BY THE COMPTROLLER GENERAL

Report To The Congress

OF THE UNITED STATES

Army Procurement Of 10kW, 60Hz Gas Turbine Generators Is Highly Questionable

A 10-kilowatt (kW), 60-hertz (Hz) gas turbine generator which the Army plans to buy does not meet the Army's requirements. Its reliability is too low, fuel consumption too high, and life-cycle cost excessive. The Army could save from $275 million to $1.6 billion over 20 years if it purchased diesel generators instead of 5,938 10kW gas turbines. GAO recommends that the Army (1) purchase diesel generators instead of gas turbines for its 10kW power requirements and (2) evaluate using 5kW diesel and gasoline generators instead of 10kW gas turbines for its 5kW power requirements.

PSAD-79-
AUGUST 9, 19

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-163058

To the President of the Senate and the Congress
Speaker of the House of Representatives

This report discusses the Army's need to reassess its intended procurement of 10-kilowatt, 60-hertz gas turbine generators.

We reviewed the Army's gas turbine research and development program because a preliminary survey indicated that the gas turbine is not reliable, uses too much fuel, and costs more than current generators.

We are sending copies of this report to the Director, Office of Management and Budget, and the Secretaries of Defense and the Army.

Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

ARMY PROCUREMENT OF 10kW, 60Hz GAS TURBINE GENERATORS IS HIGHLY QUESTIONABLE

D I G E S T

The Army could save from $275 million to $1.6 billion over 20 years if it purchased diesel generators instead of 5,938 10-kilowatt (kW), 60-hertz (Hz) gas turbine generators. In addition to its high cost, the 10kW gas turbine generator has other drawbacks, including high fuel consumption and poor reliability.

BACKGROUND

Mobile electric generators are the main source of electric power for the armed forces in the field. The two primary types of mobile generators now used by the Army are gasoline engine-driven and diesel engine-driven generators. In addition, the Army is developing a 10kW gas turbine engine-driven generator.

The 10kW, 60Hz gas turbine generator has been in research and development by the U.S. Army Mobility Equipment Research and Development Command for 13 years at a cost of $5.8 million. The Army plans to begin production in fiscal year 1980.

The 10kW, 60Hz gas turbine generator will be used primarily to support water purification equipment, machine and electrical repair shop equipment, and radio teletypewriters. The Army approved a requirement for 5,938 units, 1,387 to satisfy 10kW power requirements and 4,551 to satisfy 5kW power requirements.
(See pp. 1 to 2 .)

10kW GAS TURBINE GENERATOR DOES NOT SATISFY ARMY'S REQUIREMENTS

The 10kW gas turbine generator consumes too much fuel, has poor reliability, has a high estimated life-cycle cost, and is not human portable.

PSAD-79-95

Fuel consumption

The gas turbine generator consumes two to three times more fuel than current diesel or gasoline generators. This conflicts with the Department of Defense's policy to reduce fuel consumption.

Reliability

Also, the gas turbine generator has failed so far to meet reliability requirements. Currently it has only half the reliability of diesel generators.

Life-cycle cost

GAO estimates that the 20-year cost of acquiring and operating 5,938 10kW gas turbine generators is from $275 million to $1.6 billion more than diesel generators, depending on annual usage. Much of this cost difference is due to the gas turbine's high fuel consumption. Other factors which neither GAO nor the Army addressed in the cost estimates, but which could increase the cost of the gas turbine even more, are generator life, component costs, and diagnostic and test equipment costs.

Human portability

The gas turbine generator does not meet the Army's requirement of human portability. Originally intended to weigh 250 pounds, it now weighs 456 pounds. (See pp. 3 to 8.)

THE ARMY SHOULD BUY 10kW DIESEL GENERATORS TO SATISFY ITS 10kW POWER REQUIREMENTS

The Army justified buying the gas turbine generator, even though the diesel is more cost effective, because of the need for a lightweight generator. Only 50 of the 1,387 generators intended to fill 10kW power requirements, however, are for use by the airmobile or airborne divisions where the lightweight requirement is justified. Even though

the gas turbine weighs considerably less than the diesel, it is questionable whether the gas turbine, with its major drawbacks, should be used for this requirement. GAO looked at the requirements for 1,182 of the other 1,337 generators and could find no significant reason why the heavier 10kW diesel cannot be used.

The Army could save between $62 million and $370 million over 20 years if it bought 1,387 diesel generators instead of gas turbine generators to meet its 10kW power requirements. (See pp. 9 to 13.)

THE ARMY SHOULD EVALUATE USING 5kW DIESEL AND GASOLINE GENERATORS TO SATISFY ITS 5kW POWER REQUIREMENTS

Of the 5,938 10kW gas turbine generators the Army plans to buy, 4,551 (77 percent) will be used to satisfy 5kW power requirements. Therefore, to meet these needs, the Army should evaluate using 5kW diesel and 5kW gasoline generators in its upcoming cost and operational effectiveness analysis.

