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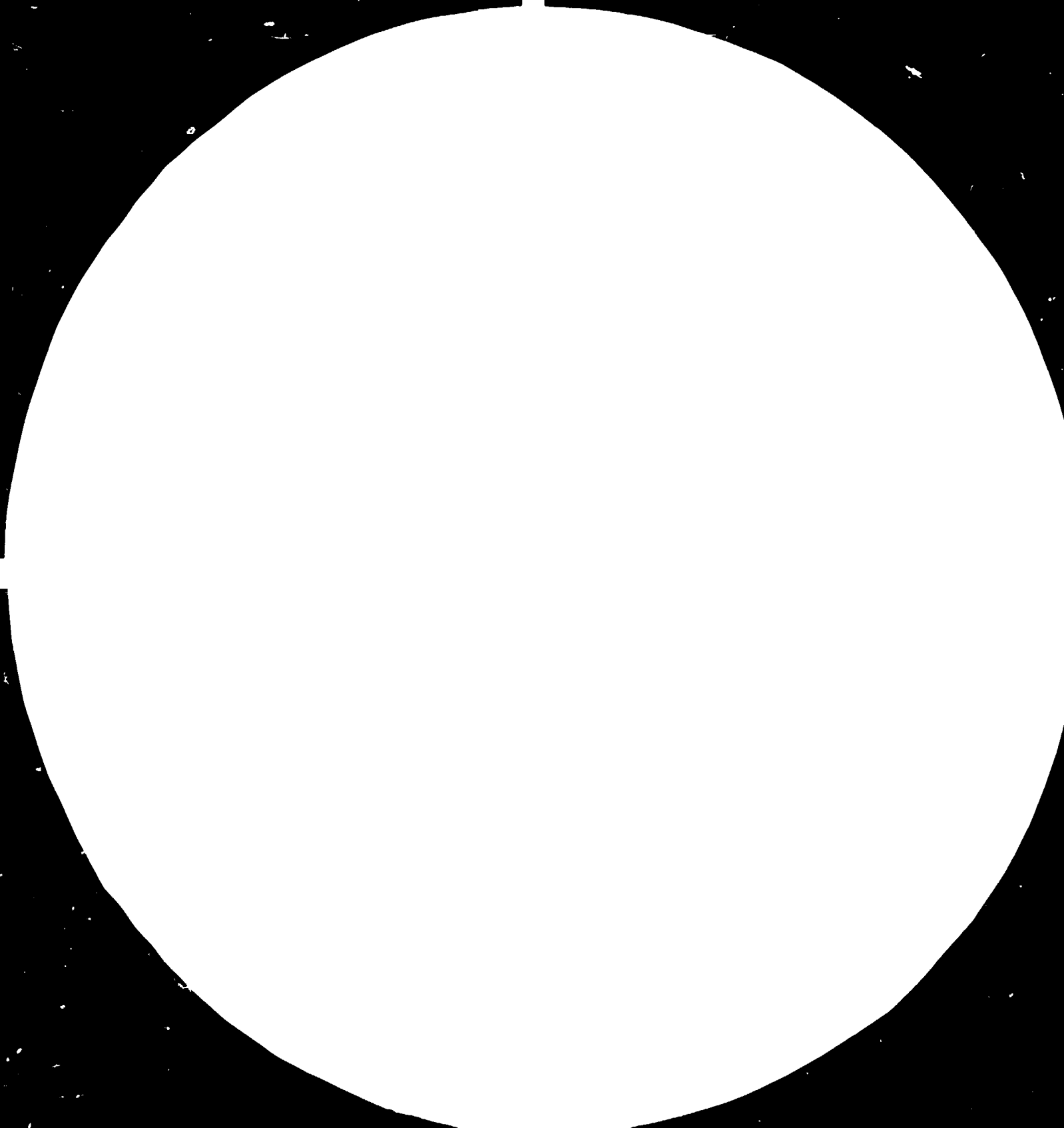

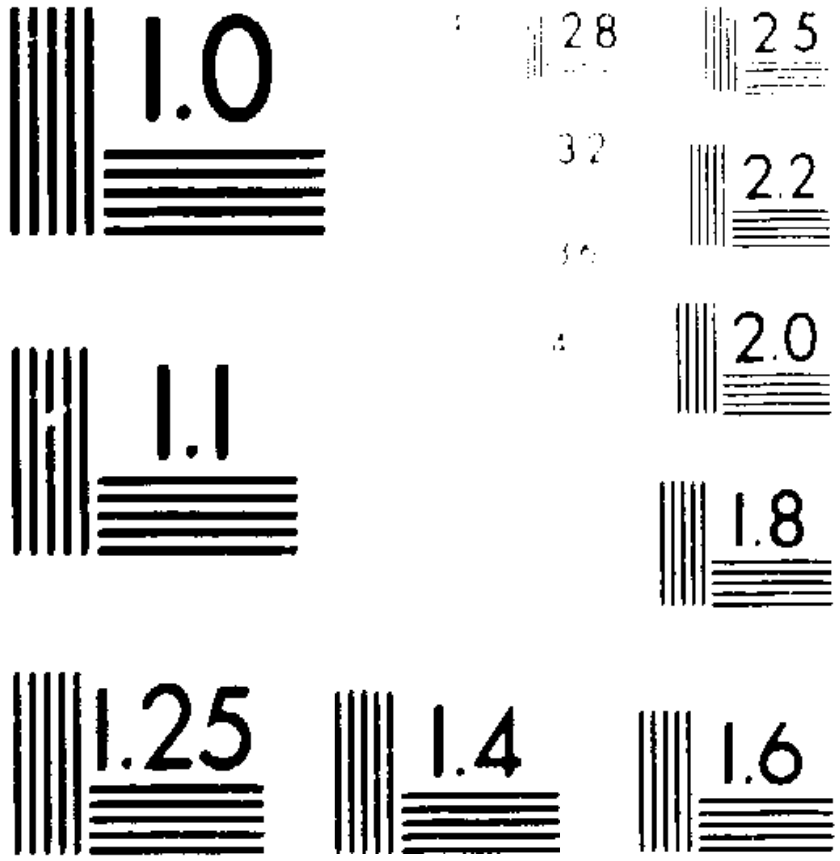

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DEVELOPMENT OF CAPITAL GOODS INDUSTRIES

DP/TUR/76/034

Turkey.

Technical Report No.VI: Light Duty Diesel Engines

M.M. Luther

Birleşmiş Milletler Kalkınma Programı

UNITED NATIONS NATIONS UNIES

DEVELOPMENT PROGRAMME IN TURKEY

CAPITAL GOODS DEVELOPMENT PROJECT IN TURKEY

DEVELOPMENT OF CAPITAL GOODS INDUSTRIES

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Technical Report No.6

LIGHT DUTY DIESEL ENGINES

U.N. BUILDING, 197 ATATÜRK BULVARI P.O. BOX 407, ANKARA CABLES : UNDEVPRO TEL : 26 54 65 TELEX : 42004

Birleşmiş Milletler Kalkınma Programı

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DEVELOPMENT OF CAPITAL GOODS INDUSTRIES

DP/TUR/76/034

Technical Report No. 6
LIGHT DUTY DIESEL ENGINES

by

M.M. Luther
Chief Technical Adviser
Capital Goods Development Project in Turkey

The views expressed in this paper do not necessarily reflect the views of UNIDO.

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CHAPTER I

INTRODUCTION

1.1 In the Capital Goods Development Project being conducted by SPO and UNIDO for planning the future of the capital goods industry in Turkey, diesel and petrol engines have been identified as one of the priority sectors. This report deals with demand and supply of light duty diesel engines, and examines the project undertaken by Tümosan for the production of light duty diesel engines (SPO's project No. 78 C 23 00 20), located at Aksaray/Nigde.

1.2 Mr. Ali Ünal of Tümosan was deputed by the General Manager of Tumosan to collect data and assist in making projections of demand and supply. SPO deputed Mr. Ömer Özdemir to assist and provide the necessary data from SPO. Mr. Ali Ünal has been further assisted by Mr. Osman Nuri Tuna and Mr. Arif Gücün. These experts from SPO and Tümosan have had a series of meetings with Mr. M. M. Luther, Chief Technical Adviser, UNIDO. Meetings were also held with the Ministry of Industry. Conclusions and recommendations have been discussed with the management of Tümosan who have agreed with them. Mrs. Güler İzmirlioğlu and Mr. Ziya Sıddıki - National Project Co-ordinators - have provided the necessary help in co-ordination with Tümosan.

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1.3 CTA, UNIDO would like to place on record his appreciation of co-operation of officials of SPO, the Ministry of Industry and the management of Tumosan for their open minded discussions as well as for the very valuable contributions made by all the experts mentioned above.

1.4 Scope of the study:

This study covers inter alia

(i) Previous demand projections

(ii) Anticipated demand in the present environment in the period 1983-1990.

(iii) Capacity available and anticipated for assembly of light duty vehicles

(iv) Proposals for filling up anticipated gaps.

M.M. Luther

Chief Technical Adviser

Capital Goods Development Project

CHAPTER II

SUMMARY

2.1 Diesel engines have been identified as one of the priority sub-sectors by SPO for Capital Goods Development Project. Heavy duty diesel engines were dealt with in Technical Report No.3, while Tractor diesel engines in Technical Report No.5. This report deals with diesel engines used in light duty vehicles mainly minibuses and pick-ups. Other uses include applications to jeeps (both for military and civilian use), generators, water pumps and marine vehicles.

