1986. It is understood from SPO, that in addition they are expected to produce 12 000 numbers p.a. of medium duty diesel engines of 110 HP. Annual anticipated producti[illegible]n is shown on Table 4.

5.1.2.4 TUMOSAN:

From comparison of demand and supply, an initial capacity of 20 000 per annum was recommended for Tumosan. As is seen from table 2, when this capacity is created by Tumosan, installed capacity for light-duty engines will reach a total of 36 000 and will be able to meet demand until 1986. From 1986 onwards, both engine production capacity and vehicle production capacity will need to be expanded to meet anticipated increases in demand and Tumosan was therefore recommended to examine expansion plans in 1986 in accordance with development in the market.

5.1.2.5 Table 3 shows anticipated demand and supply under minimum demand conditions. Comparison of planned production of engines with

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TABLE 4

PRODUCTION PLANS OF ENGINES BY BMC, TOTOSAN AND MAN

(Provided by SPO - Incentives Department)

YEARS	B M C				OTOSAN		M A N	
	52HP[x]	75HP[xx]	120 HP	145HP	65-78HP[xxx]	110 HP	180-220HP	240-350HP
1981	3.312	161	1.800	400	-	-	-	-
1982	4.000	200	2.500	500	2.000	2.000	-	-
1983	5.500	300	3.200	800	8.000	6.000	-	-
1984	7.000	400	4.000	1.500	12.000	7.000	2.130	1.270
1985	8.500	500	5.000	2.000	15.000	8.000	2.800	1.700
1986	10.000	600	5.200	2.800	20.000	10.000	3.350	1.950
1987	11.000	700	5.500	3.500	20.000	12.000	3.300	3.[illegible]0
1988	12.000	700	5.500	3.800	20.000	12.000	3.250	3.450
1989	12.000	800	5.200	4.000	20.000	12.000	3.150	3.[illegible]0
1990	12.000	800	5.000	4.200	20.000	12.000	3.050	3.950

x Figures show total production planned. Light-duty applications are expected to make up one half of total production ,the remaining half being for Leyland tractors on which a version of this engine is used.

xx Possibly intended for such stationary applications as air-compressors and similar machinery not taken into account in forecasting demand.

xxx Gasoline engines. One half of total production is intended for light-duty applications, the remaining half being for passenger cars.

demand shows that there is no danger of underutilisation of capacity even under very unfavourable market forces. It is to be noted, however, that expansion plans of Tumosan, foreseen for the year 1986, should need to be changed from the originally planned 40 000 per annum capacity to 30 000 in this case of unfavourable market forces until 1990s.

5.2 MEDIUM DUTY ENGINES FOR AUTOMOTIVE VEHICLES (85-170 HP)

5.2.1 Vehicle Production

There are presently nine firms that manufacture medium-duty vehicles, table 5. Installed capacity for the production of trucks (seven firms) is 35 250, for buses (three firms) 2000 and for minibuses 1800. Construction machinery are not yet produced in Turkey, but MF IK has undertaken to set up a plant to manufacture them for the time being a capacity of 470 units per annum has been assumed, thus making a total installed capacity of 39 520 vehicles per annum for medium-duty applications.

5.2.2 Engine Production

5.2.2.1 There is only one manufacturer of truck diesel engines and this firm, BMC, has attained a fair degree of integration in this field. The engines produced are licensed by BMC (now

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TABLE: 5

PRODUCTION CAPACITIES FOR TRUCKS AND BUSES

FIRM	TRUCK PRODUCT. CAPACITY	BUSES			TOTAL
		BUS AND COACH	MIDIBUS	TOTAL	
BMC	9.000	-	-	-	9.000
CHRYSLER	3.000	-	-	-	3.000
GENOTO	6.000	-	-	-	6.000
MAN	2.250	500	-	500	2.750
OTOKAR	-	200	300	500	500
OTOMARSAN	-	1.300	800	2.100	2.100
OTOSAN	7.000	-	-	-	7.000
OTOYOL	4.000	-	700	700	4.700
TOE	4.000	-	-	-	4.000
	35.250	2.000	1.800	3.800	39.050

NOTE: MKE plans to set up a plant of 470 units pa capacity for the manufacture of construction machinery

Source: Ministry of Industry and Technology

British Leyland) and the firm rates its capacity at 9 000 units per annum made up of 4200 of 145 HP,and 5000 of 120HP. In addition the firm has a capacity for 800 nos. of 75 HP(possibly for miscellanous stationary applications). Actual production reached in 1976 was about 5000.This firm uses 120 and 145 HP engines on TM 140 trucks of their own production,hence the availability of the engine to other possible users is limited. Details are in Table 4.

5.2.2.2. All truck manufacturers,except BMC,used to import their engines in CBU form until recently. The government brought restrictions on imports from 1979 onwards and since then truck manufacturers can only import KD and assemble their own engines from these components and bought-out parts. As the number of engines required by each manufacturer is too low to justify investment for engines,the local content ratios are very low.

5.2.2.3. One truck manufacturer (Otosan) is reported to be investing for a separate engine plant at Inonu (Eskisehir). It is understood that the plant is to have an installed capacity of 12 000 diesel engines of 110 HP per annum. As this firm (Otosan) also manufactures trucks (Ford D 1210) it was assumed that all engines are intended for their own truck production plant and it was further assumed that this firm will increase truck production capacity from the present level of 7000 to 12 000 to match the engine capacity planned.

5.2.2.4 Existing (BMC, 9200) and planned (Otosan,12000) diesel engine production capacity thus adds up to 21 200.

5.2.2.5 TUMOSAN

Tumosan has been recommended to go ahead with its project to ultimately produce 24 000 engines a year subject to the following modifications:

i- It should manufacture in the first instance only a 130 HP engine and go into the question of manufacture of other engines after detailed market investigations which may be taken up in 1984-1985.

ii- The actual purchase of machinery and plant must be phased to suit actual requirements. While one each of the special purpose machinery and assembly of engines will be necessary, a close look at all general purpose machines where the requirements are for more than one should be undertaken to ensure optimum utilisation of all assets.

5.2.2.6 Table 6 shows anticipated demand and supply,including the 24 000 capacity to be created by Tumosan. It is seen that existing vehicle production capacity will be sufficient to meet demand until 1987 and since capital investment for vehicle production is not substantial,its expansion is unlikely to be a constraint on demand.

TABLE : 6

ANTICIPATED DEMAND AND SUPPLY FOR MEDIUM-DUTY DIESEL ENGINES (FAVOURABLE CONDITIONS)

YEARS	DEMAND (Units per year) DOMESTIC	EXPORT	TOTAL	Vehicle Production Capacity (Minibus pick-up) see table 5	ENGINE MANUFACTURING CAPACITY Existing BMC	Planned OTOSAN	Recomm. for TOMOSAN	TOTAL	PLANNED PRODUCTION OF ENGINES Existing BMC xx	Planned OTOSAN xxx	Planned TOMOSAN	TOTAL
1983	17.571	1.760	19.331	39.520	9.200	12.000	24.000	45.200	4.000	6.000	4.800	14.800
1984	21.678	2.170	23.848	39.520	9.200	12.000	24.000	45.200	5.500	7.000	8.000	20.500
1985	26.765	2.680	28.935	39.520	9.200	12.000	24.000	45.200	7.000	8.000	16.000	31.000
1986	33.794	3.380	37.174	39.520	9.200	12.000	24.000	45.200	8.000	10.000	21.400	39.400
1987	38.743	3.870	42.613	39.520[x]	9.200	12.000	24.000	45.200	9.000	12.000	24.000	45.000
1988	43.313	4.330	47.643	39.520[x]	9.200	12.000	24.000	45.200	9.300	12.000	24.000	45.300
1989	44.637	4.460	49.097	39.520[x]	9.200	12.000	24.000	45.200	9.200	12.000	24.000	45.200
1990	44.736	4.470	49.206	39.520[x]	9.200	12.000	24.000	45.200	9.200	12.000	24.000	45.200
Avg(1983-86)	24.953	2.498	27.451	39.520	9.200	12.000	24.000	45.200	6.125	7.750	12.550	26.445
Avg(1987-90)	42.857	4.282	47.139	39.520	9.200	12.000	24.000	45.200	9.175	12.000	24.000	45.175
Avg(1983-90)	33.906	3.390	37.296	39.520	9.200	12.000	24.000	45.200	7.650	9.875	18.275	35.800

x Capital investment for vehicle production (excluding engines and transmissions) is not substantial and it s expansion is not likely to be a constraint on demand.

xx 120 and 145 HP engines from table 4.

xxx Figures taken from table 4.