Although the 5kW diesel appears to be the best generator to fulfill 5kW power requirements, there may be transportation problems to overcome since two diesels (one is used as an alternate) exceed the weight capacity of the 3/4-ton trailer currently used. According to Army field officials, however, the transportation problem has a number of possible solutions. Also, the heavier weight of the diesel could pose a problem for an additional 98 generators to be used by airmobile and airborne divisions.

The 5kW gasoline generator presents no weight problem, however, since it weighs basically the same as the 10kW gas turbine and can be carried on the current 3/4-ton trailer. Also, the 5kW gasoline generator offers two significant benefits over the 10kW gas turbine. First, the 5kW gasoline generator uses one-half the fuel; and, second, it costs one-fifth as much. In addition, the Army is testing a

breakerless ignition system for the 5kW gasoline generator, which is expected to increase its reliability and availability.

If the Army bought 5kW diesel generators instead of 4,551 10kW gas turbines to fulfill 5kW power requirements, the estimated life-cycle cost savings would be from $213 million to $1.3 billion over 20 years. Although the gasoline generator is not as cost effective as the diesel, it appears that it may be more cost effective than the 10kW gas turbine since fuel savings alone could be $208 million over 20 years. (See pp. 14 to 18.)

RECOMMENDATIONS

The Secretary of Defense should direct the Army to:

--Buy 10kW diesel generators instead of 10kW gas turbine generators to satisfy 10kW power requirements. (See p. 13.)

--Evaluate using 5kW diesel and gasoline generators before buying 10kW, 60Hz gas turbine generators to satisfy 5kW power requirements. (See p. 18.)

AGENCY COMMENTS

According to Defense officials, the Army is currently revising its cost and operational effectiveness analysis and analyzing recent test results. The Army will decide formally whether to buy the 10kW, 60Hz gas turbine generator in September 1979. (See p. 19.)

Contents

ABBREVIATIONS

AOH	annual operating hours
GAO	General Accounting Office
Hz	hertz
kW	kilowatt
MERADCOM	Mobility Equipment Research and Development Command
MTBF	mean-time-between-failure

CHAPTER 1

INTRODUCTION

DEPARTMENT OF DEFENSE STANDARD FAMILY OF GENERATORS

Mobile electric generators are the main source of electric power for the armed forces in the field. The two primary types of mobile generators now used by the Army are gasoline engine-driven and diesel engine-driven generators. In addition, the Army is now developing a 10-kilowatt (kW), 60-hertz (Hz) gas turbine engine-driven generator.

In 1965 the Department of Defense recognized that a proliferation of types and models of generators was causing logistics, maintenance, and training problems. As a result, it established the position of project manager for mobile electric power to coordinate a Defense-wide effort to provide a standard family of electric generators to be used by all services. Before a service can buy a new generator which is not in the standard family, the generator has to be approved as a deviation or added to the standard family.

DEVELOPMENT OF THE 10kW GAS TURBINE GENERATOR

The 10kW, 60Hz gas turbine generator has been in research and development by the U.S. Army's Mobility Equipment Research and Development Command (MERADCOM) for 13 years at a cost of $5.8 million. The Army approved a requirement for 5,938 10kW, 60Hz gas turbine generators and plans to begin production in fiscal year 1980. The 10kW gas turbine generator will be used primarily to support water purification equipment, machine and electrical repair shop equipment, and radio teletypewriters.

The 10kW, 60Hz gas turbine generator is one of a six-member family of gas turbine generators which the Army planned to develop. Development of the family of gas turbine generators began in 1966 as a replacement for standard Department of Defense tactical generators. The generators were to be lightweight, compact, quiet, highly reliable, and low in fuel consumption.

Of the six generators planned for development, the Army started developing two; but now only the 10kW gas turbine generator is authorized for development. The 10kW gas turbine generator was intended as a general purpose

generator. However, because of its high cost, the Army now plans to use it only when operational mission or mobility requirements justify a lightweight generator. The Army is now deciding whether to develop the other generators.

The Army has approved a requirement for 5,938 lightweight gas turbine generators, 1,387 to satisfy 10kW power requirements and 4,551 to satisfy 5kW power requirements. The 10kW gas turbine generator was selected to satisfy the 5kW power requirement, according to Army officials, because two 5kW diesel generators are too heavy for the trailers they would be mounted on. 1/

Production of the 10kW, 60Hz gas turbine generator is uncertain at this time. The 10kW gas turbine has had a series of reliability problems. In fall 1978, two major components of the generator were changed to correct the reliability problems. Testing of the change was completed in July 1979, but final test results are not yet available. The Army plans to decide whether to procure the 10kW, 60Hz gas turbine generator at an inprocess review scheduled for the first quarter of fiscal year 1980.

SCOPE OF REVIEW

Our review was conducted primarily at Ft. Belvoir, Virginia, at the Office of the Project Manager for Mobile Electric Power, MERADCOM, and the U.S. Army Engineer School. We discussed reasons justifying procurement of the 10kW gas turbine generator with officials at several U.S. Army Training and Doctrine Command Schools. We also obtained opinions from officials at Army field units at Ft. Hood, Texas, and at Ft. Benning, Ft. Stewart, and Ft. Gordon, Georgia.