2.2 Three previous demand forecasts for light duty diesel engines were based on time-series type of analysis, where it was assumed that the trend observed in the past would be carried into the future. In other words, they do not take into account variations in economic environment in future years. Therefore, it was felt that a new analysis of the demand pattern is necessary in view of the changing techno-economic conditions.

2.3 Developments in local market and trends in world automotive industry indicate that diesel powered vehicles are preferred because of fuel economy.

2.4 The domestic demand, estimated from relations between fleet statistics and GNP, is expected to be around 22 000 pa in the year 1983 and to gradually increase to a level between a minimum of 38 000 and normally expected figure of 59 000 pa in 1990. This total demand is distributed between pick-ups and minibuses in the ratio of about two to one.

2.5 Replacement demand values have been calculated on the basis of 12 years useful life.

2.6 Total demand for light duty diesel engines can be met by two types of diesel engines: One of about 60 HP output, the other about 80 HP.

2.7 Light duty vehicles equipped with diesel engines have good potential for export and at least 10% of capacity should be earmarked for sale to Africa and Islamic countries including the Middle East, and suitable measures should be taken early. This should include a compact but live marketing organisation.

2.8 Present capacity for production of minibuses is 10 500 and for pick-ups 30 000 units per annum. Pick-up production capacity is sufficient to meet expected developments in demand until 1987 with normal working and extra demand until 1990 may be met by marginal expansions or overtime working.

./..

Minibus production capacity could fall short of demand by 1985 but, it is felt that expansion of their capacity will not be a constraint on demand for diesel engines.

2.9 Light duty engine production capacity presently available is rated at 5000 units per annum (BMC) and a new manufacturer is reported to start production at an installed capacity of 10 000 gasoline engines pa in the year 1983.

2.10 Tumosan at present plans to produce 4DR and 6DR light duty engines. It should however create capacity in the first instance only for 4DR type engines (62-80 HP) and plans for 6DR engine (104 HP) should be postponed until a sizeable market is secured for this engine. A study may be made in 1985-86 for this.

2.11 Tumosan's original purpose provide for a capacity of 40 000 light duty engines. It is recommended that Tumosan should limit its immediate investment plans to a capacity of 20 000 pa in two shifts, but master plans should provide for a capacity of 40 000 engines in two shifts. If this is accepted, initial investment will be considerably reduced. In addition, with a high rate of capacity utilization production will be more economical and competitive.

2.12 Supply of castings and forgings will need to be closely monitored.

2.13 High priority should be given to training of production, industrial, quality control and design engineers in the offices and works of the Licensor.

2.14 A continuous watch in decrease of imported content is recommended.

2.15 This report has been discussed with the management of Tumosan who are in agreement with the conclusions and recommendations.

CHAPTER III

ANALYSIS OF PREVIOUS STUDIES FOR DOMESTIC DEMAND

3.1 Study by Ministry of Industry and Technology - 1977:

This study forecast demand from linear time-series analyses of the period 1970 -75. This period was an exceptionally good time for Turkish automotive industry and the high rates of growth obtained during this period, have not been attained since. Accordingly the predictions made appear to be too high. The average rate of growth foreseen for 1976-1987 period is 13.3% and as will be noted from table 1, the total park reaches 500 000 by 1987. Developments since 1976 have not justified the predictions of this study as is illustrated by the fact that total sales have fallen as low as 9000 in recent years against the predictions for this period of around 40 000.

3.2 Study by TSKB - 1977:

TSKB considered minibuses and pick-ups separately and forecast demand for the period 1977-1982. Although now outdated, it is

Table 1. Demand according to MIT (1977)

Years	Minibus + midibus + pick-up park	Demand (units/year) New	Replacements	Total
1982	340 710	51 743	8 802	60 545
1983	376 072	55 370	12 303	67 673
1984	410 901	58 997	17 507	76 504
1985	443 862	62 625	23 396	86 021
1986	474 873	66 301	29 222	95 523
1987	501 312	70 192	33 608	103 800
Avg. (1982-87)		60 872	20 806	81 678

useful to have a look at the method and assumptions of this forecast.

3.2.1 Pick-up Demand: The total capacity of the park (in tons) is regressed with total transport of goods as represented by rail ton x km. and truck ton x km., and the following equation is obtained.

$$\text{pick-up (tons)} = 442311.2 + 2.12X_1 - 2.90X_2$$

where (possibly) X_1 = truck ton x km.

X_2 = rail ton x km. (not stated).

From this regression equation, TSKB forecast the lower limit (projection of independent variables not given) park figures shown in Table 2. The source of the upper limit values are not explained.

3.2.2 Minibus Demand: Three separate regression analyses were carried out: In the first method minibus park was related to the population of 26 selected cities and the results were presented as the lower limit. In the second method, minibus park was regressed with total urban population. The third method was a multiple regression in which the explanatory variables were urban population and municipal bus park. TSKB considered the results of method II as upper limit and calculated demand from this method as shown in Table 3.

3.3 Tümosan Study (1979):

This study was undertaken for the appraisal of the Light Duty

Table 2, Pick-up Park and Demand Forecast by TSKB.

Years	Park		Demand calculated from lower limit of park		
	Lower Limit	Upper Limit	New	Replacements	Total
1977	111 528	129372	13 088	4 921	18 016
1978	123 630	143 411	12 288	6 134	18 442
1979	139 712	162 065	16 082	6 181	22 263
1980	155 285	180 131	15 573	7 544	23 117
1981	174 779	202 744	19 494	7 764	27 258
1982	195 949	227 301	21 170	8 747	29 917
Avg. (1977 - 82)			16 283	6 682	23 165

Table 3. Minibus Demand According to TSKB.

Years	Park		Demand calculated from upper limit of park		
	Lower Limit	Upper Limit	New	Replacements	Total
1977	41 060	48 174	5 447	2 136	7 583
1978	42 867	54 863	6 689	2 408	9 097
1979	44 765	61 857	6 994	2 743	9 737
1980	46 758	69 743	7 886	3 093	10 979
1981	48 677	78 636	8 893	3 487	12 380
1982	50 527	88 178	9 542	3 932	13 474
Avg. (1977-82)			7 575	2 967	10 542

Diesel Engines Project of Tumosan. Demand for minibus and pick-up was forecast separately from time-series analysis.

3.3.1 Minibus Demand: Linear, parabolic and exponential curves were tried for time-series analysis, and of these, the exponential curve, $Y = ae^{bx}$, was found to have the lowest standard error ($s = 1394$) and was taken as basis for projection. The second best curve in terms of standard error was the linear model ($Y = 9538 + 3422\ x$ with $s = 3321$). The equation used for projections:

$$Y = 1.3 \times 10^4\ e^{0.12475X} \quad (\text{or } \ln Y = 9.47322 + 0.12475X)$$

where Y = minibus fleet

X = years (1966 = 1)

Park and new demand projections till the year 1985 are shown in Table 4 together with replacement demand values calculated on the basis of an average useful life of 12 years. The park predictions of this study corresponds to a park growth rate of 13.3%, which is comparable to the 15.1% growth rate achieved in the period 1966-77. However, this rate of growth may be too high for the years ahead since the high growth rates observed in the past resulted mainly from the fact that park figures themselves were low and any increase in the park was reflected as a sizeable percentage increase.

Table 4. Minibus Demand Forecast of Tümosan (1979)

Years	Minibus Fleet	Annual Demand		
		New	Replacements	Total
1979	74 594	8 749	2 400	11 149
1980	84 505	9 911	2 950	12 861
1981	95 733	11 228	3 250	14 478
1982	108 454	12 721	1 800	14 521
1983	122 864	14 410	1 300	15 710
1984	139 189	16 325	2 350	18 675
1985	157 684	18 495	4 519	23 014
Avg (1979 - 85)		13 120	2 653	15 773

3.3.2 Pick-up Demand: As in minibus demand, linear, parabolic and exponential time-series analyses were made and the exponential curve, which had the lowest standard error, was used for projection. The equation is:

$$Y = 3.2898 \times 10^4 \, e^{0.1164X} \text{ (or } \ln Y = 10.4012 + 0.1164X).$$

where, as before, Y = pick-up fleet

X = years (1966 = 1).

Park and fleet growth projections and the replacement demand values are shown in Table 5. (As in minibuses, the average life of a pick-up is taken as 12 years).

Park predictions of this equation results in an average growth rate of 12.3%, comparable to the 13.55% achieved in the period 1966-77. As in the case of minibus, this rate of growth may be too high to sustain in future.

3.4 Comparison of Previous Studies:

The forecasts of these three previous studies are compared in Table 6. It will be noted that predictions of MIT are higher than the other two studies, but on the whole demand patterns of all the three are not too dissimilar. However, because all these forecasts

are essentially based on time-series type of analysis, they assume that the trend observed in the past will be carried into the future, that is, they do not take into account changing economic expectations for future years. As a result, they have predicted park increase rates above 10%, which is expected to be too high to attain. Furthermore, these forecasts do not include an evaluation of the low limit of demand and are thus unable to explain the low sales of the last three years.

