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FORD AEROSPACE AND COMMUNICATIONS CORPORATION

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Ladies and gentlemen, I am delighted to be here to provide an industrial viewpoint commentary on the status of the current parabolic dish technology and the associated DOE funded programs which assist in the development of commercialization.

I am substituting for Bob Pons who is well known to many of you. I am happy to report that Bob is making a strong recovery from open heart surgery, and he will be back leading our Solar Energy Systems engineering effort in a few weeks. He sends his regards.

First, are PFDR systems competitive? Chart 1 shows a study that compares BBEC (kWeh) for Point Focus-Distributed Receiver-Distributed Generation Systems as a function of production volume and time. This analysis draws upon much background data from JPL as well as FACC analysis. The solid lines 1-4 represent cost projections for new conventional oil fired power plants in small capacities (8 MW) at specific locations ranging from Catalina Island across the nation. The shaded area projects the cost of new coal-fired 1,000 MW capacities in the south Atlantic states to the west and north central states. Such calculations are highly sensitive to assumptions relative to fuel inflation rates over the 30 year period as well as assumed module production rates. Nonetheless, the salient point is that PFDR systems can be competitive in a large number of small communities, provided that adequate production volume can be developed.

Second, is the technology available? We think so, and intend to prove it by the operation of Engineering Experiment No. 1 this year at the JPL Parabolic Dish Test Site. You have heard, or will hear, a great deal about the Organic Rankine Engine, Phase II Experiment at this annual meeting. Further, you will hear a great deal about glass and plastic concentrators, and Stirling and Brayton engines.

Chart 2 presents the total system efficiency for each engine candidate coupled with either plastic or glass concentrators. Note the predicted engine thermodynamic performance increase is partially offset by the increased loss of the receiver at the higher temperature. The higher reflectivity of the glass concentrator provides a consistent 3-4 percent point improvement.

Third, system costs are highly sensitive to subsystem specifications. A few caveats are noted:

(1) Concentrator costs are a strong function of surface reflectivity, slope error, and concentration ratio.

(2) High temperature engine performance requires high concentration ratios, low slope errors, and high reflectance.

(3) Sun acquisition, track, and emergency detrack requirements strongly influence aperture face plate design and power conversion structural integrity, and survivability.

(4) Low life cycle costs require a fault tolerant design which utilizes simple maintenance procedures, and which does not propagate failure to adjacent modules.

(5) Low operating costs require a totally unmanned, computer controlled automatic mode of operation.

Fourth, are we heading toward the commercialization objective? Chart 4 projects a typical power module cost as a function of production quantity after initial R&D quantities have been tested. A commitment to production rates in excess of 1,000 power modules per year must be reached to achieve economic viability, and support the necessary investment in facilities and tooling. Note that the concentrator represents the largest component of cost.

Fifth, do the R&D programs phase into production? Chart 5 is an approximate schedule of current DOE development programs. Through 1984 only 65 power modules are programmed. Then a 2-year pause occurs before a production decision for first generation equipment is made. Low production rates will result in high unit costs.

We feel that it is essential that the period of 1984-86 be augmented with a number of additional 1 MW or larger systems. Secondly, we need an acceleration in production rate of prototypes to justify adequate production type tooling.

Sixth, what are the major problems inhibiting commercialization? Chart 6 lists five. Insufficient funds are currently programmed to support a full scale development transitioning into production. A multiplicity of programs is required.

PFDR technology suffers from an identity crisis. What are the appropriate markets? Does it complement the Power Tower? Is it applicable to repowering? If federal R&D funds are further reduced, will we have only the Power Tower as the sole solar thermal candidate?