1/One is an alternate generator.

CHAPTER 2

10kW GAS TURBINE GENERATOR

DOES NOT SATISFY ARMY'S REQUIREMENTS

The 10kW gas turbine generator does not satisfy the Army's requirements. It consumes too much fuel, has poor reliability, has a high estimated life-cycle cost, and is not human portable.

HIGH FUEL CONSUMPTION

The 10kW, 60Hz gas turbine generator, designed to use primarily diesel but also jet fuel, uses two to three times more fuel than current gasoline or diesel generators. This conflicts with the Department of Defense's policy to reduce fuel consumption. Consequently, the need to transport more fuel acts to negate the lighter weight of the generator.

The Army required the 10kW gas turbine generator to be low in fuel consumption. Originally, fuel consumption was not to exceed 20 pounds per hour. This was later increased to 24 pounds per hour. Although tests show the 10kW gas turbine generator meets this requirement, this fuel consumption rate is two to three times greater than that for current gasoline or diesel generators. During each 24-hour day, the 10kW gas turbine generator would use between 300 and 400 pounds more fuel than a diesel generator and about 200 pounds more fuel than a gasoline generator. The high fuel consumption rate appears to be in direct conflict with the stated Department of Defense policy to reduce gasoline and diesel fuel consumption by 10 percent by 1985.

In addition, the high fuel consumption acts to negate the 10kW gas turbine generator's primary advantage of being lightweight because of the need to transport additional fuel. According to Army field personnel, for example, in some units an additional fuel tanker would be required just to carry the extra fuel the 10kW gas turbine generator would use.

POOR RELIABILITY

The 10kW, 60Hz gas turbine generator has failed so far to meet reliability requirements. It was designed to have higher reliability than gasoline or diesel generators, but so far it has failed to do so. It was to have a minimum 500-hour mean-time-between-failure (MTBF), which would provide a reliability of 95 percent for the typical 24-hour mission.

In major test phases, however, the 10kW gas turbine failed to achieve this reliability, as shown below.

Test	MTBF (note a)
Development test II	109 hours
Operational test II	58 "
Development test II (retest of modified sets)	240 "
Development test IIA	323 "
Operational test IIA	(b)

a/MTBF is based on a 90-percent confidence level.

b/Final test results not available.

An operational test IIA was completed in July 1979, but final test results are not yet available. Both development test IIA and operational test IIA results will be used by the Army to determine if the 10kW gas turbine has met its 500-hour MTBF requirement. Even if the 10kW gas turbine generator were to attain a 500-hour MTBF, this would still be considerably lower than the 650-hour MTBF of 10kW diesel generators.

EXCESSIVE LIFE-CYCLE COST

We estimate that 5,938 10kW gas turbine generators, with their current reliability, will cost from $275 million to $1.6 billion more than diesel generators over 20 years. Much of this cost difference is due to the gas turbines high fuel consumption. The Army, however, has estimated a much smaller life-cycle cost difference between the generators.

The additional costs (in 1978 dollars) to buy 10kW gas turbine generators instead of diesel generators, according to the Army's and our estimates, are shown below and on page 6. Our first estimate assumes that the 10kW gas turbine generator has a 323-hour MTBF, which is what the generator attained during its development test IIA. Our second estimate assumes that the 10kW gas turbine generator has attained its required MTBF of 500 hours.

Increased or Decreased (-) Cost Over 20 Years of Buying 5,938 Gas Turbine Instead of Diesel Generators

Army's estimate		Our estimates			
400 AOH (note a)	4,000 AOH	323-hour MTBF 400 AOH	323-hour MTBF 4,000 AOH	500-hour MTBF 400 AOH	500-hour MTBF 4,000 AOH
(000,000 omitted)					
$102	-$13	$275	$1,635	$223	$1,128

a/Annual operating hours (AOH).

Our estimates are based on the Army's life-cycle cost estimate with certain adjustments. The primary reasons for the differences between our and the Army's life-cycle cost estimates are:

--The diesel's repair parts, maintenance personnel, and depot maintenance costs were overstated in the Army's estimate.

--The gas turbine's repair parts, maintenance personnel, and fuel consumption costs were understated in the Army's estimate.

--The Army compared the gas turbine generator only to 10kW diesels, whereas we considered a mixture of 5kW and 10kW diesels based on the user's actual power requirements. (Including 5kW diesel generators when feasible, instead of the 10kW used by the Army in its analysis, reduced the purchase, transportation, and fuel costs.)

The major changes we made to the Army's cost estimate were discussed with the MERADCOM Chief of Cost Analysis. He agreed that the changes seemed reasonable.