Table 5. Pick-Up Demand Forecast of TÜMOSAN (1979)

Years	Pick-Up Fleet	Annual Demand		
		New	Replacement	Total
1979	167 905	18 454	10 265	28 719
1980	188 636	20 731	5 514	26 245
1981	211 928	23 292	7 714	31 006
1982	238 095	26 167	6 497	32 664
1983	267 494	29 399	8 028	37 427
1984	300 522	33 028	8 271	41 299
1985	337 629	37 107	11 319	48 426
Avg (1979-85)		26 883	8 230	35 113

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Table 6. Comparison of Previous Demand Forecasts

YEARS	MIT(1977)	TSKB -(1977)			TÜMOSAN(1979)			TOTAL ACTUAL
	Total Demand	Minibus	Pick-up	Total	Minibus	Pick-up	Total	SALES
1978	40 737	9 097	18 442	27 539	-	-	-	9 817
1979	45 126	9 737	22 263	32 000	11 149	28 719	39 868	12 699
1980	49 573	10 979	23 117	34 096	12 861	26 245	39 106	9 628
1981	54 643	12 380	27 258	39 638	14 478	31 006	45 484	-
1982	60 545	13 474	29 917	43 391	14 521	32 664	47 185	-
1983	67 673	-	-	-	15 710	37 427	53 137	-
1984	76 504	-	-	-	18 675	41 299	59 974	-
1985	86 021	-	-	-	23 014	48 426	71 440	-
1986	95 523	-	-	-	-	-	-	-
1987	103 800	-	-	-	-	-	-	-

CHAPTER IV

PROJECTION OF DOMESTIC DEMAND

4.1 BASIC APPROACH AND ASSUMPTIONS

4.1.1 It is necessary to relate demand to an economic parameter so that changes in economic climate are reflected in demand. GNP, or a derivative thereof, is considered suitable for this purpose.

4.1.2 The growth pattern of GNP, anticipated by SPO, foresees increasing rates starting with 3% in 1981 and increasing 0.5% each year until 1985 (incl.). The rate of growth for 1986 onwards is assumed to stay constant at 6 per cent Demands under this favourable conditions have been projected.

4.1.3 In order to plan investment in this sector in such a way that capacity is fully utilised and resources of the country are not wasted through creation of excess capacity in one sector at the expense of other sectors, another projection has been made on the basis of 3.5% constant rate of growth during 1981-90. This latter

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projection represents the minimum possible demand.

4.1.4 Engine is not an end product but is used as a power source in various applications. Hence the demand for engines is derived from the demand of end-products into which engines are installed.

4.1.5 The main field of application for light duty engines is in the automotive industry, namely pick-ups, minibuses and vans, and jeeps. For the evaluation of the domestic market only minibus and pick-up applications have been considered, jeeps and other uses such as marine and stationary applications have not been taken into account. Incidentally this will also mean that the market is not overestimated.

4.1.6 Considering the strong tendency worldwide and countrywide towards diesel engines, it is assumed that, if light duty diesel engines are locally manufactured, the domestic market will use these in preference to gasoline engines. There are two reasons for this assumption. The first is that both minibuses and pick-ups are used as commercial vehicles in this country and hence the cheaper-to-run diesel types are preferred. The second is that most of the vehicle manufacturers presently assemble their own gasoline engines from CKD and locally procured parts in primitive conditions and on uneconomical scales. Thus engines as separate and complete

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units would be appreciated by vehicle manufacturers. The fact that diesel powered TM30 pick-up of BMC can sell at prices a lot higher than gasoline-powered pick-ups and that two manufacturers have recently introduced diesel minibuses support this contention.

4.1.7 New demand for pick-ups and minibuses will be estimated from relations between fleet statistics available and GNP (data is given in table 7). Although this method of regressing past park figures with GNP is likely to be susceptible to positive auto-correlation, it is considered adequate for the purpose of appraising investment plans.

4.2 REGRESSION ANALYSES AND FORECASTS OF NEW DEMAND

4.2.1 New Demand for Minibuses:

4.2.1.1 Various forms of relations were tried to relate minibus park between 1962 and 1980 to GNP (at 1968 producer's value) and the following logarithmic equation was selected:

$$\log Y = -6.715 + 2.159 \log GNP$$
$$(0.4114)(0.0801)$$

The fit of this equation is good and the explanatory variables are significant*

---

* $R^2 = 0.977$, t value for log GNP is 27.

Table 7. Data Used in Calculating the New Demand

YEARS	Minibus Park	Pick-Up Park	GNP (In 1968 producer's Value) (Million TL:)
1962	5 625	27 754	76 754
1963	7 543	30 739	84 188
1964	9 196	38 658	87 619
1965	10 476	39 804	90 368
1966	10 913	41 462	101 204
1967	16 008	39 927	105 461
1968	18 967	43 441	112 493
1969	20 540	48 655	118 594
1970	20 916	52 152	125 425
1971	22 380	57 011	138 185
1972	25 559	62 796	148 477
1973	31 123	69 671	156 458
1974	34 421	77 960	168 013
1975	39 924	93 046	181 383
1976	46 575	111 930	195 751
1977	52 610	127 253	203 358
1978	57 568	136 945	209 183
1979	62 178	147 138	208 343
1980	65 607	156 908	206 061

Source : State Inst. for Statistics

4.2.1.2 Table 8 shows the minimum new demand values forecast by this equation. It will be noted that under this alternative the minibus fleet rises from the present level of about 65 000 to 120 327 in 1990 and this corresponds to an average park growth rate of 7.7 per cent per annum.

4.2.1.3 Demand under favourable conditions, shown in table 9, results in an average park growth rate of 12.5 per cent pa and the park predicted for 1990 is 163 962.

4.2.2 New Demand for Pick-ups:

4.2.2.1 Similar analyses were carried out for pick-ups. The best regression equation is:

$$\log Y = -4.0323 + 1.718 \log GNP \ *$$

$$(0.378) \quad (0.0736)$$

4.2.2.2 Forecasts made on the basis of this equation show that under minimum growth conditions the average park growth rate will be 6% and this figure rises to 9.9% when anticipated growth rates for GNP are used, tables 10 and 11.

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* $R^2 = 0.9663$, t value for log GNP is 23.4.

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Table 8. Minibus New Demand - Minimum Level

$$\text{Log } Y = -6.715 + 2.159 \log GNP$$

(0.4114) (0.0801)

YEARS	Rate of growth in GNP (%)	GNP (Million TL)	Minibus Park	New Demand
1981	3.5	213 273		
1982	3.5	220 738	66 422	
1983	3.5	228 464	71 543	5 121
1984	3.5	236 460	77 059	5 516
1985	3.5	244 736	83 000	5 941
1986	3.5	253 302	89 400	6 400
1987	3.5	262 168	96 293	6 893
1988	3.5	271 344	103 717	7 424
1989	3.5	280 841	111 714	7 997
1990	3.5	290 670	120 327	8 613

Average park growth rate : 7.7 %

Table 9. Minibus New Demand Under Favourable Conditions

$$\log Y = -6.715 + 2.159 \log GNP$$

(0.4114) (0.0801)

YEARS	Rate of Growth in GNP (%)	GNP (Million TL)	Minibus Park	New Demand
1981	3	212 243		
1982	3.5	219 671	65 731	
1983	4	228 458	71 539	5 808
1984	4.5	238 739	78 672	7 133
1985	5	250 676	87 411	8 739
1986	6	265 717	99 130	11 719
1987	6	281 659	112 418	13 288
1988	6	298 560	127 490	15 072
1989	6	316 473	144 580	17 090
1990	6	335 461	163 962	19 382

Average park growth rate : 12.5 %

Table 10. Pick-Up New Demand - Minimum Level

$$\log Y = -4.0323 + 1.718 \log GNP$$

(0.378) (0.0736)

YEARS	Rate of growth in GNP (%)	GNP (Million TL)	Pick-Up Park	New Demand
1981	3.5	213 273		
1982	3.5	220 738	140 711	
1983	3.5	228 464	149 278	8 567
1984	3.5	236 460	158 367	9 089
1985	3.5	244 736	168 008	9 641
1986	3.5	253 302	178 238	10 230
1987	3.5	262 168	189 090	10 852
1988	3.5	271 344	200 602	11 512
1989	3.5	280 841	212 815	12 213
1990	3.5	290 670	225 771	12 956

Average park growth rate:6 %

Table 11. Pick-Up New Demand Under Favoruable Conditions

$$\log Y = -4.0323 + 1.718 \log GNP$$
$$(0.378) \qquad (0.0736)$$

YEARS	Rate of growth in GNP (%)	GNP (Million TL.)	Pick-Up Park	New Demand
1981	3	212 243	131 537	
1982	3.5	219 671	139 545	
1983	4	228 458	149 272	9 727
1984	4.5	238 739	160 998	11 726
1985	5	250 676	175 075	14 077
1986	6	265 717	193 509	18 434
1987	6	281 659	213 881	20 372
1988	6	298 560	236 403	22 522
1989	6	316 473	261 292	24 889
1990	6	335 461	288 803	27 511

Average park growth rate:9.9 %

4.3 REPLACEMENT DEMAND

4.3.1 Sales of light duty vehicles in the period 1970-80 are shown in Table 12. It is seen that total sales steadily increased from around 6000 in 1970 to 25 000 in 1976, more than four fold increase in 6 years. Because of the economic difficulties of the country, however, sales fell from 1977 onwards to a total of around 10 000 in 1980.