5.2.2.7 Planned production of engines matches anticipated demand until 1988 and extrapolated demand for the period 1988-1990 (about 3000 per annum) can be met by overtime working should the manufacturers be able to fully utilize their capacity.

5.2.2.8 Pattern of demand and [illegible] is shown in table 7. It is to be noted that under these conditions vehicle production capacity and planned production of engines may be in excess of demand. However, the possible non-civilian use for Tumosan engines not taken into account in demand estimates (since EMC and Otosan engines are not suitable for non-civilian uses), may increase [illegible] Tumosan.

5.2.2.9 It is understood that a joint sector project for medium diesel engines is also under consideration. Prospects for these two in the context of limited unmet demand have been dealt with in chapter VI-Policy Consideration(paragraph 6.2)

5.3 HEAVY-DUTY ENGINES

5.3.1 Heavy-duty engines used for truck-tractors, construction machinery, power generators and for marine applications are not produced in Turkey. All demand is met by imports.

TABLE

ANTICIPATED DEMAND AND SUPPLY FOR MEDIUM-DUTY DIESEL ENGINES (MINIMUM DEMAND COND.)

YEARS	DEMAND (Units per year) DOMESTIC	EXPORT	TOTAL	Vehicle Production Capacity (Minibus, pick-up) see table 5	ENGINE MANUFACTURING CAPACITY Existing BMC	Planned (OTOSAN)	Recomm. for TOMOSAN	TOTAL	PLANNED PRODUCTION OF ENGINES Existing BMC x	Planned OTOSAN xx	Planned TOMOSAN	TOTAL
1983	16.256	1.625	17.881	39.520	9.200	12.000	24.000	45.200	4.000	6.000	4.800	14.800
1984	18.749	1.875	20.624	39.520	9.200	12.000	24.000	45.200	5.500	7.000	8.000	20.500
1985	21.926	2.193	24.119	39.520	9.200	12.000	24.000	45.200	7.000	8.000	16.000	31.000
1986	24.984	2.498	27.482	39.520	9.200	12.000	24.000	45.200	8.000	10.000	21.400	39.400
1987	28.744	2.875	31.619	39.520	9.200	12.000	24.000	45.200	9.200	12.000	24.000	45.000
1988	31.987	3.199	35.186	39.520	9.200	12.000	24.000	45.200	9.200	12.000	24.000	45.300
1989	31.847	3.185	35.032	39.520	9.200	12.000	24.000	45.200	9.200	12.000	24.000	45.200
1990	30.326	3.033	33.359	39.520	9.200	12.000	24.000	45.200	9.200	12.000	24.000	45.200
Avg(1983-86)	20.478	2.048	22.526	39.520	9.200	12.000	24.000	45.200	6.125	7.750	12.550	26.445
Avg(1987-90)	30.727	3.073	33.800	39.520	9.200	12.000	24.000	45.200	9.175	12.000	24.000	45.175
Avg(1983-90)	25.604	2.561	28.165	39.520	9.200	12.000	24.000	45.200	7.650	9.875	18.275	35.800

x 120 and 145 HP engines from table 4.

xx Figures taken from table 4.

5.3.2 There are two projects for the production of heavy-duty engines above 190 HP. One is planned by Tumosan in Aksaray (Nigde) integrated plant and the other is by Ercan Holding A.Ş., in which MAN of West Germany are reported to be participating with a 35% foreign equity.

5.3.3 Tumosan has a license agreement with Volvo of Sweden, and intends to manufacture these engires in the building erected for medium-duty engines in Aksaray site. Preliminary engineering work is completed but no machinery has yet been bought.

5.3.4 MAN project of Ercan Holding foresees an initial capacity of 7000 engines pa and the plant is to be located within provincial boundaries of Ankara. The project has been issued with an incentive certificate and this certificate stipulates the investment to start in first half of 1981 and plant fully commissioned by the end of 1983. The engines to be produced are in 180-350 HP (D 25 series of MAN) and the project foresees bus and heavy-trucks as main field of applications for the engines. The anticipated production year by year by MAN is shown on Table 4.

5.3.5 Market estimates of Ercan Holding as 3191 units in 1980 and increasing nearly four-fold to 11 377 in 1986 are unrealistic, apparently based on a GNP growth rate of 7% pa are likely to be too high. Earlier estimates of Desiyab (App.17) which predicts an average market of 3665 engines pa for the period 1983-86 could better represent the size of this

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market. Neither estimate however has looked at the saturation point when the demand will be principally for replacement.

5.3.6. The size of heavy-duty engine market does not allow two engine manufacturers to operate on internationally competitive and economic production levels. This would mean that only one of the projects should be allowed.

5.4 TRACTORS AND TRACTOR ENGINES

5.4.1. Tractors

5.4.1.1. The level of integration in the present tractor industry appears to be extremely low: number of manufacturers and models are too many and the production level of many of the manufacturers are too low to permit economical manufacture. Degree of integration varies greatly among manufacturers: Only three of the present producers (Turk Traktor, B.C and TOE) have attained a degree of integration and a fourth, Burtrak, is understood to be investing. All other producers are "assemblers" with almost no degree of integration, and hence heavily dependent on the availability of foreign exchange of CKD.

5.4.1.2. The total installed capacity reported, 122 500, is supported by neither the level of production reached (max 37 453 in 1976 when installed capacity was 44 900) nor the expansion of rated capacities by a relative growth in the degree of integration of the manufacturing

facilities. Total installed capacity (including Burtrak) for transmissions appears to be between 43 000-60 000 pa* and it is understood that Hema plant in Polatli will be able to supply gears and shafts to the same extent. Except BMC, there is almost no engine manufacturing facilities** and the production level of each manufacturer is too low to enable them to set up their own units. The total capacity reported, 122 500, is essentially the capacity to assemble tractors when parts/components/ semicomplete units are available. It appears that matching capacities for pressing, and semicomplete units are also not available. This adds to the imbalance in this industry.

5.4.2. Tractor engines

5.4.2.1 The present practice of each manufacturer assembling its own engine from CKD and some locally manufactured parts (mainly from sub-suppliers) is uneconomical. Types of engines should be reduced. For this purpose, the engines manufactured in Konya by Tumosan should be fully utilized. It is understood that Tumosan started engine assembly in March 1981 on a 50 000 pa capacity assembly line and is considering expansion to 100 000 pa. Expansion plans of Tumosan should however be closely monitored to ensure that they match the development of tractor demand.

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* Assuming production facilities of firms involved are matched with the assembly capacities reported.

** BMC uses engine of own manufacture, 30 HP, 6000 pa. Iltor uses locally manufactured small engine (about 10 HP).

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5.4.3. TUMOSAN PROJECT FOR TRACTORS AND TRACTOR ENGINES

5.4.3.1. In the interest of economical manufacture of engines, the initial capacity of [illegible] appears to be justified. However, their absorption in the market will depend on the acceptability of engines by other tractor manufacturers and this is an issue which, beside aspects of price and delivery, will involve consideration of commitments with licensors and technical/economical feasibility of the adaptation of these engines to their tractor designs. The restructuring of the tractor industry, which is badly needed, is dependent on economical manufacture and maximum standardisation of main parts. Tumosan plan looked at with this background and subject to successful negotiations with other tractor assembler/manufacturers should, for the time being be limited to

25 000 tractors in 2 shifts and
50 000 tractor engines in 2 shifts

5.4.3.2. With the above background table 8 shows the number of Tumosan engines that is expected to be available to other tractor manufacturers. It will be seen that in 1982,83 84 and 85, the engines manufactured will be just sufficient for Tumosan and Turk Traktor.

ANNEX: 8

AVAILABILITY OF TÜMOSAN TRACTOR ENGINES BY TÜMOSAN AND OTHER MANUFACTURERS TILL 1986

Year	Number of Engines Produced by TÜMOSAN	Number of Tractors Planned by TÜMOSAN	Number of Tractors Available	Remarks
1983	15.000	7.000	11.000	Just sufficient for Turk tractors.
1984	25.000	8.000	[illegible]	" "
1985	25.000	11.000	[illegible]	" "
1985	39.500	15.600	2 .900	" "
1986	58 000	19.400	38.6 [illegible]	[illegible] available [illegible]

5.4.3 Some engines may be available for adapted use in 1985 depending on the production programme of Türk Traktor (capacity 22 500 tractors per annum), but real availability will come in 1986 when Tumosan's engine production can rise to [illegible] with overtime working. Since total tractor demand in 1986 is estimated to be between 54 000 and 62 000 (see App. 18), it would appear that Tumosan will be able to provide all the engines needed. It is presumed that there are no other plans for the manufacture of tractor engines in Turkey and hence from 1986 onwards Tumosan should plan engine production so as to meet the requirements of all tractor manufacturers.