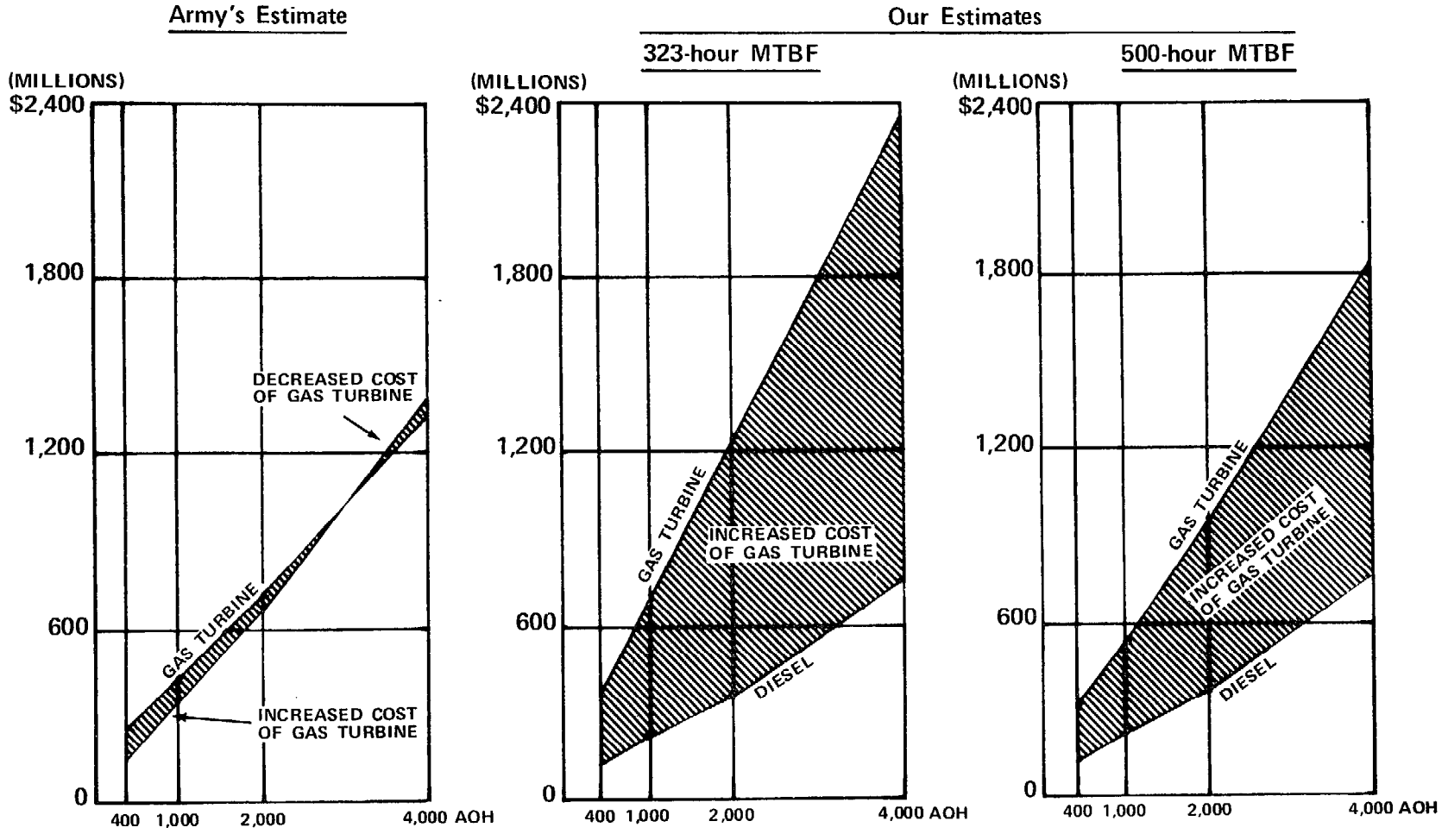
Other questionable aspects of the life-cycle cost estimate

Several other aspects of the cost estimate appear to be questionable and could significantly increase the cost of the 10kW gas turbine generator, although we did not attempt to quantify them.

Questionable generator life

The life of the 10kW gas turbine is shown as 50,000 hours, which is double the 25,000 hours shown for the diesel.

Increased or Decreased Cost over 20 Years of Buying 5,938 Gas Turbine Instead of Diesel Generators



However, according to MERADCOM representatives, the determination of the life estimate of the gas turbine was completely arbitrary. Showing the life of the gas turbine generator as double that of the diesel created the need to purchase almost twice the number of diesels as gas turbine generators at the higher AOH (2,000 to 4,000).

Undetermined component cost

According to a MERADCOM representative, the Army has not determined the cost of the 10kW gas turbine generator's 12 major components. Under the current maintenance concept, its components would have to be stockpiled and replaced in the field. The cost of the most often replaced components and the cost to store the major components in the field may greatly increase the life-cycle cost of the 10kW gas turbine generator.

Undetermined diagnostic and test equipment cost

The Army has not determined the cost of diagnostic and test equipment for the 10kW, 60Hz gas turbine generator, according to a MERADCOM representative. The logistic plan for the 10kW gas turbine generator shows that 15 types of diagnostic and test equipment, not now standard in the Army, will be required to maintain the gas turbine generator. The cost of this additional diagnostic and test equipment for field units would increase costs.