4.3.2 The average useful life of light duty vehicles in Turkey is accepted as 12 years. This probably represents a good average, since although repair and revision of vehicles are much used, roads and working conditions do not permit a longer average life.

4.3.3 Replacement demand values may be obtained from records of past sales as follows: If there were no deviation in the useful life, vehicles scrapped in any one year would be those sold 12 years previously. By taking moving averages, allowance is made for the variation of useful life about the average.

4.3.4 Replacements calculated on the basis of 12 years useful life are shown in tables 13 and 14.

./..

Table 12. Past Sales of Light Duty Vehicles

YEARS	PICK-UP			MINIBUS	TOTAL
	Local Manufacture	Imports	Total	(All Local Manufacture)	
1970	4 395	286	4 681	1 101	5 782
1971	4 449	119	4 568	1 931	6 499
1972	5 986	63	6 049	3 792	9 841
1973	8 674	73	8 747	4 533	13 280
1974	11 529	147	11 676	4 584	16 260
1975	17 692	414	18 106	5 221	23 327
1976	19 740	111	19 851	5 053	24 904
1977	14 057	142	14 199	5 447	19 646
1978	5 437	93	5 530	4 287	9 817
1979	9 362	106	9 468	3 231	12 699
1980	6 992	533	7 525	2 103	9 628

Source : Ministry of Industry and Technology, Automotive Section

Table 13. Replacement Demand for Minibuses

YEARS	Sales of 12 Years earlier	3_year moving averages
1982	1 101	
1983	1 931	2 275
1984	3 792	3 419
1985	4 533	4 303
1986	4 584	4 780
1987	5 221	4 593
1988	5 053	5 240
1989	5 447	4 929
1990	4 287	4 322
1991	3 231	
Avg (1983-86)		3 695
Avg (1987-90)		4 771
Avg (1983-90)		4 233

Table 14. Replacement Demand for Pick-Ups

YEARS	Sales of 12 Years earlier	3-year Moving averages
1982	4 681	
1983	4 568	5 100
1984	6 049	6 455
1985	8 747	8 824
1986	11 676	12 843
1987	18 106	16 544
1988	19 851	17 385
1989	14 199	13 163
1990	5 437	9 666
1991	9 362	
Avg (1983-87)		8 306
Avg (1987-90)		14 190
Avg (1983-90)		11 248

4.4 TOTAL DEMAND FOR LIGHT DUTY VEHICLES

4.4.1 Tables 15 and 16 show total demand for minibuses and pick-ups, respectively, under the two alternative patterns of economic growth considered.

4.4.2 Combining the results shown in tables 15 and 16, total demand for light duty vehicles are obtained as in table 17.

4.4.3 It will be seen from table 17 that :

i- under minimum demand conditions, total demand for light duty vehicles will increase from a level of 21 000 in 1983 to around 36 000 in late 80's, and on the average, pick-up demand will make up two thirds of the total demand.

ii-under favourable conditions, total demand is 22 900 in 1983 and rises to about 60 000 in the last three years of the decade, and pick-up demand makes up 64% of total demand.

4.5 DISTRIBUTION OF DEMAND INTO HP RANGES

4.5.1 Minibuses:

4.5.1.1 Minibuses are used for in-town passenger transport.

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Table 15. Minibus Demand (Total)

Years	Minimum Demand			Favourable Conditions		
	New	Replacement	Total	New	Replacement	Total
1983	5 121	2 275	7 396	5 808	2 275	8 083
1984	5 516	3 419	8 935	7 133	3 419	10 552
1985	5 941	4 303	10 244	8 739	4 303	13 042
1986	6 400	4 780	11 180	11 719	4 780	16 499
1987	6 893	4 593	11 486	13 288	4 593	17 881
1988	7 424	5 240	12 664	15 072	5 240	20 312
1989	7 997	4 929	12 926	17 090	4 929	22 019
1990	8 613	4 322	12 935	19 382	4 322	23 704
Avg(983-86)	5 745	3 694	9 439	8 350	3 694	12 044
Avg(987-90)	7 732	4 771	12 503	16 208	4 771	20 979
Avg(983-90)	6 738	4 233	10 971	12 279	4 233	16 512

(Replacement demand Calculated on the basis of sales 12 years earlier.)

Table 16. Pick-Up Demand (Total)

Years	Minimum Demand			Favourable Conditions		
	New	Replacement	Total	New	Replacement	Total
1983	8 567	5 100	13 667	9 727	5 100	14 827
1984	9 089	6 455	15 544	11 726	6 455	18 181
1985	9 641	8 824	18 465	14 077	8 824	22 901
1986	10 230	12 843	23 073	18 434	12 843	31 277
1987	10 852	16 544	27 396	20 372	16 544	36 916
1988	11 512	17 385	28 897	22 522	17 385	39 907
1989	12 213	13 163	25 376	24 889	13 163	38 052
1990	12 956	9 666	22 622	27 511	9 666	37 177
Avg(983-86)	9 382	8 306	17 688	13 491	8 306	21 797
" (987-90)	11 883	14 190	26 073	23 824	14 190	38 014
" (983-90)	10 633	11 248	21 881	18 658	11 248	29 906

(Replacement demand calculated on the basis of Sales 12 years earlier.)

Table 17. Total Demand for Light Duty Vehicles

Years	Minimum Demand			Favourable Conditions		
	Minibus	Pick-Up	Total	Minibus	Pick-Up	Total
1983	7 396	13 667	21 063	8 083	14 827	22 910
1984	8 935	15 544	24 479	10 552	18 181	28 733
1985	10 244	18 465	28 709	13 042	22 901	35 943
1986	11 180	23 073	34 253	16 499	31 277	47 776
1987	11 486	27 396	38 882	17 881	36 916	54 797
1988	12 664	28 897	41 561	20 312	39 907	60 219
1989	12 926	25 376	38 302	22 019	38 052	60 071
1990	12 935	22 622	35 557	23 704	37 177	60 881
Avg(1983-86)	9 439	17 688	27 127	12 044	21 797	33 841
Avg(1987-90)	12 503	26 073	38 576	20 979	38 014	58 993
Avg(1983-90)	10 971	21 881	32 852	16 512	29 906	46 418

Otosan has the largest capacity, and produces about seven times as many as the total production of the other two manufacturers. Otosan uses gasoline engines (of 63.2 HP). Otobus Karoseri uses a diesel engine (of 80 HP) and BMC, which has now left the minibus field, used gasoline engines. Recently, two firms, Karsan in Bursa and TOE, have started to produce diesel minibuses.

4.5.1.2 Because minibus owners tend to carry more passengers than normal and Turkish cities are situated on uneven ground (Istanbul, Ankara, Bursa, Zonguldak are a few examples), it is considered that buyers will prefer minibuses with high tractive force and maneuverability, and hence majority of the minibuses could be powered by a diesel engine of 80 HP. In line with this, two thirds of the demand is expected to be for 80 HP engines, one third for 62 HP.

4.5.2 Pick-ups:

4.5.2.1 Diesel-run pick-ups may be grouped into two power ranges. Those with GVW between 2300-3500 kg are equipped with an engine around 62 HP. Higher capacity pick-ups (GVW between 3500-5500 kg) use engines of about 80 HP.

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Some intermediate models are also available (see fig.1).

4.5.2.2 Lighter pick-ups make up a large portion of the park. Taking 1977 park of W.Germany, for example, it is seen that (see fig.2):

35.8% of park has pay load below 1000 kg

33.2% of park has pay load between 1000-1500 kg

13.9% of park has pay load between 1500-2000 kg

11.2% of park has pay load between 2000-2500 kg

5.8% of park has pay load between 2500-3000 kg.

4.5.2.3 This fact is also confirmed by the distribution of annual production into pay load ranges: 80% of W. German pick-up production in 1977, see fig.3, consisted of pick-ups with GVW below 4000 kg.This GVW range roughly corresponds to pick-ups with pay load below 2000 kg.

