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## THE CROSBYTON PROJECT

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## ABSTRACT

The occasion of this meeting was a Big Event for the Crosbyton Solar Power Project. The project both hosted the meeting and used the occasion for the first test of the ADVS, the largest single solar collector ever built. This project represents the only American work on the Bowl Concept, which Texas Tech refers to as the Solar Gridiron Concept. The concept is unique among the concentrating/tracking concepts in that it employs a stationary mirror to reduce cost. Tracking is accomplished by moving the receiver/boiler. The ADVS gridiron mirror forms a  $120^\circ$  arc of a sphere, surfaced with 430 curved panels, each about 1 m x 1 m. The aperture diameter of the dish is 65-ft. The preliminary system performance agrees with predictions and expectations. The mission of the project is to determine the feasibility and utility of building a 5 MWe solar-fossil fuel hybrid electric power plant employing the Solar Gridiron Concept, and, should the technical basis warrant construction, then to establish such a power plant at Crosbyton, Texas.

The Crosbyton Solar Power Project has hosted this meeting for Texas Tech and the U. S. Department of Energy. This has been a great privilege for several reasons. In particular, it offered us the opportunity to exhibit our Analog Design Verification System (ADVS), including the largest single solar collector ever built. The only problem with the exhibit was that it was not complete! In parallel with our efforts to make this a meeting that you would enjoy, we were trying very hard to complete the system and ready it for a demonstration. Intensive effort went into the site, particularly during the thirty days immediately preceding the meeting. Frankly, we wanted to try the system out in private, before a public demonstration-particularly in front of a "public" like you fellows.

By nightfall last Thursday, January 17, 1980 the ADVS had finally reached the point where it could be tested to see if it could make steam. The sun passed into clouds at sunset. There was no sunlight Friday, only clouds. There was no sunlight Saturday, . . . or Sunday, . . . or Monday. Time had essentially run out; this meeting would begin Tuesday morning. The meeting, targeted as an opportunity to show off the world's largest single solar collector, had come, and the ADVS was untested!

The crowning blow, after the four long days of waiting for the sun, came at 3:30 a.m. Tuesday, January 22: the snowfall began. I know well when it started to snow; I was driving through Crosby County on the way home from the

site. Tuesday morning and the USDOE meeting began with 6 inches of snow on the ground and a totally overcast sky.

Several USDOE officials, who could only be away from Washington for the one day, Tuesday, were driven to the Crosbyton site on Tuesday afternoon to, at least, see the hardware that they had funded: the largest single solar collector ever built. At that time it had collected only snow, never any solar power. As the van pulled into the site parking lot, a pale disk of the sun glimmered through the clouds. There might be an opportunity to test the system! Should an untested system be tried under such poor weather conditions, so late in the day (about 3:30 p.m.), in front of such distinguished visitors? Who knows what should have been -- it was! Following steps, rehearsed only mentally, the work force set up to try, not just for the first hot water ever produced, but to try for steam.

By 4:15 p.m. the system was ready for the attempt. The sun was doing much better, but was hazy and low in the sky. A foot of snow covered the bottom of the giant bowl. Upper mirror panels were caked to a lesser degree with snow and glittered with ice. Sixteen mirror panels were covered with plastic, frozen to the glass. The receiver had to be swung up two feet above the rim of the dish to acquire the sun. [Sometimes, your self-confidence has to be tested.] At 4:20 p.m. January 22, 1980, the system produced 500°F, 500 psi steam. The first scrimmage had taken place at the Solar Gridiron. Texas Tech and its subcontractor E-Systems had done it, had at least brought the system to operational status.

A second decision was required: should the demonstration, long pre-scheduled for 3:30 p.m. Wednesday, January 23, be attempted in front of the entire USDOE meeting attendance? [Your self-confidence will be tested more than once.] The two Greyhound buses and four vans, bringing you fellows, arrived at the site a little late. One bus had missed a turn, had gotten stuck in roadside mud, had been pulled out by former Crosbyton Mayor Snodgrass' son with a tractor, and arrived somewhat after 3:30 p.m. Somehow the word of a "first test" had spread through Crosbyton and Crosby County. The longest parade of pick-up trucks, vans, cars, ambulances, and school buses in memory, appeared, as if by magic, and covered every parking place for a quarter of a mile. Two separate, but well-mixed audiences were present. A crowd of approximately 300 people had come to the Solar Gridiron.

All was ready, the sun was bright in a crystal clear sky. [One lady from Crosbyton has prayed all night for a clear sky so we could have our chance. She was there, and there were tears in her eyes.] The receiver was swung to the correct position, the focal region of the dish. The receiver lit up with incredible brightness for the first time ever and steam came forth. Without any doubt, steam was produced. Santa Fe Railroad had loaned a steam whistle to the project. Before 300 witnesses the whistle began to spit and sputter; then it sounded and released its cloud of steam into the clear air. [At least it looked like a cloud to us, remember?] The first game had been played at the Solar Gridiron and you had Complimentary Tickets.



[Since this is the kind of paper that obviously could not have been written before my talk was given on Thursday morning, January 24, I will admit writing it later by inserting some anachronisms and describing what may appear to be future history.] Two days later, on Friday, January 25, the project work force made its first effort at "design condition steam": 1000°F at 1000 psi. Design condition was easily achieved! The week in review: Tuesday morning, it might work; Wednesday morning, it will work; Thursday morning, it does work.

Following the week of the meeting in late January, sixteen of the next eighteen days brought no useful sun. You fellows were here at the "right" time, as it turned out. Although our work force was under considerable pressure, it was a "right" time for us, too. You fellows had a rare experience that you may never have again: you got to watch somebody else's system being born in public. Sure, we were nervous, but you should have been also. You were the first to stand by those lines bearing live steam!

The ADVS is a scaled down (65-ft) version of the ten 200-ft mirror paneled dishes planned for an electric power plant at Crosbyton. Construction of the 65-ft dish was begun in July of 1979, but the project has been in the works since 1974. When the City Council of Crosbyton, Texas became alarmed with the high, and rising, prices of fossil fuels, T. J. Taylor (then mayor pro-tem) and Norton Barrett (City Secretary), and Bob Rhodes, Chamber of Commerce President, came to Texas Tech University to find someone interested in Solar Research. They were directed to me, a Professor of Electrical Engineering. Several ideas were discussed, and we finally decided on the Solar Gridiron Concept. The next step was Washington, D. C. Mr. Taylor, Mr. Barrett, Mr. Rhodes, and Dr. Stan Liberty (also a Professor in E.E.) and I went to Washington to talk with the ERDA, now USDOE. The project received \$2.5 million in 1976 to begin the necessary research to bring this dream to a reality. I have served as Project Director since the beginning and Dr. Herb J. Carper of the Department of Mechanical Engineering has been Project Manager since 1977, replacing Dr. Liberty. The Administrative Coordinator is Travis L. Simpson, whom you should all remember.

What makes the Solar Gridiron or Bowl Concept different from most concentrating/tracking solar concepts is that the mirror panels are fixed in place, and the receiver tracks the sun. The ADVS receiver, which is cylindrical in shape is wrapped with 2 black tubes. Through these tubes flows water, which because of the sun's concentration on the receiver, is heated to 1000°F steam. In a full scale system, the steam would then turn a turbine to produce electricity. If data from the ADVS proves, as expected, that the design is sound, then construction of the 200-ft dishes could begin as early as 1981. The preliminary optical to thermal conversion efficiency measure is coming in right on the expected levels. The dream is still there, and you were there!