NOT HUMAN PORTABLE

The 10kW gas turbine generator weighs too much to meet the Army's requirement of human portability. It weighs 456 pounds, and Army regulations specify that it should not be lifted by hand higher than 2 feet or carried more than five steps. A generator that could be moved without materials handling equipment, Army officials said, would help offset the additional fuel logistics burden of the gas turbine. However, since 77 percent of the gas turbines are to be bolted to trailers prior to being fielded, human portability for most of the generators is unnecessary.

CONCLUSIONS

The 10kW, 60Hz gas turbine generator has failed to satisfy many of the Army's requirements and is poorer in most aspects than current generators. In comparison with the diesel generator, the gas turbine uses three times more fuel,

is half as reliable, has a considerably higher estimated life-cycle cost, and is not human portable.

In commenting on our draft report, Army officials said that reliability of the 10kW gas turbine may improve. However, if a reliability of 500-hour MTBF is attained, the additional life-cycle cost for 5,938 gas turbines would still be from $223 million to $1.1 billion greater than for diesels. Moreover, in order for the maintenance cost of the gas turbine and diesel to be the same, the gas turbine's MTBF would have to increase to about 830 hours (a 90-percent confidence level). However, the diesel would still have a cheaper life-cycle cost, with the savings being primarily due to its lower fuel consumption. Our life-cycle cost estimate is based on a 1978 diesel fuel cost of 46 cents a gallon, which, with the recent increase in fuel costs, no doubt substantially understates the diesel's fuel cost advantage.

CHAPTER 3

ARMY SHOULD BUY 10kW DIESEL GENERATORS TO SATISFY ITS 10kW POWER REQUIREMENTS

The Army could save between $62 million and $370 million over 20 years if it bought 1,387 diesel generators instead of gas turbine generators to meet its 10kW power requirements. Of the 5,938 generators the Army plans to buy, only 1,387 need to be the 10kW size. Chapter 4 discusses the alternatives to be considered in satisfying 5kW requirements for the remaining 4,551.

The Army justified buying the gas turbine generator, even though the diesel is more cost effective, because of the need for a lightweight generator. Only 50 of the 1,387 generators, however, are for use by the airmobile or airborne divisions where the lightweight requirement is justified. Even though the gas turbine does weigh considerably less than the diesel, it is questionable whether the gas turbine, with its major drawbacks, should be used for this requirement.

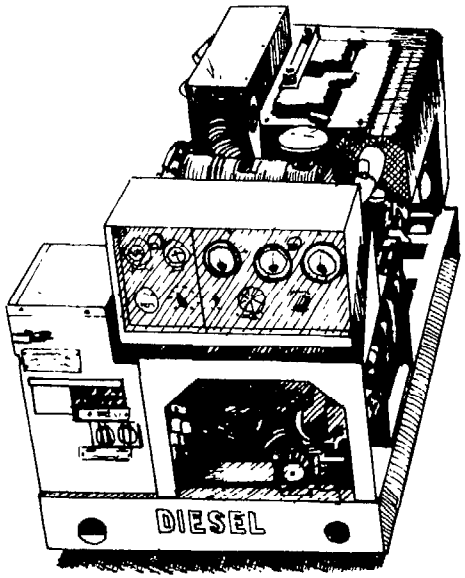
In looking at the requirements for 1,182 of the other 1,337 generators, we could find no significant reason why the heavier 10kW diesel cannot be used.

10kW DIESEL GENERATOR BETTER THAN 10kW GAS TURBINE

The 10kW diesel generator is better than the 10kW gas turbine in three major aspects--it costs less, is twice as reliable, and uses one-third as much fuel. However, it weighs three times as much. A comparison of the generators and a picture of each follow.

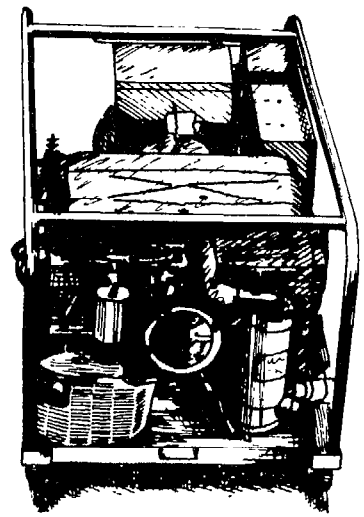
Comparison factors	Alternative generators	
	10kW gas turbine	10kW diesel
Unit purchase cost	$ 26,130	$ 5,843
Estimated life-cycle cost per generator:		
400 AOH	$ 70,483	$ 20,877
4,000 AOH	$424,771	$153,239
Reliability (mean-time-between-failure based on development tests)	323 hrs.	650 hrs.
Durability (mean-time-between-overhaul)	6,000 hrs.	5,000 hrs.
Weight	456 lbs.	1,240 lbs.
Fuel consumption per 24 hours	548 lbs.	181 lbs.