It is my personal opinion that we - both government and corporate researchers - have failed to clearly delineate the roles for parabolic dish technology, particularly in regards to the decision makers in the Congress of the United States. In the months ahead, in view of the personnel changes in the Congress and the rather unsettled situation in the DOE, we ought to make a major effort to identify the roles and comparative benefits of this technology and present it to our government leaders. Given the desirability of this technology, I believe there is a major difficulty in bringing it to rapid and successful development and production. Although virtually all economic analyses show that the concentrator is approximately one-half the cost of the system, concentrator development is not proceeding at a pace sufficient to give the system developer choices and flexibility. Furthermore, there is not strong evidence that advanced concentrators are being developed which result in installed costs of less than $\$100/m^2$. We need to develop a parabolic dish industry as quickly as we can.

We feel that Parabolic Dish Technology offers significant advantages for thermal-electric application and it can be competitive in many situations. Industry faces the need to aggressively market these system advantages to obtain development funds and to proceed on a schedule which would permit timely evaluations and comparisons with alternate systems. We, at Ford, are dedicated to making this happen.

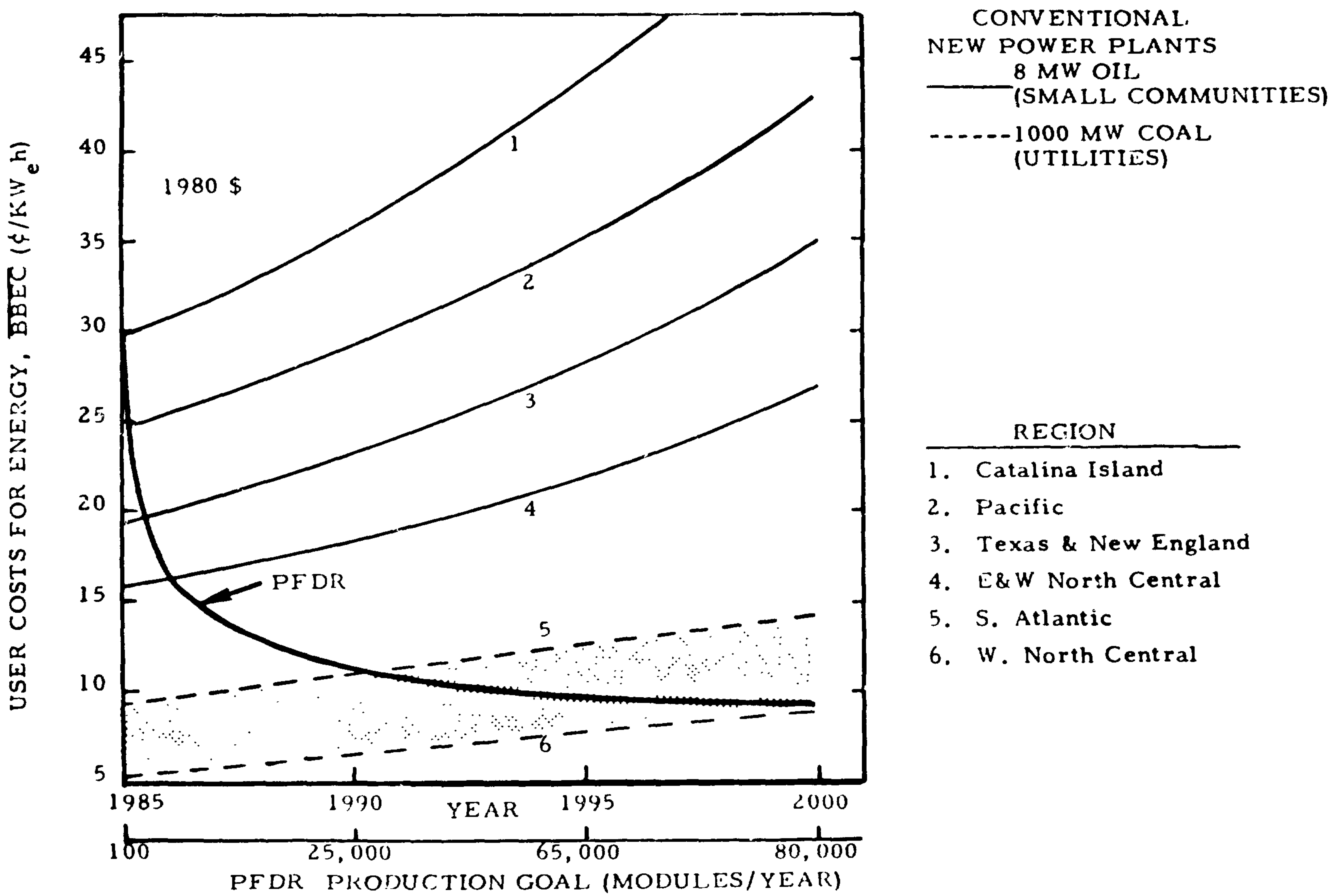
SYSTEM EFFICIENCY TRAINS

ENGINE TYPE	TURBINE INLET TEMP.	REFLECTOR	EFFICIENCIES		
			COLLECTION	PCS	SYSTEM
ORC	750°F	PLASTIC	0.67	0.28	0.17
		GLASS	0.79	0.28	0.20
STIRLING	1500°F	PLASTIC	0.61	0.37	0.21
		GLASS	0.73	0.37	0.25
	2200°F	PLASTIC	0.51	0.50	0.23
		GLASS	0.63	0.50	0.28
BRAYTON	1500°F	PLASTIC	0.61	0.30	0.17
		GLASS	0.73	0.30	0.20
	2200°F	PLASTIC	0.51	0.40	0.19
		GLASS	0.63	0.40	0.23