CHAPTER VI

POLICY CONSIDERATIONS

6.1 GOVERNMENT POLICY FOR AUTOMOTIVE SECTOR

6.1.1 Local manufacture of engines and transmissions, first foreseen in the second five-year development plan (1967-72), has been occupying a prominent place in the development strategy of Turkey for the last fifteen years. The third and fourth plans assigned the task of leading the development of this sector to state enterprises.

6.1.2 Production of engines and transmissions, aimed at integral manufacture of vehicles and tractors in Turkey, is supported by several factors:

i-It would enhance the value added and promote real technological growth both of which are low in the case of an assembly industry dependent on large scale imports

ii-The domestic market together with potential exports (estimated at 10% of local market) can support plants of economic sizes.

iii-These industries are rich in "external economies" in that the technical and management skills required by sub-suppliers would be an asset in developing other engineering industries.

iv- Export potential created by integrated production of

trucks and tractors would more than offset the cost of imports and hence make this sector self-sufficient in foreign currency developing into a net export earner.

6.3.1 While financial constraints have come in the way of physical realisation of the Tumosan projects originally conceived, today there are two factors which have emerged on the scene and are relevant to the future of Tumosan projects and indeed the future of diesel engine industry in Turkey. These are:

i- There is a downward revision of total demand for the types of engines envisaged by Tumosan and

ii- Private sector has shown interest and has produced plans to step in to augment capacity for engine manufacture in Turkey.

6.2 MASTER PLAN FOR DIESEL ENGINE INDUSTRY

6.2.1 In order to take an objective look at the totality of demand and capacity for diesel engines, an integrated chart has been prepared with the help of SPO (Tesvik ve Uygulama Dairesi) Table 9.

6.2.2 It will be noted from this that

i- There is a substantial demand for tractor engines (estimated at a level between 65 000 and 85 000 in the year 1990) to justify the speedy completion of Tumosan's project for tractor engines which as recommended in technical report no V, may be set up for 50 000 units pa in the first instance,

TABLE 9 MASTER PLAN FOR DIESEL ENGINE INDUSTRY IN [illegible] 1990

FIRMS	DEMAND / HP		TRACTOR ENGINES 1981	TRACTOR ENGINES 1983-86 (1)	TRACTOR ENGINES 1987-90 (2)	LIGHT-DUTY ENGINES 1981	LIGHT-DUTY ENGINES 1983-86	LIGHT-DUTY ENGINES 1987-90	MEDIUM-DUTY ENGINES 1981	MEDIUM-DUTY ENGINES 1983-86	MEDIUM-DUTY ENGINES 1987-90	HEAVY-DUTY ENGINES 1981	HEAVY-DUTY ENGINES 1983-86 (5)	HEAVY-DUTY ENGINES 1987-90 (6)	REMARKS
		MN.		56.[illegible]	65.113		31.203	44.407		22.526	33.800		3.667	4-.065	
		AV.		61.[illegible]	84.890		37.225	64.843		27.491	47.139				
	30	C	6.000	6.000	[illegible]										For tractors
		P	663 (5)	5.000	[illegible]										
	52	C				6.000	6.000	6.000							For [illegible]
		P				1.317 (5)	5.000	6.000							
[illegible]N	75	C							800	800	800				For stationary appl.
		P							161 (5)	600	800				
	125	C							5.000 (5)	5.000	5.000				For 8 ton trucks
		P							1.554	5.000	5.000				
	145	C							4.200 (5)	4.200	4.200				For 9 ton trucks
		P							677	2.[illegible]	4.200				
	550 (8)	C					10.000 G	10.000 G							For pick-ups and minibuses
SAN		P					10.000 G	10.000 G							
	110	C								12.000	12.000				For 8 ton trucks
		P								10.000	12.000				
	150-220	C											3.050 (7)	3.050 (7)	14 ton trucks, buses
[illegible]AN		P											3.350 (7)	3.050 (7)	
	240-350	C											3.950	3.950	truck tractors
		P											[illegible]	3.950	
	49-58	C		50.000	50.000										For tractors
	66-76	P		58.000	58.000										
[illegible]MOSAN	65-79	C					20.000	20.000							For pick-ups and minibuses trucks buses, midibuses
		P					15.000	20.000							
	85-168	C								24.000	[illegible]				
		P								21.000	24.000				
	250-350	C													
		P													
TOTAL		C	6.000	56.000	56.000		36.[illegible]	[illegible]		46.000	46.000		7.000	7.000	
		P	663	63.000	64.000		30.000	3[illegible]		40.000	46.000		5.300	7.000	

1) Average annual demand for 1982-[illegible] period
2) Average annual demand for 19[illegible] period
3) Including export demand at [illegible] maximum [illegible]
4) Excluding 15.000 gasoline [illegible] for [illegible] weight [illegible]
5) Figures from Ministry of [illegible] Roadways
6) Figures from Desivab study [illegible] new figures for [illegible] demand not fa[illegible] conditions not available
7) See comments in paras 6.2.

Abbreviations: C: Capacity planned or existing
P: Production planned
HP: Horse power
[illegible]

ii- Taking into account the anticipated capacity for light-duty diesel engines with BMC and that planned by Otosan, there is an ample justification for another plant with a capacity of 70 000 pa on two shift basis as recommended in the final report of VI.

iii- With projection of capacity for medium-duty engines as 12 000 (of 110 HP) planned by Otosan and 9200 existing with BMC (excluding 800 for stationary applications), unmet demand in 1990 is anticipated to be 13 000 under minimum demand conditions and 21 000 under favourable conditions. There is room for one more plant. For this plant to be economical and competitive in export markets, it could be a part of a larger diesel engine plant of 30-40 000 pa total capacity in which case additional investment will be mainly for tooling and auxilliary units will be shared.

It is understood that in addition to Tumosan Medium-Duty Engine Project, a joint sector project for medium-duty vehicles, trucks and buses in particular, is under consideration.

In the context of what is stated above, the Government should take a policy decision on implementing one of the following two alternatives:

Alt.1. The joint sector project to manufacture 10-15000 engines pa by 1990 and ALSO to achieve full

local integration by that time .

Alt.2. Tumosan to go ahead with its project for medium-duty engines but with following modifications:

i- initial capacity to be 12 000 pa.

ii- master plan to be raised at 24 000 pa

iii- full integration to be achieved by 1990

iv- poasible non-civilian uses should be taken into account.

For presentation purposes,master plan for diesel engine industry (table 9) shows only Tumosan capacity of 24 000pa.

iv. Total demand for heavy-duty engines is anticipated to reach a level of 4300 units pa by 1990 and hence there is room only for one manufacturer.Ercan Holding is entering this field with MAN project for engines of 180 HP and over. Initial capacity of 7000 units pa with provision to expand to 11000 selected for this project appears to be too high and a review of investment plans would be desirable.

6.2.3. The master plan in Table 9 is based on tractor engines being manufactured by two firms,light-and medium-duty diesel engines by three firms,and heavy-duty engines by one firm. These manufacturers should try and reach 100% local manufacture during the eighties, It is felt that it will not be necessary to give any more incentives for diesel engines. To ensure updated technology for design and manufacture. However the market should be kept open

to competition from foreign manufacturers.

6.3 DESIGN

Facilities for original design of diesel engines and their associated subsectors like transmissions are extremely limited in Turkey. It is considered crucial for a healthy growth of the industry that a strong cadre of design engineers be trained, Tumosan and other manufacturers, it is felt, should specifically be asked to make a plan of action for this activity in consultation with their collaborators.

6.4. ADAPTATION OF ENGINES

6.4.1 It is necessary to ensure that the present vehicle and tractor manufacturers who do not have capacity for engine manufacture get their supplies from a Turkish manufacturer.

6.4.2 Simultaneously it will have to be ensured that the engines made by local manufacturers can and will be fitted in a variety of vehicles and tractors and measures for adaptation by vehicle manufacturers will be essential.

6.4.3 While foreign exchange is being given to individual manufacturers to import CKD's of a number of models, the industry will have both immediate and long term economies if they use a standard engine even in the initial stages when the new unit will need to import CKD.

6.5. RESEARCH AND DEVELOPMENT

A national R and D organisation to handle problems of adaptation,

trial of new concepts and designs, follow up of international trends in designs and manufacturing technologies will be desirable, This could be done either as a wing of Vehicle Directorate of Armed Forces or of Tumosan.