4.5.2.4 Sales of pick-ups in the last ten years in the domestic market would tend to confirm this trend in the distribution of pick-ups into capacity ranges. As seen from tables 18 and 19, on the average, 46% of sales belong to under 1000 kg pay load range, 32% to 1000-1500 kg

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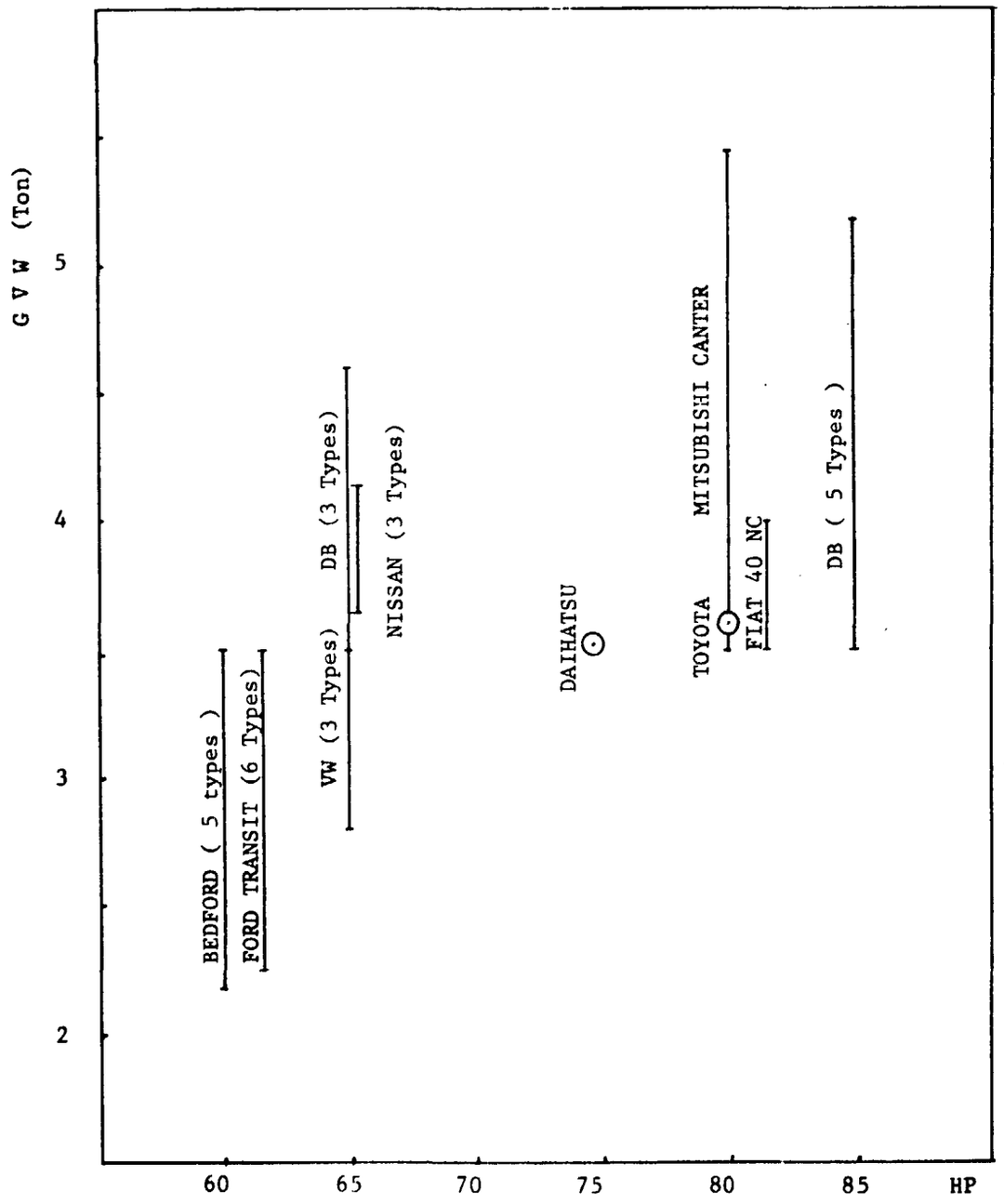

FIGURE : 1. HP RANGES OF DIESEL ENGINES USED ON PICK-UPS

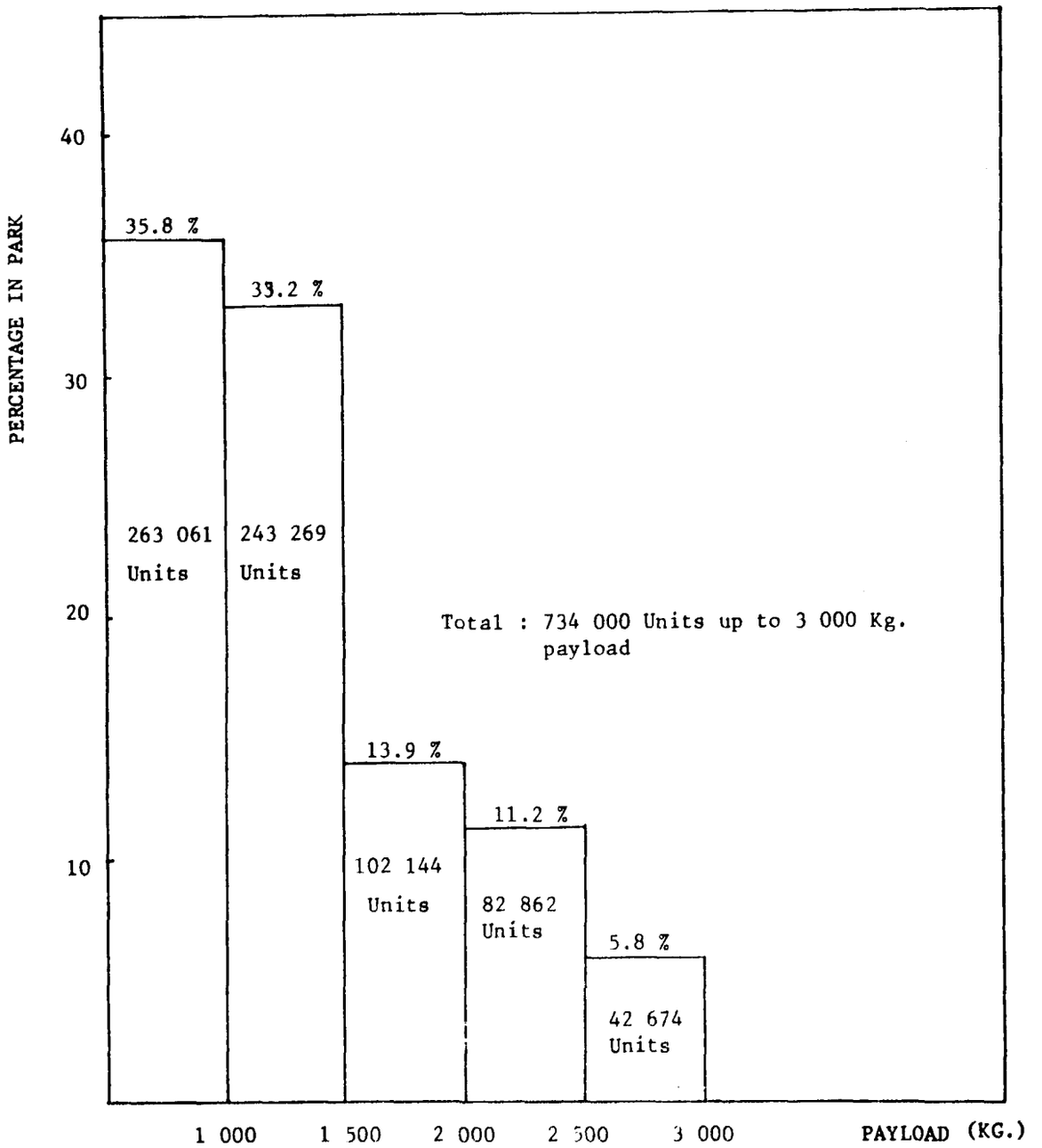

FIGURE : 2. DISTRIBUTION OF PICK-UP PARK INTO PAYLOAD RANGES

(W.GERMANY- 1977 PARK)