ARMY MOBILE ELECTRIC GENERATORS



10kW Diesel

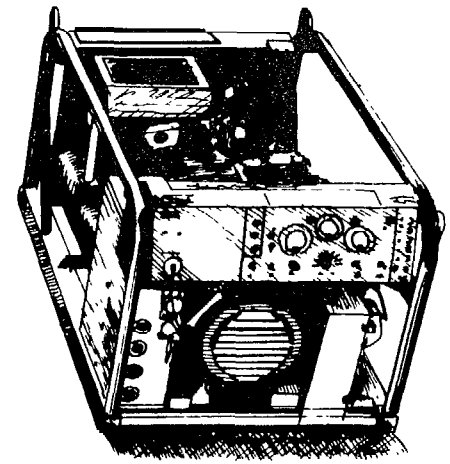
Length	62"
Width	32"
Height	37"
Cubic Ft.	42.5



10kW Gasoline

Length	57"
Width	30"
Height	28"
Cubic Ft.	27.9

Current Generator



10kW Gas Turbine

Length	45"
Width	29"
Height	25"
Cubic Ft.	18.9

If the Army bought 1,387 10kW diesel generators instead of 10kW gas turbines, it could save from $62 million to $370 million over 20 years.

LIGHTWEIGHT GENERATORS NOT REQUIRED FOR 10kW POWER NEEDS

In reviewing equipment specifications and talking with Army personnel responsible for equipment that the generators will support, we could find no significant reason why the 10kW diesel generator could not be used instead of the gas turbine. Of the 1,387 10kW gas turbine generators the Army plans to buy to fulfill the 10kW power requirement, 1,182 are to support one of four types of equipment--water purification, demineralization, woodwork shop, and electrical shop equipment sets. The lightweight generators are not necessary for this equipment.

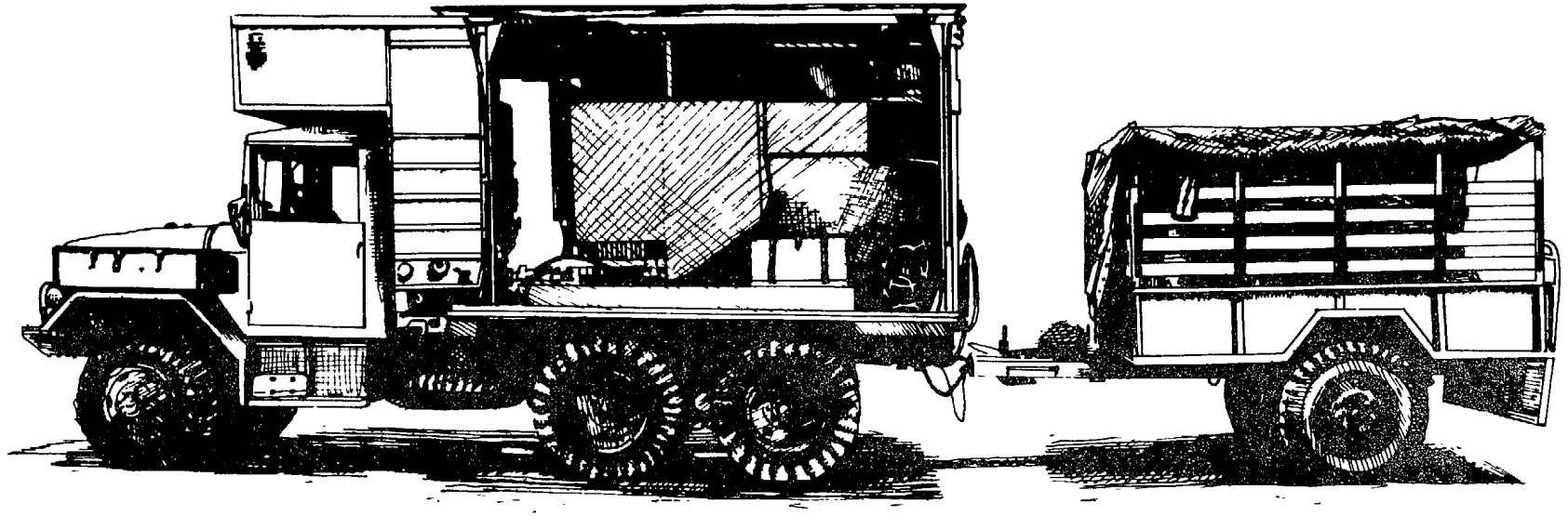
10kW diesel generator can support water purification, demineralization, and woodwork shop equipment sets

We could find no significant reason why a 10kW diesel generator could not be used in support of water purification, demineralization, and woodwork shop equipment sets. One generator to support each set is carried on a 1-1/2-ton trailer as shown in the following picture. The U.S. Army Engineer School representative responsible for justifying these requirements could give no reason why a 10kW diesel generator could not be used, other than that lightweight generators are better for forward areas than heavier ones.

10kW diesel generator can support electrical shop equipment sets

A 10kW diesel generator can be carried on existing vehicles with no problem. It and the shop equipment can be transported on a 6-ton semitrailer. Each shop equipment set is powered by one 10kW generator carried on the tongue of the semitrailer. According to Army personnel responsible for this equipment, the diesel generator could physically fit and could be supported on the tongue of the semitrailer. Army personnel could see no significant reason the diesel could not be used and actually preferred a diesel generator because of its reliability.