6.6 STATEMENT OF POLICIES AND OBJECTIVES

In view of the [illegible] industrial picture of Turkey involving greater reliance on market forces it is necessary to identify the course that should be followed in years to come by Tumosan as well as their relationship with principal users particularly from the point of view of suitability and adaptation of former's products by the latter. A clear statement of Government's directives will help the industry to go forward in an organised manner and avoid serious slippages in the programmes aimed for self reliance in this sector.

CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY

CHAPTER VII

LICENCE AGREEMENTS

7.1 An initial study has been made by Chief Technical Adviser with foreign collaborators in the context of the need by Turkish industry to protect own interests to the extent possible while negotiating these agreements. A broad outline of salient points that may be borne in mind is given in succeeding paras. It is relevant to point out that some of these points are already covered in agreements but to varying degree of effectiveness - the final clauses being dependent considerably on negotiating strengths of both parties:

7.2 JUSTIFICATION

7.2.1 The license proposal must justify the appropriateness of technology proposed to be acquired with specific reference to technology already available in the country. This should cover:

(i) a comparative analysis of alternative technologies,
(ii) justification for the technology recommended,
(iii) domestic market forecasts,
(iv) export forecasts,
(v) obligations of licensors for economical manufacture of a saleable product,
(vi) limitations/constraints (eg. availability of aid from a country) which inhibit a wide choice.

7.3 PRODUCTS

7.3.1. The agreements should cover the possibility of manufacture of other products made by the licensor or products licensed by other licensors.

7.3.2. There should be no restriction in the application or uses to which the licensed products can be put.

7.3.3. Products should be clearly defined including major specifications.

7.4 UPDATING OF KNOW-HOW

7.4.1 The licensee should have full rights over design improvements made by it and should be in a positions to obtain patents world-wide. The licensor should be obliged to check them and comment on them if desired by the licensee and grant a sublicense to the licensor on a royalty free basis during the term of the agreement.

7.4.2 The licensor must guarantee to inform the licensee of all improvements made in design or production technology including patented and unpatented techniques,within 3 months of their being adopted in the licensor's works during the pendency of the agreement.

7.4.3 The licensor must guarantee that the design and production technology offered to the licensee includes the latest in use by the licensor himself and his associates,the choice of designs and production technology to be licensed being left to the licensee. The data to be provided by licensor should include a comparative analysis with at least 2-3 world-renowned competitors.

7.5 DOCUMENTATION

7.5.1 Production technology documentation to be supplied by licensor will include

(i) Production norms for all components,subassemblies and assemblies in terms of machine-hours and man-hours with details of their calculation

(ii) Manufacturing drawings of dies,tools,jigs and fixtures.

7.5.2 Product documentation will include besides detailed designs complete calculations for design of product as well as individual components,

designed by the licensor or his associates.

7.5.3 Industrial engineering documentation will include basic data for compilation of production norms for all equipment used for production of licensed items in the licensor's works.

7.6. EXPORT

7.6.1 The licensee should have the right to export specifically to all Middle East and other Islamic countries and as far as possible to other developing countries.

7.6.2 If possible there should be an arrangement for the licensor to buy back licensed products from Turkish firms at international prices.

7.7. PATENTS AND TRADE MARKS

7.7.1 The licensor should provide all legal data to support the validity of patents and trade marks.

7.7.2 The licensee should have the right to use the trademarks of the licensor, if he so chooses. Any payment for this if desired by licensor should be saparately spelt out.

7.8 GUARANTEES

7.8.1 The licensor must guarantee that

(a) technology supplied is suitable for the products covered,

(b) it will enable the licensee to reach the specified level of production,

(c) documentation is full and complete, and

(d) the time schedule agreed for documentation will be adhered to.

7.9. EXCLUSIVITY

7.9.1. The licensor should have the right to transfer the technology or know-how to others in the country.

7.10. ASSIGNATION AND SUB-LICENCING

7.10.1. The licensee should be able to assign the agreement to other parties if required by Government decree or in other cases with agreement of licensor.

7.10.2. The licensee should have the right to sublicense to other firms in the country with the licensor being kept informed about sublicensors.

7.11. PHASING AND ITS MONITORING

7.11.1. The phasing of the transfer of manufacturing technology must be so done as to minimise the period of dependence for processed materials, intermediate products and components - (The licensor's aim is to stretch it over as long a period as possible). An agreed PERT network for all aspects of transfer of technology for monitoring it should be appended to the agreement.

7.12. SUPPLY OF RAW MATERIALS AND COMPONENTS

7.12.1. The licensor should be obliged to offer raw materials and other purchased components and patented items necessary to be imported for manufacture of licensed goods. The licensee would however be free to order them either from the licensor or obtain them directly on his own.

7.13. PAYMENTS

7.13.1. Royalties are meant to reflect the value of input of the licensor to the licensee and should cover specifically only the technology that the licensee is acquiring.

7.13.2. If possible the know-how fees should be converted into equity holdings upto specified limits,not exceeding 10%.

7.13.3. Payments should be specified in terms of

(i) lump sum fees if any

(ii) running royalties

(iii) total fixed fee

(iv) payments for technical services.

7.13.4. The basis of these payments should be based on sales (and not production) excluding value of imports from licensor. They should be indicated separately for various items such as

Feasibility studies

Detailed project reports

Plant design

Assistance in securing, installation and start up of machinary and plant

Trainig programmes

Special design work

Technical experts from licensor.

7.14. TRAINIG

7.14.1. The visits of licensors personnel to Turkey should be specific objectives and time bound programmes and for agreed periods which should be minimum. The licensor should satisfy the licensee that any experts sent by the former answer job description which have been approved by the licensee.

7.14.2 The training in licensor's works must cover all facilities into design, planning and control, industrial engineering, production, maintenance and should be free of charge. The number of experts and their period of training should be specified.

7.14.3. The duration should be as short as possible taking into account the time for absorption of technology.

7.15. OTHER RESTRICTIONS

7.15.1. There should be no restriction on volume of production.

7.15.2. There should be no restriction on

(i) sales (except as specifically agreed),

(ii) production,

(iii) pricing,

(iv) obtaining know-how from others

(v) purchase of materials and components from others.

7.16. OTHER DESIRABLE CLAUSE

7.16.1 There should be a clause for renewal of the agreement at the option of both licensor and licensee.

7.16.2. Effort should be made to include a 'most-favoured-licensee' clause.

CHAPTER VIII

CONCLUSIONS AND RECOMMENDATIONS

8.1. CONCLUSIONS

8.1.1. Domestic Demand Levels

8.1.1.1. Diesel engines are used primarily on agricultural tractors and on commercial vehicles including pick-ups, minibuses, midibuses, buses, trucks and all types of heavy trucks. There are, in addition, a number of peripheral uses among which the more important are marine vehicles, construction machinery and stationary applications in power generators and water pumps.

8.1.1.2. Renewed forecasts for diesel engines (greater than 50 HP) indicate that total domestic demand will be at an average level of 120.000 per annum in the 1983-86 period

and will rise to above 130.000 by 1990, Table 10. Farm tractor applications are expected to provide the largest field of use and make up over 40% of total demand. Next in importance come light duty and medium-duty commercial vehicles with approximately 30 and 20% market shares, respectively. Heavy-duty engine demand is only about 4000 per annum. But they represent a much larger percentage in terms of value and are comparable in market share to light and medium-duty engines.

8.1.1.3. This level of domestic demand is sufficient for local manufacture on an economical and internationally competitive basis. In this context it is important to bear in mind that manufacture implies nearly 100% level of integration with all major components produced in Turkey and needs to be clearly distinguished from assembly which gives low added value.

TABLE 10 : AVERAGE ANNUAL DOMESTIC DEMAND FOR DIESEL ENGINES

	MINIMUM DEMAND CONDITIONS		FAVOURABLE CONDITIONS	
APPLICATION	1983-86 period	1987 - 90 period	1983 - 86 Period	1987 - 90 period
LIGHT-DUTY VEHICLES (60-80 HP)	28.368	40.371	35.760	62.911
MEDIUM-DUTY VEHICLES (80-210 HP)	20.478	30.727	24.952	42.858
HEAVY-DUTY VEHICLES[x] (220-350 HP)	3.665	4.305	3.665	4.305
TRACTORS (49-100 HP)	51.361	59.134	56.080	77.174
TOTAL	103.872	134.537	120.457	187.248

x These figures were taken from Desiyab study (1977).

8.1.2. Vehicle and Tractor Manufacturing Industries

8.1.2.1. Vehicle manufacturing in Turkey, which started as an assembly industry in early 1960's, has developed over the years to a stage where it new meets local demand in almost all types of vehicles from small pick-ups to buses and heavy lorries. The only important exception is truck-tractors for articulated lorries. This industry has also shown a certain potential for exports in the past two years, specially in the field of coaches.