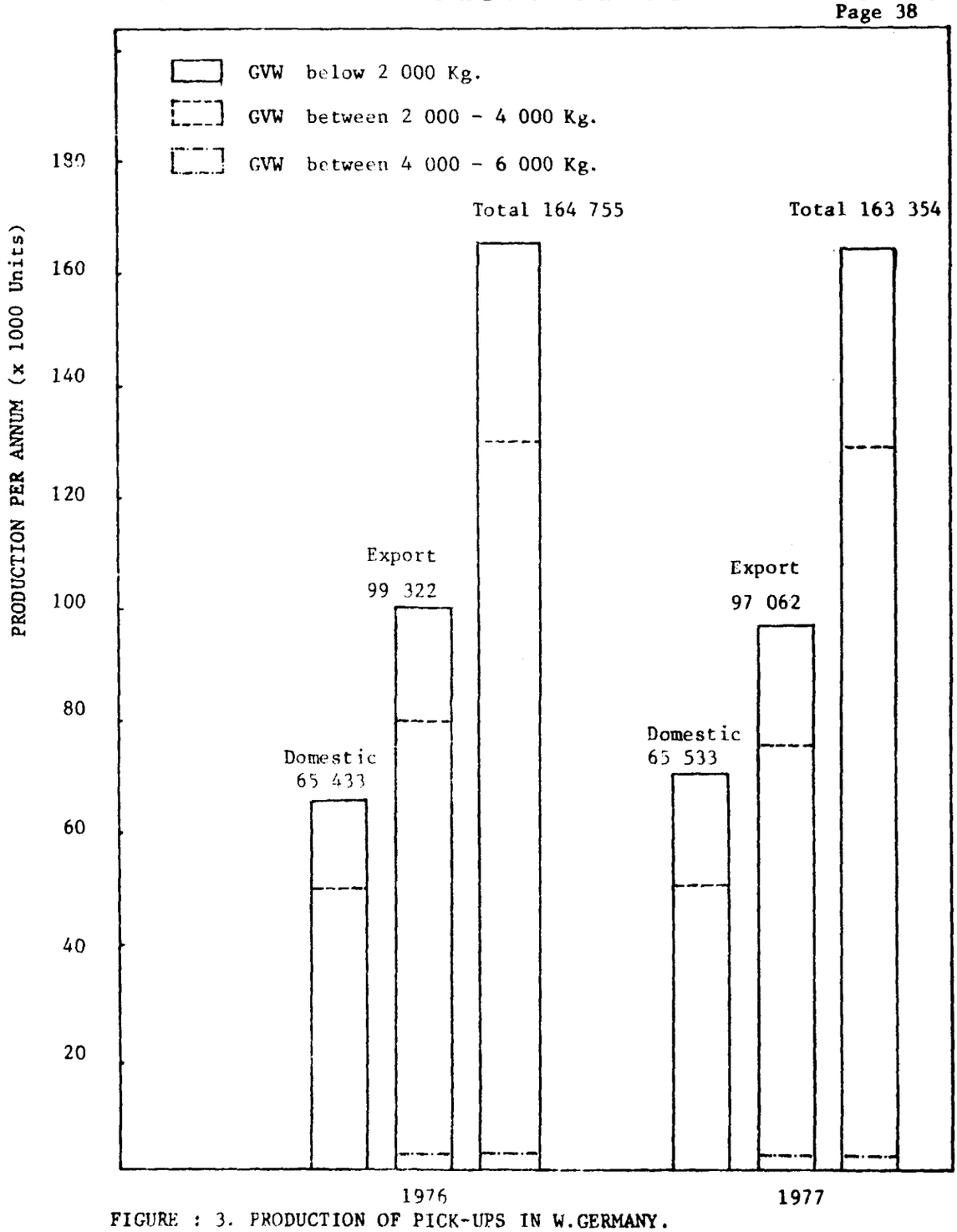

FIGURE : 3. PRODUCTION OF PICK-UPS IN W.GERMANY.

(GROUPED IN GVW RANGES)

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Table 18. Distribution of Past Pick-Up Production into Capacity Ranges

YEARS	Payload below 1 Ton				Payload between 1 and 1.5 Ton				Payload between 1.5 and 2.5 Ton			Total
	Anadolu Holding	Otosan Anadol	Çiftçiler	Sub. Tot.	BMC	Cyrysler	Otosan Ford.Trs.	Sub. Tot	TOE	Chrysler	Sub. Total	
1970	2 279	-	-	2 279	-	1 185	-	1 185	583	348	931	4 395
1971	916	299	-	1 215	132	1 448	-	1 580	1 066	588	1 654	4 449
1972	2 100	512	-	2 612	598	876	-	1 474	757	1 143	1 900	5 986
1973	2 385	1 002	-	3 387	1 139	1 239	-	2 378	1 328	1 581	2 909	8 674
1974	2 533	1 564	152	4 249	1 908	2 692	-	4 600	1 000	1 680	2 680	11 529
1975	2 811	4 133	352	7 296	1 913	3 066	551	5 530	1 818	3 048	4 866	17 692
1976	3 346	5 202	238	8 786	2 220	2 802	2 062	7 064	1 230	2 640	3 870	19 740
1977	655	4 124	901	5 680	2 014	2 936	1 495	6 445	300	1 632	1 932	14 057
1978	800	2 831	700	4 331	468	72	-	540	-	566	566	5 437
1979	3 274	2 732	220	6 226	696	474	646	1 816	400	920	1 320	9 362
1980	2 097	2 055	316	4 468	665	607	627	1 899	100	525	625	6 992
TOTAL	23 196	24 454	2 879	50 529	11 753	17 397	5 381	34 531	8 582	14 671	23 253	108 313

Table 19. Distribution of Past Pick-Up Production into Payload Ranges (Percentages)

Years	Percentage of production		
	Payload below 1 Ton	Payload 1-1.5 Ton	Payload 1.5 - 2.5 Ton
1970	52	27	21
1971	27	36	37
1972	44	25	31
1973	39	27	34
1974	37	40	23
1975	41	31	28
1976	45	36	19
1977	40	46	14
1978	80	10	10
1979	67	19	14
1980	64	27	9
Total	46	32	22

Table 20. Manufacturers, Models and Suitable HP Ranges

Payload	Manufacturer and Model	Engine Presently Used, HP/d/d	Suitable Diesel Engine
Less than 1 Ton	Skoda 1202	G 47/4500	50 HP
	Anadol 500	G 54/5500	
	Çiftçiler VWEA 489	G 45/4000	
1-1.5 Ton	BMC TM 30	D 52/4250	65 HP
	Chrysler D 100	G 111/3600	
	Chrysler W 100	G 111/3600	
	Otosan Ford Transit	G 63/5000	
1.5 - 2.5 tons	TOE IH 1230	D 78/2480	80 HP
	Chrysler D 200	G 111/3600	

G : Petrol Engine D : Diesel Engine

range and 22% to 1500-2500 kg range. That is, the percentage share of sales of pick-ups equivalent to 80 HP diesel run pick-ups is about 22%.

4.5.2.5 However, the share of this range of pick-ups is expected to increase in future to the level of 30% in parallel with trends observed in W. German market. Therefore, 30% of pick-up demand is expected to be for 80 HP engines, 70% for 62 HP.

4.5.3 Distribution of Total Demand into HP Ranges:

4.5.3.1 Total demand figures shown in table 17 are divided into HP ranges, in accordance with the percentages stated in paragraphs 4.5.1.2 and 4.5.2.5. The results are shown in table 21.

4.5.3.2 From this analysis of total demand for light duty diesel engines we may conclude as follows:

(i) Total demand for light duty diesel engines is estimated to be about 22000 in the year 1983. This demand increases to the level of 38 500 per annum towards the end of the decade under minimum

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demand conditions and, to the level 59 000 under favourable conditions.

(ii) Total demand can be met by two types of diesel engines: one of about 62 HP output, the other 80 HP. About 45% of total demand is for 80 HP engine and 55% for 62 HP engine.

Table 21. Distribution of Diesel Engine Demand Into HP Ranges

	Minimum Demand Conditions			Favourable Conditions		
YEARS	62 HP	80 HP	TOTAL	62 HP	80 HP	TOTAL
1983	12 032	9 031	21 063	13 073	9 837	22 910
1984	13 859	10 620	24 479	16 244	12 489	28 733
1985	16 340	12 369	28 709	20 378	15 565	35 943
1986	19 878	14 375	34 253	27 394	20 382	47 776
1987	23 006	15 876	38 882	31 801	22 996	54 797
1988	24 449	17 112	41 561	34 706	25 513	60 219
1989	22 072	16 230	38 302	33 976	26 095	60 071
1990	20 147	15 410	35 557	33 925	26 956	60 881
Avg(983-86)	15 527	11 600	27 127	19 272	14 569	33 841
" (986-90)	22 419	16 157	38 576	33 602	25 391	58 993
" '983-90)	18 973	13 879	32 852	26 437	19 981	46 418

Table 21. Distribution of Diesel Engine Demand Into HP Ranges

	Minimum Demand Conditions			Favourable Conditions		
YEARS	62 HP	80 HP	TOTAL	62 HP	80 HP	TOTAL
1983	12 032	9 031	21 063	13 073	9 837	22 910
1984	13 859	10 620	24 479	16 244	12 489	28 733
1985	16 340	12 369	28 709	20 378	15 565	35 943
1986	19 878	14 375	34 253	27 394	20 382	47 776
1987	23 006	15 876	38 882	31 801	22 996	54 797
1988	24 449	17 112	41 561	34 706	25 513	60 219
1989	22 072	16 230	38 302	33 976	26 095	60 071
1990	20 147	15 410	35 557	33 925	26 956	60 881
Avg(983-86)	15 527	11 600	27 127	19 272	14 569	33 841
" (986-90)	22 419	16 157	38 576	33 602	25 391	58 993
" '983-90)	18 973	13 879	32 852	26 437	19 981	46 418

CHAPTER V

EXPORTS

5.1 There is a considerable potential for exports of light duty vehicles equipped with diesel engines 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.

5.2 It is felt that a minimum of 10% of the engine production should be earmarked for exports either as engines to developing countries, like Saudi Arabia and Iran, which have started automotive assembly industries, or indirectly in vehicles to be exported.

5.3 It should be ensured that there is no restriction in license agreements between Turkish manufacturers and foreign Licensors, concerning exports of engines manufactured in Turkey.

5.4 Export Projections:

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. It is important that they 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.

5.5 With the domestic demand expected to be around 40 000-50 000 by 1990, plans should be made to export 5000 engines by that time.

5.6 Considerable efforts will be needed to set up an effective marketting organisation to get a foothold in foreign markets. This will includ. not only organisational step to be taken by manufacturers but also help and assistance by the Government during bilateral trade negotiations with potential customer countries.

CHAPTER VI

SUPPLY POSITION

6.1 VEHICLE MANUFACTURE

6.1.1 Minibus:

Minibus manufacturers have no engine production facilities as such, except BMC. With restrictions in recent years on the import of CBU engines, all manufacturers have started to assemble their own engines from CKD imports and some locally manufactured parts.

All minibus manufacturers use gasoline engine, except Otobus Karoseri which installs an 80 HP air-cooled diesel (Klockner-Humboldt-Deutz license). Karsan in Bursa has started a diesel minibus (Peugeot J9 type) recently and is expected to shortly market it. TOE, too, has introduced a diesel minibus.