Ford Aerospace & Communications Corporation
Aeronutronic Division

POINT FOCUS DISTRIBUTED RECEIVER DISTRIBUTED GENERATION SYSTEMS ARE COST COMPETITIVE

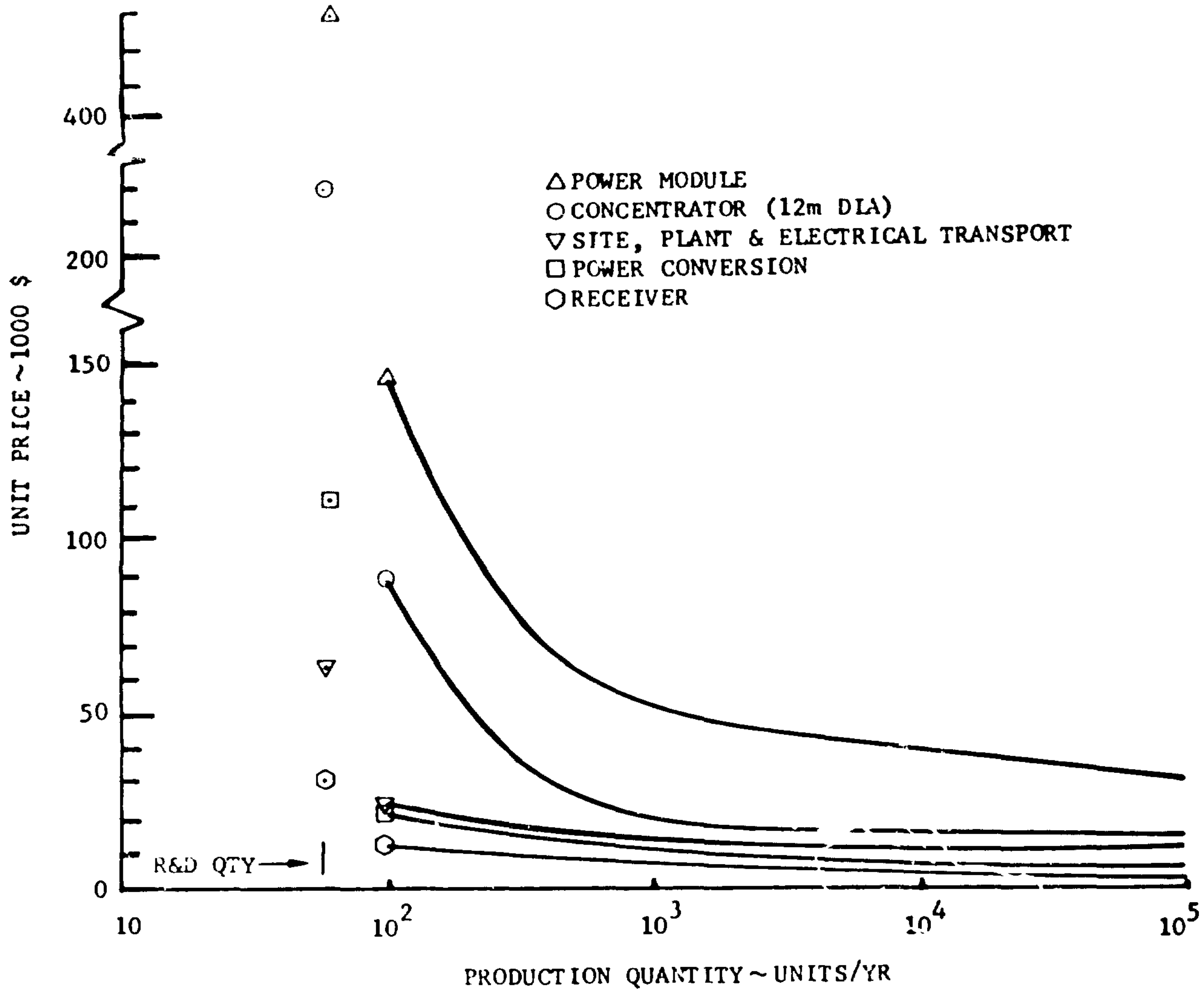
- NEAR TERM - SMALL COMMUNITIES
- FAR TERM - UTILITIES



SYSTEM COST CAVEATS

- CONCENTRATOR COSTS f (REFLECTIVITY, SLOPE ERROR, AND CONCENTRATION RATIO)
- HIGH TEMPERATURE ENGINE PERFORMANCE REQUIRES
  - HIGH CONCENTRATION RATIO
  - LOW SLOPE ERROR
  - HIGH REFLECTANCE
- SUN ACQUISITION, TRACK, DE-TRACK INFLUENCE
  - APERTURE FACE PLATE DESIGN
  - POWER CONVERSION STRUCTURAL INTEGRITY
  - SYSTEM SURVIVABILITY
- LOW LIFE CYCLE COSTS REQUIRE
  - FAULT TOLERANT SYSTEM DESIGN
  - UN-MANNED, COMPUTER-CONTROLLED SYSTEM OPERATION

TYPICAL POWER MODULE COSTS



POWER MODULE SCHEDULE

FY	'81	82	83	84	85	86	87	88	89	90	91	92	93	'94