However, the number of firms involved is too many (8 firms manufacture light-duty vehicles, 9 firms trucks and buses, and 2 firms heavy trucks, and all being private firms) and this inhibits economical production. This and the high cost of investment on capacity for engines, gearboxes and rear axles has prevented manufacturers from investing into this field. Accordingly, facilities available for manufacturing engines, gearboxes and rear axles are very limited, making this sector heavily dependent on imports of complete units

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or components. As a result, the automotive industry is still an assembly industry in character, productivity is low, capacity utilisation is also low and consequently prices are much higher than European prices for similar vehicles.

8.1.2.2. This low degree of integration is also observed in the tractor industry in which currently eight firms (7 private, 1 government firm) operate. The total installed capacity is reported as 122.500 but actual production has been far short of this figure. An equally critical aspect is that of the degree of integration in manufacturing facilities which varies greatly among manufacturers. Only three of the present producers have attained a fair degree of integration (total capacity 39.500), and a fourth is understood to be investing. All others are "assemblers" with almost no degree of integration, and hence heavily dependent on the availability of foreign exchange for CKD's.

8.1.2.3. This structure of the vehicle and tractor sectors has affected the development of ancilliary industries which could improve in specialisation as well as realize economies of scale.

8.1.3. Diesel Engine Manufacturing Industry

8.1.3.1. Engine manufacturing facilities have high capital costs and would be uneconomical on scales required by individual vehicle manufacturers. Government regulations have allowed import of complete units (considerably cheaper than local production in initial stages) until recently and such import is still permitted for bus applications. Imposition of restrictions on the import of CBU engines (and transmissions) in 1979, however, led to each manufacturer setting up assembly facilities for their own engines. As a result now almost all commercial vehicle manufacturers assemble their own engines from CKD and/some parts made locally in sub-supplier industries. The local content ratio of engines so assembled is low and what is more, it cannot be increased above about 50% . This is because in-plant production is required for higher local content ratios and, as pointed out above,

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tr[illegible] requires inv[illegible]ment seemingly beyond the capabilities of individual firms.

8.1.3.2. There is only one vehi[illegible] manufacturing diesel engines. This firm, BMC, has reached a fair degree of integration and reports engine capacity at 32.000 units per annum. Out of this capacity 12.000 units are for 52 HP engines(6000 for tractors and 6000 for pick-ups), 800 units for 75 HP engines (for [illegible] and miscellaneous applications) and 9200 units for [illegible] 145 HP engines (for trucks). Actual production [illegible] of the firm, however, has been low. and the highest level reached in 1976 was around 50% of this installed capacity.

Engines manufactured by BMC are installed onto their own produce of trucks, tractors and pick-ups and hence their availability to other vehicle firms is very limited.

8.1.4. Engine Projects in Private Sector

8.1.4.1. It is understood from SPO that two private firms have been issued with incentive certificates to manufacture engines. One of these, Otosan, belongs to KOÇ Group

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... plans 20.000 gasoline engines (65-78 HP) and 12000 diesel engines (110 HP) in İnönü, Eskişehir. This firm cooperates with Ford and has its own vehicle manufacturing facilities and it is anticipated that the diesel engines are for use on their 8-ton trucks (Ford D 1210). Out of the 20.000 gasoline engines planned it is supposed that 10.000 are for their Anadol passenger car (not considered in this study) and 10000 for light-duty applications in pick-ups and minibuses. The other firm MAN belongs to Ercan Holding and is understood to be interested in heavy-duty engines of 180-350 HP range. (This firm collaborates with MAN of West Germany and the foreign collaborator is understood to be considering providing foreign equity). The tentative capacity figure of this firm is 7000 units per annum. Otosan plans to start production in 1982 and MAN in 1984.

8.1.4.2. Both Otosan and MAN are vehicle manufacturers and it is supposed that their engines are principally intended for their own production of vehicles.

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8.1.5. TÜMOSAN Projects

8.1.5.1. TÜMOSAN was set up by the Government in 1976 with the aim of restructuring the automotive industry into a driving, instead of a retarding sector for the economy. TÜMOSAN was to be effective in two ways. One was that local production and standardisation in engines and transmissions would bring solutions to such problems as declining productivity, underutilisation of capacity and high costs that vehicle producers then faced. The other was that TÜMOSAN would be instrumental in transmitting modern technology to sub-suppliers and large production figures would enable them to expand to economical capacities and operation levels.

8.1.5.2. TÜMOSAN started five main projects* to achieve this goal (Table 11).

1- Light-duty Diesel Engines Project:

40.000 engines pa capacity, Aksaray, Licensor Mitsubishi (Japan) (65-79 HP).

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* Support projects of Tümosan, Foundry, Forge and Central tooling facility are to be dealt with in a separate report at a later date,

TABLE:11

FIVE MAIN PROJECTS UNDERTAKEN BY TÜMOSAN

	TRACTOR ENGINES PROJECT x	LIGHT-DUTY DIESEL ENGINE PROJECT	MEDIUM-AND HEAVY DUTY DIESEL ENGINE xx	TRANSMISSIONS PROJECT	TRACTOR PROJECT
LICENSOR	FIAT SpA (ITALY)	MITSUBISHI(JAPAN)	DAIMLER-BENZ (GERM) VOLVO (SWEDEN)	ZF (W.GERMANY) [illegible] (USA)	Fiat SpA (ITALY)
PRODUCTS	49-135 HP three diesel engines	79HP/3700 rpm 104 HP/3500 rpm two engines	85-168 HP three eng 250,350 HP two eng.	18-125 kgm range of gear boxes 1,5-7,5 ton carrying capacity 3 axles	Two main types of tractors Fiat 6[illegible] and 80 series
CAPACITY	100 000	40 000	24 000 D-B 5000 Volvo	57000 gear boxes, 42000 rear axles	[illegible] 000
APPLICATION OF PRODUCTS	Tractors, vehicles,	minibus,pick-up	trucks,buses, heavy trucks	[illegible] vehicles	Farming
INVESTMENT COST (10^6 $)	133 $ foreign 175 $ total	60 $ foreign 80 $ total	66 $ foreign 100 $ total	[illegible] $ foreign [illegible] total	72.6$ Foreign 125.5$ Total
INVESTMENT PERIOD	1978 - 87	1979 - 87	1978 - 86	1978 - 87	1977 - 87
EMPLOYMENT	1500	[illegible]	1753	1400	400
LOCATION	KONYA	AKSARAY	AKSARAY	KONYA	KONYA

x Assembly started in March 1981

xx Investment carried out by Akmos.

UN. BUILDING, 197 ATATÜRK BULVARI [illegible] ANKARA. CABLE: UNDEVPRO TEL: 26 54 85 TELEX: 42604

2- Medium- and Heavy Duty Engines Project:

Aksaray(Akmosan) 24.000 pa 85-168 HP medium-duty engines, Licensor Mercedes-Benz

5.000 pa 250-350 HP heavy duty engines, licensor Volvo (Sweden).

3- Tractor Engines Project:

100.000 engines pa, Konya, 45-100 HP range, Licensor Fiat (Italy).

4- Tractor Project:

50.000 farm tractors pa, Konya. 45-100 HP range tractors of two types, Licensor Fiat(Italy).

5- Transmission Project:

Konya, 57.000 gear boxes pa, Licensor ZF(Germany)

42.000 rear axles pa, Licensor Dana(USA).

Investment is under way at two sites in Central Anatolia in Aksaray(Niğde) and Konya. Total investment to date is 6 billion TL(book value). Assembly production in tractor engine plant was started in March 1981. Production of tractors is planned for end 1982. In all other projects, there is little or no progress because of non-availability of funds.

8.2. RECOMMENDATIONS

8.2.1. MASTER PLAN FOR DIESEL ENGINE INDUSTRY

... shows the overall ... as emerges from data collected and a ... plan for the industry up to 1990

8.2.1.1. TRACTOR ENGINES

With the demand in ... to be ... units pa including 6000-7000 units for exports and BMC being the only private sector manufacturer for these engines with a capacity of 6000 units pa, TÜMOSAN should expeditiously complete the first phase of its project to create a capacity of 50000 units pa of tractor engines on two shift basis. Simultaneously, however, steps will need to be taken by ... manufacturers to adapt their products to the TÜMOSAN engines ... will need Governmental action which may include phased reduction ... imports of CKD engines.