WATER PURIFICATION EQUIPMENT



Water Purification Set

Generator

CONCLUSIONS

The 10kW diesel generator is better than the 10kW gas turbine generator in three major aspects--cost, reliability, and fuel economy. Despite the drawbacks of the gas turbine, the Army justified using it to fulfill the 10kW power requirement because of its lightweight. However, only 50 generators are required for airborne and airmobile uses, and there appears to be no other reason why the diesel generator could not be used instead of the gas turbine in the other 1,337 cases. Buying 10kW diesel generators instead of the 1,387 10kW gas turbines could save an estimated $62 million to $370 million over 20 years.

RECOMMENDATION TO THE SECRETARY OF DEFENSE

We recommend that the Secretary of Defense direct the Army to buy 10kW diesel generators instead of 10kW gas turbine generators to satisfy its 10kW power requirements.

CHAPTER 4

ARMY SHOULD EVALUATE USING 5kW DIESEL AND GASOLINE GENERATORS FOR 5kW POWER REQUIREMENTS

The Army should evaluate using 5kW diesel and 5kW gasoline generators instead of gas turbines to satisfy its need for approximately 4,551 5kW generators. However, the Army does not plan to consider 5kW generators in its upcoming cost and operational effectiveness analysis, even though most of the 5,938 10kW gas turbines will be used to satisfy 5kW power requirements. A picture of the three generators is on the following page.

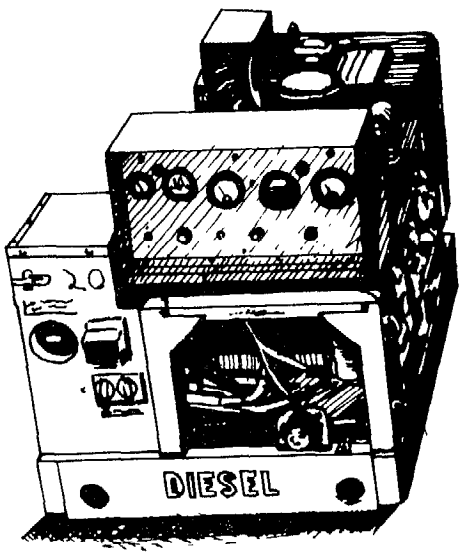
The diesel generator and possibly the gasoline generator could satisfy the Army's needs more cost effectively than the gas turbine. For example, if the Army used 5kW diesels instead of the 4,551 10kW gas turbines, it could save between $213 million and $1.3 billion over 20 years depending on hours of use. Although the Army did not determine the cost effectiveness of the gasoline generator, it may also be more cost effective than the gas turbine. For example, fuel savings alone could be $208 million over 20 years.

The heavier weight of the diesel would cause transportation problems for all of the generators and would be less desirable for the 98 generators to be assigned to airborne and airmobile divisions. Army field officials suggested a number of possible solutions to the transportation problems. In computing the estimated savings for using diesels instead of gas turbines, we did not consider the potential additional cost of alternative means of transporting the diesels. If the Army concludes that there is no cost-effective solution to using the heavier diesel, it should consider 5kW gasoline generators, which weigh about the same as the gas turbine.

5kW GENERATORS BETTER THAN 10kW GAS TURBINE

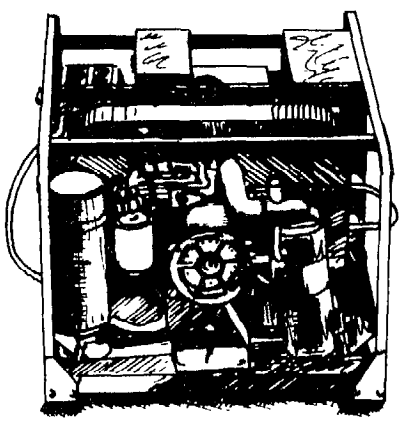
As shown in the table on page 16, the 5kW diesel and the 5kW gasoline generators appear to better satisfy the Army's 5kW power requirements than the 10kW gas turbine. For each comparison factor, we have indicated which generator is best. The diesel is best in four of the six categories and almost as good in another. The only category in which it falls short is weight. The primary advantage of the gas turbine is its lightweight, but the gasoline generator weighs only a few pounds more.