BMC is the only minibus manufacturer who also produces engines. BMC diesel engines are not suited to minibus applications and BMC used gasoline engines on minibuses of their own production

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until 1978 when they stopped minibus production.

Minibus production capacity is shown in table 22.

6.1.2 Pick-ups:

Only two firms produce diesel powered pick-ups: BMC and TOE. BMC uses a 52 HP engine of their own manufacture and TOE assembles from imported KD and some locally supplied parts. Diesel powered pick-ups make up only 1% of total sales of the past ten years.

Gasoline engines are installed in all other makes of pick-ups. Import of gasoline engines in CBU form is prohibited and vehicle manufacturers assemble their own engines at varying local content levels.

Pick-up production capacity is shown in table 23.

6.2 ENGINE MANUFACTURING

6.2.1 BMC Diesel Engines:

BMC produces two series of diesel engines (forged components are imported) and has a total installed capacity of 20 000 units per annum. Series 98 engines have two versions: the 4

Table 22. Minibus production capacity (as of 1980)

Name of Firm	Model Produced	Installed capacity
Otosan	Ford Transit	5000
Otobüs Karoseri	Magirus M 80 S 4,5	1000
Karsan	Peugeot J 9	3500
TOE	D1230	1000
	T O T A L	10500

Table 23. Pick-Up production capacity (as of 1980)

Name of Firm	Model Produced	Installed Capacity
Otosan	Ford Transit Pick-Up ,Anadol 500	7000
BMC	TM 30	5000
Chrysler	D 100, W 100, D 200	6000
TOE	D 1230	2000
Çelik Montaj†	Skoda 1202	4000
Çiftçiler	VW EA 489	6000
	TOTAL	30000

† Now a member of "Anadolu Otomotiv Sanayii"

cylinder version, 4/98, produces 75 HP at 2600 rpm, while 6/98 gives 120 HP (at the same rpm). These engines, being of intermediate speed and high torque, is suitable for use on medium duty trucks. Installed capacity for series 98 engines is 10 000 units per annum. The second type of engine manufactured by BMC has a displacement volume of 1800 cc and produces 52 HP at 4250 rpm. The production capacity for this type of engine, too, is 10 000 units per annum.

BMC uses a version of their 1800 cc engine on Leyland tractors of their own manufacture and the installed capacity of BMC for tractors is 5000 per annum. This leaves a capacity of 5000 engines as being available for light duty engines suitable for pick-up/minibus application.

6.2.2 Otosan:

It is understood from SPO that Otosan has firm plans to produce 25 000 gasoline engines, and it has been assumed that 10 000 of these will be for pick-up/minibus application.

6.2.3 Other Manufacturers:

As noted earlier, all vehicle manufacturers assemble their

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own engine as the import of CBU engines is not permitted. But, since local manufacturers operate on relatively low levels of production, they have not been able to install engine manufacturing facilities.

6.3 Comparison of Supply and Demand:

6.3.1 We may now compare projections of supply and demand for light duty engines for 1983-1990 period, table 24. It will be seen that planned supply (Tumosan project not included) will not meet demand and the difference, that is unmet demand, will be between 12 000 and 19 000 in 1983-86 period and will rise to a level between 24 000 and 44 000 towards the end of the decade.

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Table 24 : Comparisan of Supply and Demand Projections for the Period of 1983-1990

YEARS	Total Domestic Demand		Installed Capacity of other manufacturers (BMC+OTOSAN)	Unmet Demand	
	Minimum Demand Conditions	Favourable Conditions		Minimum Dem. Conditions	Favourable Conditions
1983	21 063	22 910	15 000	6 063	7 910
1984	24 479	28 733	15 000	9 479	13 733
1985	28 709	35 943	15 000	13 709	20 643
1986	34 253	47 776	15 000	19 253	32 776
1987	38 882	54 797	15 000	23 882	39 797
1988	41 561	60 219	15 000	26 561	45 219
1989	38 302	60 071	15 000	23 302	45 071
1990	35 557	60 881	15 000	20 557	45 881
Avg(1983-86)	27 127	33 841	15 000	12 126	18 766
Avg(1987-90)	38 576	58 993	15 000	23 575	43 992
Avg(1983-90)	32 852	46 418	15 000	17 851	31 379

CHAPTER VII

TUMOSAN LIGHT DUTY DIESEL ENGINE PROJECT

7.1 PRODUCTS:

7.1.1 License Agreement signed with Mitsubishi Motors Corporation (MMC) covers two types of diesel engines. These engines are the 4 and 6 cylinder versions of the same basic engine and hence the two engines have many common parts. The parts which are not common can be machined on the same machining lines.

7.1.2 The 4DR50 engine, which is the 4-cylinder type, gives 79 HP at 3700 rpm (DIN 70020). By adjustment of the fuel pump, a version of this engine is obtained with an output of 62 HP at 3600 rpm. Hence, the 79 HP version is suitable for minibuses, midibuses and pick-ups of 1.5-2.5 tons carrying capacity, while the main use for the 62 HP version will be pick-ups of carrying capacity upto 1.5 tons. In addition to these conventional uses, the 79 HP version is likely to have a sizeable market in military jeep applications.

./..

7.1.3 6DR50 engine, the six cylinder type, produces 104 HP at 3600 rpm and is suitable for light trucks of net carrying capacity above 2.5 tons and for such applications as fork lifts and generators.

7.2 CAPACITY AND INVESTMENT PROGRAMME

7.2.1 The proposed capacity of the plant is 40 000 engine per annum, and the product mix at full capacity is planned as 4DR engine 32 000, 6DR engine 8000 pa.

7.2.2 Investment plan foresees that five main components of the engine, known as 5 C, cylinder block, cylinder head, crankshaft, camshaft and conn-rods be manufactured in the plant. Only a few components such as injection pump and glow plugs will be imported and all other parts will be procured from local sub-suppliers.

7.2.3 Investment is proposed to be carried out in three stages: In the first stage, cylinder block machining line is to be set up together with assembly and test facilities and a local content of 40.9% is proposed to be reached. Equipment for machining cylinder head and conn-rods is planned to be installed in the second stage and the local content ratio is planned to increase, at the end of this stage, to 62.5%. Production of crankshaft

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and camshaft will be left to the third phase. When the third phase investment is completed, the total of local content in engines is planned to reach 84.3%, and in-plant production within this figure is expected to be 38.4%.

7.2.4 Total cost of investment (June 1981 prices and 1 $. = 107.45 TL) is as follows: (1000.--TL.)

Total cost: 8 571 000 TL.

Foreign currency: 6 538 000 TL. (60.8 Million $.)

7.2.5 Foreign currency required for the import of machinery and equipment totals 55.6 million $. and this total is divided into the three investment phases as follows:

First phase: 26 million $.

Second phase: 13.1 million $.

Third phase: 16.5 million $.

7.2.6 The project is planned to employ 688 employees and foreign currency savings to result from local production is estimated at 65 million $. per annum.

7.3 PRODUCTION PLAN

7.3.1 The plant is to start assembling engines in 1984 and a total

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of 5000 engines is foreseen for this first year. 10 000 engines are planned for the second year of operation and cylinder blocks of 5000 of these engines are to be manufactured in the plant. Second phase of investment is planned to be completed in the year 1986 and third phase in 1987. Proposed annual productions of 4DR engines is shown in table 25 together with local content ratios to be reached each year.

7.3.2 There is no definite plans for the manufacturing of 6DR engines. These engines are to be introduced to the Turkish market through import and production is to be planned according to the response obtained.

Production plans of Tumosan are compared in table 26 with market available for 4DR50 type engines.

7.3.3 It will be seen that while under favourable conditions the market will be sufficiently large for Tumosan to sell all of its production, in the case of minimum demand conditions, the market will be too small for Tumosan from 1987 onwards, and this may lead to serious underutilisation of capacity at levels as low as 50% towards 1990's.

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UNITED NATIONS DEVELOPMENT PROGRAMME IN TURKEY

Birleşmiş Milletler Kalkınma Programı

NATIONS UNIES

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Table 25 : Local Content Ratio by Years Planned by Tümosan

%	3.6		15.2		10.7		8.9		LOCAL CONTENT RATIO %		
	A S S E M B L Y		CYLINDER BLOCK		CYLINDER HEAD CON ROD.		CRANKSHAFT CAMSHAFT				
	Production Q'ty	Capacity Utilizat. (%)	Production Q'ty	Capac. Utili. (%)	Production Q'ty	Cap. Util. (%)	Produc. Q'ty	Capa. Util (%)	IN PLANT	SUB SUPPLI.	TOTAL
1984	5 000	13	-	-	-	-	-	-	3.6	21.0	24.6
1985	10 000	25	5 000	13	-	-	-	-	11.2	29.7	40.9
1986	15 000	38	10 000	25	5 000	13	-	-	17.3	33.0	50.3
1987	25 000	63	25 000	38	15 000	38	5 000	13	27.0	36.7	63.7
1988	32 000	80	32 000	80	32 000	80	15 000	38	33.7	41.0	74.7
1989	40 000	100	40 000	100	40 000	100	32 000	80	38.4	45.9	84.3
1990	40 000	100	40 000	100	40 000	100	40 000	100	38.4	45.9	84.3

Table 26 : Comparison Between TÜMOSAN plans and available Market for 4DR50 type engines

YEARS	Minimum Demand Conditions			Favourable Conditions		
	Market Available	Planned Production By TÜMOSAN	Market/ Production	Market Available	Planned Production By TÜMOSAN	Market/ Production
1983	6 063	-	-	7 910	-	-
1984	9 479	5 000	1.90	13 733	5 000	2.75
1985	13 709	10 000	1.37	20 643	10 000	2.06
1986	19 253	15 000	1.28	32 776	15.000	2.19
1987	23 882	25 000	0.96	39 797	25 000	1.59
1988	26 561	32 000	0.83	45 219	32 000	1.41
1989	23 302	40 000	0.58	45 071	40 000	1.13
1990	20 557	40 000	0.51	45 881	40 000	1.15

7.4 WORK IN PROGRESS

7.4.1 Plant is located next to Medium and Heavy Duty Diesel Engine Plant of Tumosan in Aksaray (Nigde). Infrastructure facilities at the site such as power center, water and electricity supply, roads and drainage are built jointly. Main workshop with 25 000 sq. metre roofed area is under construction.