●1 MW EE-1	1		55											
●100 KW EE-2A				6										
●20 KW EE-3	2													
●STIRLING PON		1												
TOTALS	3	1	55	6										
● PRODUCTION PROTOTYPES							1st GEN. SYS 600/YEAR				2nd GEN. SYS. 2,000/YEAR			
●PRODUCTION DECISION : FIRST GENERATION							◇							
SECOND GENERATION											◇			

MAJOR PROBLEMS INHIBITING COMMERCIALIZATION

- INSUFFICIENT FUNDING AND IDENTIFIED PROGRAMS TO BRIDGE BETWEEN DEVELOPMENT AND PRODUCTION
- PFDR IDENTITY CRISIS RELATIVE TO MARKETS, AND RE-POWERING, RELATIONSHIP TO CENTRAL RECEIVER-CENTRAL GENERATION SYSTEMS AND TROUGHS
- WHAT IS THE LIKELY OUTCOME OF A COMPETITION FOR FUNDS BETWEEN THE THREE SOLAR TECHNOLOGIES?
- NEED TO DELINEATE THE APPROPRIATE MARKET AND OBTAIN CONGRESSIONAL COMMITMENT
- ECONOMIC NECESSITY TO DEVELOP IMPROVED CONCENTRATORS WITH INSTALLED COSTS BELOW $\$100/M^2$.