ARMY MOBILE ELECTRIC GENERATORS



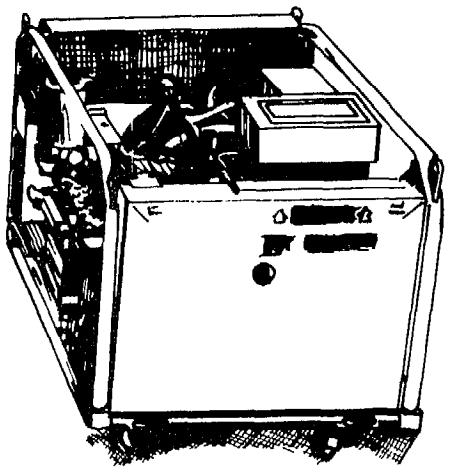
5kW Diesel

Length	50 5/8"
Width	32"
Height	37"
Cubic Ft.	34.7



5kW Gasoline

Length	39 3/4"
Width	30"
Height	25"
Cubic Ft.	17.3



10kW Gas Turbine

Length	45"
Width	29"
Height	25"
Cubic Ft.	18.9

Current Generator

Comparison of Generators
To Satisfy 5kW Power Requirements

Comparison factors	Alternative generators		
	10kW gas turbine	5kW diesel	5kW gasoline
Unit purchase cost	$26,130	a/$4,708	$4,854
Estimated life-cycle cost per generator:			
400 AOH	b/$ 68,083	$ 16,261	(c)
4,000 AOH	b/$400,814	$117,611	(c)
Reliability (mean-time-between-failure)	323 hrs.	650 hrs.	d/250 hrs.
Durability (mean-time-between-overhaul)	6,000 hrs.	5,000 hrs.	3,000 hrs.
Weight	456 lbs.	900 lbs.	488 lbs.
Fuel consumption per 24 hours	b/440 lbs.	94 lbs.	207 lbs.

a/Blocking indicates best or nearly best.

b/Fuel consumption and life-cycle cost based on operating at 5kW power level, which uses less fuel and therefore costs less than when operating at 10kW power level.

c/Not determined.

d/This figure is for the current generator, which does not have a breakerless ignition system expected to increase future reliability.

FEASIBILITY OF USING 5kW DIESEL GENERATORS

Most of the 10kW gas turbine generators are to be mounted in pairs on 3/4-ton trailers. Although two 5kW diesels are too heavy to be transported on a single 3/4-ton trailer, the Army did not examine other methods of transporting the 5kW diesel generator, according to a MERADCOM official.

Army field personnel believe there are acceptable ways of transporting the heavier diesel generators. Although no one solution was acceptable to everyone, solutions which users said would be acceptable and not interfere with carrying out a combat mission are as follows:

--Strengthen the 3/4-ton trailer to carry the diesel load, or buy a 1-ton trailer and pull this either with the current 1-1/4-ton truck (if possible) or with a larger truck.

--Buy a second 1-1/4-ton truck ($6,000) and a 3/4-ton trailer ($1,900) to carry the second diesel generator. (Unit representatives said they needed additional trucks for administrative purposes. The extra truck could be used to move the second generator to where it is needed and then used for other purposes.)

--Use only one reliable 5kW diesel generator on current vehicles, along with the 100-ampere generator kit on the truck engine, and some (0 to 15 percent) alternate units. 1/

In our opinion, one of the above suggestions, or a combination of them, could be a cost-effective solution allowing the use of diesel generators. If the Army bought 5kW diesel generators instead of the 4,551 10kW gas turbines, it could save between $213 million and $1.3 billion over 20 years.

FEASIBILITY OF USING 5kW GASOLINE GENERATORS

Although the gasoline generator is not as cost effective as the diesel, it appears to be more cost effective than the 10kW gas turbine and weighs only 32 pounds more. The current 3/4-ton trailer is now used to transport two 5kW gasoline generators. Also, its weight should pose no more problem for airborne and airmobile units than a gas turbine since they weigh about the same. Therefore, if the Army concludes that there is no cost-effective solution to carrying the heavier diesels, we believe that it should examine the cost effectiveness of gasoline generators.

The current gasoline generator has a 250-hour MTBF, with its present ignition system accounting for over half of the failures. However, MERADCOM is to test the use of a breakerless ignition system on 5kW gasoline generators. The Army expects the breakerless ignition system to increase the future reliability and availability of the gasoline generator as well as reduce its fuel consumption.

1/Two generators have been used in the past to provide an alternate if the first generator fails.

Although the Army only compared the 10kW diesel generator with the 10kW gas turbine generator, by buying 4,551 5kW gasoline generators, the Army could save up to $208 million in fuel costs alone.

CONCLUSIONS

Both the 5kW diesel generator and the 5kW gasoline generator appear to be more cost-effective ways than the 10kW gas turbine generator to satisfy the Army's 5kW power requirements. The Army, however, did not evaluate using the 5kW gasoline or diesel generators in its cost and operational effectiveness analysis. Before buying the 10kW gas turbine, we believe the Army should evaluate the 5kW generators.

RECOMMENDATION TO THE SECRETARY OF DEFENSE

We recommend that the Secretary of Defense direct the Army to evaluate using 5kW diesel and gasoline generators before buying 10kW, 60Hz gas turbine generators to satisfy the 5kW power requirements.

CHAPTER 5

AGENCY COMMENTS

On June 28, 1979, representatives of the Secretary of Defense gave us their oral comments on this report. We have evaluated their comments and made appropriate changes.

In general, Department of Defense representatives said the formal decision to buy the 10kW, 60Hz gas turbine generators has not yet been made. They stated that they are currently revising the cost and operational effectiveness analysis and that testing had not been completed. They also said an inprocess review committee will meet in September 1979 to determine if the gas turbine generator meets the Army's requirements and should enter production. The committee will then forward its recommendation to the Secretary of the Army for final approval.

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