8.2.1.2. LIGHT-DUTY ENGINES

Demand is expected to reach a level between ... and ... pa by 1990. The capacity available in the private sector is 16000 comprising 10000 gasoline engines planned by Otosan (excluding 15000 gasoline engines for Anadol cars) and 6000 diesel engines with BMC. There is therefore scope for TÜMOSAN to go a head with the first phase of this project, that is 20000 units pa on two shift basis. Simultaneously, however, suitable steps will have to be taken by BMC and Otosan to realise production according to their installed capacity with necessary help and guidance from the Government.

8.2.1.3. MEDIUM-DUTY ENGINES

The demand is forecast to reach between 34000 and 47000 and the capacity existing with BMC is 9200 (excluding 800 for stationary

applications) and that planned by Otosan 12 000 thus leaving a gap of 13 000 under minimum demand conditions and 26 000 under favourable conditions,

There is thus room for one more manufacturer,be it Tumosan or a joint sector project which,it is understood is under consideration. The crucial aspect which needs to be stressed is that the aim of all manufacturers must be to achieve 100% local manufacture during the eighties. This indeed,it is felt, should be an important condition to be set by the Government for approving any project.

It is felt that a fully integrated plant to produce 10-15 000 engines may not be economical in this highly competitive industry. The possible non-civilian uses for this range of engines,not taken into account in demand estimates,should also be taken into account while taking decision on creation of capacity particularly since BMC and Otosan engines are not suitable for such uses.

With the background of a joint-sector project being also under consideration for medium-duty commercial vehicles,it is recommended that the Government should take a policy decision on implementing one of the following two altermatives:

Alt.1. The joint-sector project to manufacture 10-15 000 engines by 1990 and also to achieve full local integration by that time.

Alt.2. Tümosan to go ahead with its project for medium-duty engines but with following modifications:

i- initial capacity to be 10-12 000 pa

ii- master plan to be retained at 24 000 pa

iii- full integration to be achieved by 1990

iv- possible non-civilian uses should be taken into account.

8.2.[illegible] HEAVY-DUTY ENGINES

[illegible]re is room for only [illegible] manufacturer in this range and the private [illegible] firm MAN who are [illegible] the field for engines of over 180 HP should undertake to achieve [illegible] integration by 1990. Initial capacity of 7[illegible] units pa.with provision to expand to 11,[illegible] of [illegible] appears to be too [illegible] and a review [illegible] investment plans is recommended.

8.2.2 TRANSMISSIONS

For tractor gears capacity exists in Hema and MKEK but it will fall short of demand by 1990. Car plant of Oyak has capacity for car transmission gears and demand of other car producers appears to be unmet. There is no manufacturer of engine timing gears and the total unmet demand for tractors,car transmission and timing gears in terms of tractor gears is expected to meet only about [illegible] of demand.

Capacity for medium gear boxes and rear axles is expected to be adequate with Hema and Ege Industries.

There is at present no capacity for light-duty gear boxes and rear axles.nor for heavy duty boxes and axles while Tumosan's project for transmissions provides for a production of 57000 light and heavy duty gear boxes and 42000 of light duty rear axle there is no provision for heavy duty rear axles. It is recommended that Tumosan's project should be expeditiously pursued and in addition it should also cater for heavy duty rear axles.

8.2.3. CASTINGS AND FORGINGS

It is recognised that there are shortfalls in the capacity of castings and forgings of relatively high complexity. This is particularly true of the intricate high quality castings and forgings required for the diesel engine industry. While no provisions have so far been made for Tumosan's Forge and Foundry projects,it is comsidered that in this area where gaps in terms of technology are known even if this cannot be quantified,an updated report of Tumosan's minimum needs for castings and forgings should be prepared and processed.

APPENDIX 1

DATA USED IN REGRESSION ANALYSES

YEARS	TRUCK PARK	BUS PARK	MINIBUS PARK	PICK-UP PARK	GNP (Million TL)
[illegible]	47.931	12.041	10.913	31.462	101.204
[illegible]	56.889	13.332	16.008	39.927	105.461
[illegible]	62.616	13.948	18.967	43.441	112.493
[illegible]	69.478	15.529	20.540	48.655	118.594
1970	70.730	15.980	20.916	52.152	125.425
[illegible]	73.433	17.140	22.380	57.0[illegible]	138.185
[illegible]	78.920	18.504	25.559	62.796	149.477
1973	89.685	20.340	31.123	69.671	156.45[illegible]
1974	97.050	21.387	34.421	77.960	168.013
1975	108.614	22.928	39.924	93.046	181.383
1976	124.569	24.581	46.[illegible]	111.930	193.751
1977	143.664	26.261	52.610	127.253	203.358
1978	152.334	27.666	57.568	136.945	209.[illegible]
1979	162.667	29.313	62.178	147.138	208.343
1980	170.809	30.411	65.607	156.908	206.061

ANNEX 2

PREDICTOR EQUATIONS USED FOR PROJECTING VEHICLE PARKS

[illegible]	PREDICTOR EQUATION(x)			EXPLANATORY VARIABLE
[illegible]	ln Y = -6.7715	+	2.0251 ln GNP	$\bar{R}^2$ = 0.9584
	(0.5669)		(0.1125)	t value for constant -11.94
				t value for ln GNP 18.01
[illegible]	ln Y = -5,3512	+	1.9183 ln GNP	$\bar{R}^2$ = 0.9655
	(0.4875)		(0.0967)	t value for constant -6.5[illegible]
				t value for ln GNP [illegible]
BUSES	ln Y = -2.7008	+	1.1298 ln GNP	$\bar{R}^2$ = 0.9753
	(0.2415)		(0.0479)	t value for constant [illegible]
				t value for ln GNP [illegible]
TRUCKS	ln Y = -3.0012	+	1.4969 ln GNP	$\bar{R}^2$ = 0.9806
	(0.4588)		(0.0910)	t value for constant -6.54
				t value for ln GNP 16.445

(x) Equations applicable when GNP and park figures are given in units of 1000.

APPENDIX 3

PROJECTION OF GNP FOR MINIMUM DEMAND CONDITIONS AND FAVOURABLE CONDITIONS

YEARS	MINIMUM DEMAND CONDITIONS		FAVOURABLE CONDITIONS	
	Rate of increase %	GNP in 1968 producer's value as 10^6TL	Rate of increase %	GNP in 1968 Producer's value as 10^6TL
1980	-	206,061	-	206,061
1981	3.5	213,273	3	212,343
1982	3,5	220,737	3,5	219,751
1983	3.5	228,463	4	228,458
1984	3.5	236,459	4.5	238,779
1985	3.5	244,735	5	250,675
1986	3.5	253,301	6	265,716
1987	3.5	262,167	6	281,659
1988	3.5	271,343	6	298,559
1989	3.5	280,840	6	316,472
1990	3.5	290,669	6	335,460

APPENDIX 4

PROJECTIONS OF VEHICLE PARKS

	MINIMUM DEMAND CONDITIONS				FAVOURABLE CONDITIONS			
YEARS	TRUCK	BUS	MINIBUS	PICK-UP	TRUCK	BUS	MINIBUS	PICK-UP
1981	152,323	28,718	59,634	139,200	151,223	28,562	59,052	137,913
1982	160,372	29,857	63,937	148,697	159,214	29,694	63,313	147,322
1983	168,847	31,040	68,550	158,840	168,841	31,039	68,547	158,833
1984	177,720	32,270	73,496	169,676	180,340	32,622	74,938	172,827
1985	187,163	33,549	78,798	181,250	194,004	34,470	82,720	189,784
1986	197,054	34,879	84,484	193,616	211,689	36,816	93,080	212,229
1987	207,467	36,261	90,580	206,825	230,978	39,321	104,728	237,329
1988	218,431	37,698	97,115	220,934	252,030	41,997	117,856	265,396
1989	229,974	39,192	104,122	236,006	274,999	44,854	132,617	296,783
1990	242,126	40,745	111,635	252,106	300,063	47,906	149,227	331,882
Rate of park growth per annum	5,28%	3.96%	7.21%	6,82 %	7,91 %	5.9 %	10.85%	9.25%

APPENDIX 5

[illegible] SALES OF VEHICLES (IMPORTS [illegible]

YEARS	TRUCK	BUS	MINIBUS	PICK-UP
1970	5,605	709	1,101	4,68[illegible]
1971	4,247	604	[illegible],9[illegible]	4,568
1972	7,602	1,031	3,792	6,049
1973	10,963	1,341	4,533	8,747
1974	10,992	1,234	4,584	[illegible]1,[illegible]76
1975	14,315	1,548	5,221	18,10[illegible]
1976	20,495	855	5,05[illegible]	[illegible],8[illegible]
1977	18,981	[illegible],157	5,447	14,19[illegible]
1978	12,754	781	4,287	[illegible],530
1979	13,701	1,081	3,231	9,[illegible]56
1980(x)	8,412	1,098	2,103	[illegible],[illegible]3

(x) Imported vehicles not included in 1980 figures.