7.4.2 The Licensor, MMC, prepared a general engineering study for the whole plant and a detailed engineering study for the assembly stage.

7.4.3 Investment to date totals 280 million TL.(book value) which is made up of 250 million TL. spent on construction and 30 million TL. paid to the Licensor for engineering studies.

7.4.4 Adaptation of 4DR50 engine (79 HP) to light trucks manufactured by Chrysler AŞ has been carried out successfully and a prototype is under test. This same engine has been adopted to the jeeps used by the Army. At present, jeeps are powered by gasoline engines, thus, besides other advantages, substitution of diesel engines will result in a significant saving of petroleum since diesels consume 30% less fuel (in volume) than gasoline engines for the same power production.

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[illegible]

[illegible] RECOMMENDATIONS

8.1 Domestic Demand

8.1.1 [illegible] two main uses for light-duty vehicles [illegible] stations to jeeps (both for military and civilian use), generators, water pumps and [illegible].

8.1.2 [illegible] have grown very rapidly in the past 20 years. Pick-up park increased from a level of 28 000 in 1962 to 344 [illegible] corresponding, [illegible] growth rate [illegible] Minibus park rose in the same period, [illegible] 62 478

[illegible] available [illegible] used in [illegible] policies recommended [illegible] 00, average [illegible] and 3.9% and [illegible].

8.1.4 Predictions made on this basis show that total annual demand for minibuses and pick-ups will be about 22 000 in the year 1983 and this will rise to a level between 38 000 and 59 000 towards the end of this decade. Total demand is distributed between pick-ups and minibuses in the ratio of about two to one, respectively.

8.1.5 Most of locally manufactured minibuses are powered by gasoline engines. Only one manufacturer (Otokar) uses diesel engines but two other diesel models have recently been introduced to the market by Karsan (66.5 HP) and TOF (78 HP). Pick-up situation is similar in that although two manufacturers TOE (78 HP) and BMC (52 HP) have diesel models, a very large percentage in the market have gasoline engines.

8.1.6 Developments in local market (mentioned in 8.1.5) and trends in world automotive industry indicate that diesel powered vehicles are preferred (specially for commercial applications) because of the fuel economy.

8.1.7 Domestic demand for light duty diesel engines are grouped in two power ranges. Engines of around 52 HP are used in pick ups of pay load upto 1.5 tons and engines of about 80 HP on minibuses and pick ups of pay load between [illegible] tons. Analysis of local market indicates that [illegible] will be

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for 62 HP range and 45% for 80 HP.

8.2 Local Manufacture:

8.2.1 Vehicle Manufacturing Capacity: Present capacity for production of minibuses is 10 500 and for pick-ups 30 000 units per annum. Pick-up production capacity is sufficient to meet expected developments in demand until 1987 with normal working and extra demand until 1990 may be met with overtime working. Accordingly, pick-up production capacity is not expected to limit demand. Minibus production capacity could already fall short of demand by 1985 and hence could restrict engine demand. But, developments expected in minibus demand (table 17) indicate that expansion of capacity will be justified and it is supposed that such expansion will be duly realised so as not to restrict demand over a significant period of time.

8.2.2 Engine Manufacturing Capacity: Vehicle manufacturers using gasoline engines assemble their own engines from CKD and locally manufactured parts. But, because each manufacturer requires only a small number of engines, modern production facilities are not available. Situation with diesel users is much the same except BMC who has attained a fair degree of localisation in engine manufacturing. BMC has a total capacity for the light duty type of engine of 10 000 units per annum, but

considering their production of engines for their own tractors it has been assumed that they will be able to achieve an output of 5000 light duty engines per annum for automotive applications most of which will be in the form of pick-ups rather than separate engines sold to vehicle manufacturers.

8.3 Comparison of Demand and Supply:

8.3.1 Although engine requirements of vehicle manufacturers are presently met without resorting to the import of CBU engines (i.e. by assembling CKD and parts procured from local sub-suppliers), actual capacity for engine production is much behind that for vehicle production.

8.3.2 Otosan were given in 1977 an incentive to produce 10 000 trucks, 7000 minibuses and 3000 pick-ups. Later, however, they sought permission to produce parts of gasoline engines (25 000 pa) for minibuses and pick-ups and diesel engines for trucks (10 000 pa). This permission was granted in 1980. Assuming that Otosan will meet the market for 10 000 minibuses and pick-ups (with gasoline engines), the demand of diesel engines for these applications will be reduced to this extent.

8.3.3 Comparison of supply and demand (Table 24) shows that engine manufacturing capacity present and planned will not be able to meet demand in future years. The difference between projected demand and planned supply, unmet demand, is expected to be between 12 000 and 19 000 in the period 1983-86 and to rise to a level between 24 000 - 44 000 pa towards the end of this decade.

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8.4 Tumosan Light Duty Diesel Engine Project

8.4.1 Engine Type: Tumosan 4DR engines with two versions, one of 79 HP and the other 65 HP can meet the requirements of the domestic market until 1990s. The market is not yet large enough for a second type of engine such as 6DR.

8.4.2 Production Capacity: Tumosan plans to install a total production capacity of 40 000 units per annum for two types of engines (4DR and 6DR), but only the 4DR type is to be produced until 1990s. Comparison of Tumosan's plans with market available indicates that under minimum demand conditions, Tumosan will not be able to fully utilize this capacity.

8.5 RECOMMENDATIONS

8.5.1 i- Tumosan should create capacity in the first instance only for 4DR engines. Investment plans for 6DR engine should be postponed until the domestic market is secured for this engine.

ii- Tumosan should base its immediate investment plans on a capacity of 20 000 per annum in 2 shifts.

iii- The master plan for light duty engines however should provide for a capacity of 40 000 in 2 shifts.

iv- A review of market condition may be taken up in 1985-86

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to determine the feasibility of expansion of capacity to 40 000 engines pa.

v- Collaboration agreements of Tumosan should be reviewed in the light of above recommendation.

By following these recommendations the amount of initial investment required, specially foreign currency part, will be considerably reduced. In addition, with high rate of capacity utilisation the production will be more economical and competitive and at the same time Tumosan will be ready to expand capacity when required.

8.5.2 Localisation Plans: Tumosan plans to start production with a local content ratio of 24.6% in 1984 and increase this to a level of 84.3% by the year 1988. Local content ratio planned for each year of production is as follows:

Local Content Ratio

	In-plant	Sub-suppliers	Total
1984	3.6	21.0	24.6
1985	11.2	29.7	40.9
1986	17.3	33.0	50.3
1987	27.0	36.7	63.7
1988	33.7	41	74.7
1989	38.4	45.9	84.3
1990	38.4	45.9	84.3

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It is understood that local content ratio cannot be increased beyond 84.3% until fuel pump, glow plugs and some bearings are available as local manufacture. A continuous and close watch on the local content ratio is recommended.

8.5.3 Adaptation Work: It is understood that adaptation of 4DR engines to military jeeps has been successfully completed. Its application for Chrysler pick-ups has completed trials. A plan should be drawn out for adapting the engine to other vehicles and this plan should be promptly implemented so as to make sure that vehicle manufacturers are ready to use this engine when it becomes available in 1984. This however will be possible only with active Government support.

8.5.4 An emphasis on creation of marketing organisation to promote exports is essential. A nucleus of one or two persons could be provided even now to continually study trends of design and technology in the context of demand in Turkey's natural markets for exports to the Middle East and other Islamic countries.

8.5.5 A very close watch on steps to ensure adequate and timely supply of castings and forgings will be necessary to avoid locked-up utilized costly machinery and assembly equipment. (Supply of castings and forgings will be dealt with in a separate report).

8.5.6 An organisation to encourage and monitor the development of ancillary industries to feed Tumosan will be essential. It is recommended that full use be made of the computerized "components and process data bank" developed by IDBT (TSKB) as a part of their contribution to the Capital Goods Development Project.

8.5.7 Training of engineers, technicians and workers in the licensor's plant and offices will require very close monitoring. Particular attention is recommended for training of production, industrial, quality control and design engineers.