APPENDIX 6

PROJECTION OF DOMESTIC DEMAND FOR CITY BUSES

	PESSIMISTIC DEMAND CONDITIONS				FAVOURABLE CONDITIONS			
		GEN.	REPLACEMENT			NEW	REPLACEMENT	
YEARS	PARK	DEMAND	DEMAND	[illegible]	[illegible]	DEMAND	DEMAND	DEMAND
[illegible]	68,550	4,613	2,275	6,[illegible]	68,547	5,233	2,275	7,508
[illegible]	73,496	4,946	3,419	8,[illegible]	74,938	[illegible],391	3,419	9,810
1985	78,798	5,302	4,303	9,605	82,720	7,782	4,[illegible]	12,085
1986	84,484	5,686	4,780	10,466	93,080	10,360	4,780	15,[illegible]
1987	90,580	6,096	4,593	10,689	104,738	11,[illegible]	[illegible],59[illegible]	16,[illegible]
1988	97,115	6,535	5,240	11,775	117,856	13,118	[illegible],[illegible]4[illegible]	[illegible]
1989	104,122	7,007	4,[illegible]29	11,936	132,617	14,761	4,[illegible]2[illegible]	[illegible],596
1990	111,635	7,513	4,[illegible]3	11,8[illegible]6	149,227	16,610	4,[illegible]4[illegible]	[illegible]92
Avg.(1983-86)		5,137	3,695	8,832		7,442	3,69[illegible]	[illegible],137
Avg.(1987-90)		[illegible],[illegible]3	4,771	11,559		14,037	4,771	18,808
Avg.(1983-90)		5,963	4,233	10,196		10,740	4,233	14,973

ANNEX 7

PROJECTION OF DOMESTIC DEMAND FOR [illegible] - 000

	MINIMUM [illegible] CONDITIONS				[illegible] CONDITIONS			
Year	MARK	NEW DEMAND	REPLACEMENT DEMAND	TOTAL DEMAND	MARK	NEW DEMAND	REPLACEMENT DEMAND	TOTAL DEMAND
[illegible]	[illegible],840	10,144	5,100	15,244	158,833	[illegible],511	[illegible],10[illegible]	16,6[illegible]
1[illegible]	[illegible],676	10,836	6,455	17,291	172,827	[illegible],[illegible]34	[illegible],45[illegible]	[illegible],4[illegible]
19[illegible]	181,250	11,574	8,824	20,398	189,7[illegible]	[illegible],9[illegible]7	[illegible],[illegible]6	[illegible],[illegible]
	193,616	12,366	12,843	25,209	212,22[illegible]	[illegible]	[illegible],[illegible]3	[illegible],[illegible]
198	206,825	13,209	16,544	29,753	237,329	25,[illegible]	[illegible]	41,[illegible]
1988	220,934	14,109	17,385	31,494	265,396	28,[illegible]	[illegible]	[illegible]
1989	236,006	15,072	15,163	30,235	296,783	31,387	13,1[illegible]	[illegible]
1990	252,106	16,100	9,[illegible]	[illegible],[illegible]	331,882	35,099	[illegible],66	[illegible],[illegible]
Avg.(1983-86)		11,230	8,306	19,536		16,227	8,306	[illegible],[illegible]
Avg.(1987-90)		14,622	14,130	28,812		29,913	14,190	44,103
Avg.(1983-90)		12,926	11,248	24,174		23,070	11,248	34,318

APPENDIX 8

PROJECTION OF DOMESTIC [illegible] FOR [illegible]

	MINIMUM DEMAND CONDITIONS				PAST TREND CONDITIONS			
		DEMAND				DEMAND		
YEARS	PARK	NEW	REPLACEMENT	TOTAL	PARK	NEW	REPLACEMENT	TOTAL
1983	166,847	8,474	5,818	14,292	166,541	9,127	5,818	[illegible]
1984	177,770	8,923	7,604	16,527	180,340	[illegible]	7,604	[illegible]
[illegible]	187,163	9,393	9,852	19,245	194,004	[illegible]	9,852	[illegible]
1986	197,054	9,891	12,090	21,981	211,689	17,685	12,090	[illegible]
1987	207,467	10,413	15,267	[illegible]	230,978	19,289	[illegible]	[illegible]
1988	218,431	10,963	17,930	[illegible]	252,030	21,051	17,930	[illegible]
1989	229,974	11,542	17,410	[illegible]	274,999	22,969	17,410	[illegible]
1990	242,126	12,152	15,143	27,297	300,063	25,063	15,[illegible]	[illegible]
Ave.(1983-86)	9,170		8,841	18,011		13,119	8,841	21,960
Ave.(1987-90)	11,268		16,438	27,706		22,093	16,438	38,531
Ave.(1983-90)	10,219		12,640	22,859		17,606	12,640	30,246

A.

PROJECTION OF DOMESTIC DEMAND FOR

	MINIMUM DEMAND CONDITIONS				FAVOURABLE CONDITIONS			
		DEMAND				DEMAND		
YEARS	PARK	NEW	REPLACEMENT	TOTAL	PARK	NEW	REPLACEMENT	TOTAL
1983	31,040	1,183	781	1,964	31,039	1,345		2,1
1984	32,270	1,230	992	2,222	32,682	1,58		
1985	33,549	1,279	1,202	2,481	34,470	1,648		
1986	34,879	1,329	1,374	2,703	36,816	2,3	1,37	3,719
1987	36,261	1,382	1,212	2,594	39,321	2,505		
1988	37,698	1,437	1,1	2,4	41,997	2,675	1,1	3,8
1989	39,192	1,494	931	2,425	44,854	2,857		3,788
1990	40,745	1,553	1,006	2,559	47,906	3,052	1,	4,05
Avg.(1983-87)		1,259	1,087	2,342		1,780	1,087	2,868
Avg.(1987-90)		1,467	1,084	2,551		2,773	1,084	3,856
Avg.(1983-90)		1,361	1,086	2,447		2,276	1,086	3,362

ANNEX 10

DISTRIBUTION OF LIGHT DUTY DIESEL ENGINE DEMAND INTO HP RANGES (GMC, AND PICK-UP)

YEARS	MINIMUM DEMAND CONDITIONS			FAVOURABLE CONDITIONS		
	60-65 HP	75-80 HP	TOTAL	60-65 HP	75-80 HP	TOTAL
[illegible]	12,967	9,165	22,132	14,131	9,988	24,119
[illegible]	14,892	10,764	25,656	17,584	[illegible]	[illegible]
1985	17,481	12,522	30,003	22,075	[illegible]	37,866
1986	21,135	14,540	35,675	29,749	[illegible]	[illegible]
1987	24,390	16,052	40,442	34,568	23,327	[illegible]
1988	25,971	17,298	43,269	37,935	25,[illegible]	[illegible]
1989	23,744	16,427	40,171	37,748	26,[illegible]	[illegible]
1990	21,981	15,620	37,601	38,313	27,384	65,697
Avg.(1983-86)	16,619	[illegible]	25,368	20,885	14,785	35,670
Avg.([illegible]-90)	24,022	16,349	40,371	37,141	25,770	62,911
Avg.(1983-90)	20,321	14,049	34,370	29,013	20,278	49,291

APPENDIX II

DISTRIBUTION OF TRUCK PRODUCTION INTO PAY-LOAD RANGES

	3 1/2 TON PAY-LOAD			8 TON PAY - LOAD							10 TON PAY-LOAD				PERCENTAGE OF		
YEARS	GENOTO	OTOYOL	TOTAL	BMC	MAN	GENOTO	TOE	CHRYSLER	OTOSAN	TOTAL	TAŞIT SAN.	MAN	TOTAL	GRAND TOTAL	3 1/2 TON	8 TON	10 TON
1970	768	-	768	1,858	300	348	399	533	1,275	4,713	52	-	52	5,533	14	85	1
1971	744	-	747	1,185	372	-	31	639	1,179	3,406	47	-	47	4,197	18	81	1
1972	1,236	-	1,236	2,512	780	-	12	763	2,073	6,140	191	-	191	7,567	16.5	81	2.5
1973	924	-	924	3,403	1,001	344	152	1,572	3,150	9,622	268	-	2[illegible]	10,814	8.5	89	2.5
1974	1,056	85	1,141	2,576	920	1,056	528	950	3,201	9,231	245	-	2[illegible]	10,617	10.7	87	2.3
1975	1,308	693	2,001	3,585	976	780	377	1,921	4,207	11,846	235	71	306	14,153	14	83.7	2.3
1976	2,028	1,250	3,278	4,933	790	1,464	450	2,805	5,283	15,723	-	221	221	19,222	17	81.8	1.2
1977	2,232	1,637	3,869	3,520	325	1,596	1,040	2,029	5,998	14,508	-	262	262	18,639	20.8	77.8	1.4
1978	868	897	1,765	2,810	589	799	1,035	419	4,533	10,194	-	570	570	12,529	14	81.4	4.5
1979	1,092	1,399	2,491	3,066	338	672	654	711	4,666	10,101	-	677	677	13,269	18.8	76	5.2
1980																	
														Avg.	15.23	82.37	2.40

APPENDIX 12

DISTRIBUTION OF TRUCK DEMAND INTO RANGES

	MINIMUM DEMAND CONDITIONS				FAVOURABLE CONDITIONS			
YEARS	TOTAL	85 HP	130 HP	170 HP	TOTAL	85 HP	130 HP	170 HP
1983	14,292	2,144	11,433	715	15,445	2,317	12,355	773
1984	16,527	2,480	13,221	826	19,193	2,866	15,282	955
1985	19,245	2,887	14,818	1,540	23,515	3,527	18,107	1,881
1986	21,981	3,297	16,266	2,419	29,775	4,466	22,034	3,275
1987	25,680	3,852	18,233	3,595	34,556	5,183	25,595	3,838
1988	28,893	4,334	19,647	4,912	38,981	5,847	26,507	6,627
1989	28,952	4,343	18,819	5,790	40,379	6,057	26,246	8,076
1990	27,297	4,095	16,924	6,278	40,208	6,031	24,929	9,248
Avg(1983-87)	18,011	2,702	13,932	1,375	21,960	3,294	16,945	1,721
Avg(1987-90)	27,706	4,156	18,406	5,144	38,531	5,780	25,555	7,197
Avg(1983-90)	22,859	3,429	16,169	3,260	30,246	4,537	21,250	4,459

APPENDIX 13

DISTRIBUTION OF BUS PRODUCTION [illegible] RANGES

(MIDIBUS - BUS)

YEARS	BUS (130-192 HP)				MIDIBUS				TOTAL	PERCENTAGE OF	
	OTOMARSAN	OTOKAR	MAN	TOTAL	OTOYOL	OTOKAR	OTOMARSAN	TOTAL		BUSES	MIDIBUSES
19[illegible]	284	158	62	504	154	-	-	154	658	[illegible]6	24
1971	362	70	-	432	101	22	-	123	555	[illegible]	22
19[illegible]2	532	121	5	658	85	58	-	143	[illegible]01	82	[illegible]
[illegible]973	821	72	110	1,003	100	70	-	170	1,[illegible]73	[illegible]3	[illegible]3
1974	928	58	211	1,197	90	29	-	119	1,3[illegible]6	[illegible]	[illegible]9
1975	1,046	87	122	1,255	177	-	-	177	1,4[illegible]	[illegible]7	13
1976	949	93	169	1,211	2[illegible]		-	252	1,463		17
1977	828	82	400	1,300	246	-	212	458	1.818	7[illegible]	25
1978	878	190	100	815	300	-	140	440	1,25[illegible]	[illegible]5	35
1979	525	73	225	1,134	-	445	82	527	1,661	68	32
1980	836	-			-						

Avg. 79 Avg.21

APPENDIX 14

DISTRIBUTION OF BUS DEMAND INTO HP RANGES

	MINIMUM DEMAND CONDITIONS			FAVOURABLE CONDITIONS		
YEARS	TOTAL	85HP MIDIBUS	170-210 HP BUS AND COACH	TOTAL	85 HP MIDIBUS	170-210 HP BUS AND COACH
1983	1,964	393	1,571	2,126	425	1,701
1984	2,222	445	1,777	2,575	515	2,060
1985	2,481	496	1,985	3,050	610	2,440
1986	2,703	540	2,163	3,719	744	2,975
1987	2,594	519	2,075	3,717	743	2,974
1988	2,624	525	2,099	3,862	772	3,090
1989	2,425	485	1,940	3,788	757	3,031
1990	2,559	512	2,047	4,058	812	3,246
Avg.(1983-86)	2,342	468	1,874	2,868	574	2,294
Avg.(1987-90)	2,551	511	2,040	3,856	771	3,085
Avg.(1983-90)	2,447	490	1,957	3,362	673	2,689

APPENDIX 15

MEDIUM - DUTY DIESEL ENGINE DEMAND (FAVOURABLE CONDITIONS)

YEARS	85 HP ENGINE TRUCK	MIDIBUS	CONST. MACH.	TOTAL	130 HP ENGINE TRUCK	CONST. MACH.	TOTAL	170 HP ENGINE TRUCK	CONST. MACH.	TOTAL	[illegible]	GRAND TOTAL
1983	2317	425	-	2742	12355	-	12355	773	[illegible]	[illegible]	1701	17571
1984	2866	515	-	3381	1528[illegible]	-	15282	955	-	955	2060	21678
1985	3527	610	43	4180	181[illegible]	85	18192	1881	72	1953	2440	26765
1986	4456	744	64	5274	2203[illegible]	128	22162	3275	108	[illegible]	297[illegible]	[illegible]
1987	5184	743	100	6027	24534	[illegible]	24734	3838	170	50[illegible]	2974	[illegible]
1988	5847	772	100	6719	26507	200	26707	6627	170	[illegible]	[illegible]	[illegible]
1989	6057	757	100	6914	2624[illegible]	200	26446	8076	170	[illegible]	[illegible]	44637
1990	6031	812	100	6943	24929	200	25129	9248	170	[illegible]	[illegible]	44736
Avg(1983-86)	3294	574	27	3895	16945	53	16998	1721	45	[illegible]	2294	24952
Avg(1987-90)	5780	771	100	6651	25555	200	25755	[illegible]	108	[illegible]	[illegible]	42858
Avg(1983-90)	4537	673	114	5324	21250	127	2137[illegible]	59	[illegible]	[illegible]	[illegible]	33905

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APPENDIX 16

MEDIUM-DUTY DIESEL ENGINE DEMAND (MINIMUM DEMAND CONDITIONS)

	85 HP ENGINE				130 HP ENGINE			170 HP ENGINE				
YEARS	TRUCK	MIDIBUS	CONST. MACH.	TOTAL	TRUCK	CONST. MACH.	TOTAL	TRUCK	CONST. MACH.	TOTAL	170-210 HP BUS	GRAND TOTAL
1983	2144	393	-	2537	11433	-	11433	715	-	715	1571	16256
1984	2480	445	-	2925	13221	-	13221	826	-	826	1777	18749
1985	2887	496	43	3426	14818	85	14903	1540	72	1612	1985	21926
1986	3297	540	64	3901	16266	128	16394	2418	108	2526	2163	24984
1987	3852	519	100	4471	18233	200	18433	3595	170	3765	2075	28744
1988	4334	525	100	4959	19647	200	19847	4912	170	5082	2099	31987
1989	4343	485	100	4928	18819	200	19018	5790	170	5960	1940	31847
1990	4095	512	100	4707	16924	200	17124	6278	170	6448	2047	30326
	2702	468	27	3197	13932	53	13988	1375	45	1420	1874	20478
	4156	511	100	4767	18406	200	18606	5144	108	5314	2040	30727
	3429	490	114	4033	16197	127	16297	3269	77	3367	1957	25604

APPENDIX 17

DOMESTIC DEMAND FOR HEAVY-DUTY ENGINES (DESI AB 1977)

YEARS	DEMAND FOR 240-340 HP ENGINES
1983	3425
1984	3585
1985	3745
1986	3905
1987	4065
1988	4225
1989	4385
1990	4545
Average (1983-86)	3665
Average (1987-90)	4305

APPENDIX 18

DOMESTIC DEMAND FOR TRACTOR DIESEL ENGINES

	Minimum demand conditions			Favourable conditions		
YEARS	New demand	Replacement demand	Total	New Demand	Replacement Demand	Total
1983	25360	23544	48904	27066	23544	50610
1984	18236	32309	50545	21538	32309	53847
1985	7367	44764	52131	12815	44764	57579
1986	283	53580	53863	8703	53580	62283
1987	4084	52476	56560	15412	[illegible]	67888
1988	8305	49611	57916	24155	49611	73766
1989	17185	42997	60182	37163	42997	80160
1990	39908	22208	62116	64674	22208	86882
Avg.(1983-87)	12811	38553	51364	17530	38550	[illegible]80
Avg.(1987-90)	17371	41823	59194	35351	41823	77174
Avg.(1983-90)	15090	40187	55277	26440	[illegible]187	[illegible]627

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