The goal of The High Average Power Laser Program is to develop a high energy, repetitively pulsed laser system for Inertial Fusion Energy and other DOE and DOD applications.

The program is in its third year. In 1999 and 2000 the research concentrated on the two laser concepts: Krypton fluoride lasers (KrF) at NRL, and diode pumped solid state lasers (DPPSL) at LLNL. In 2001 the program was expanded to incorporate a national team to address the other critical components of Laser Fusion Energy, including: target fabrication, target injection, final optics, fusion chamber, and materials. The key components are being developed in concert with one another, with the science and engineering issues being addressed at the same time. This “integrated systems” approach ensures Laser Fusion Energy can be developed as a viable energy source. Significant progress has already been made in this program. A few highlights are summarized here. Also shown is a rendition of a laser fusion power plant.

1. **Lasers**
   - **KrF Lasers (“Electra”):**
     - Commissioned the first generation pulsed power system. This 500,000 Volt, 100,000 Amp system can run at 5 pulses per second for 5 hours (90,000 shots), which is unprecedented for a pulsed power system of this class. It is now being used to develop the laser components. The system is expected to operate as a laser in CY 2002.
     - Used advanced codes and modeling to develop a “basic principles” theoretical model that will be used to enhance the efficiency of Electra and design large KrF systems.
     - Demonstrated an advanced, miniature, all solid state pulsed power switch. This has potential applications beyond the laser program, including all-electric defense platforms.

2. **Target Fabrication**
   - Developed advanced foams and methods of applying thin metallic coatings on spherical shells. These are needed for both IFE and ICF (NIF) targets.

3. **Target Injection**
   - Demonstrated the use of a recyclable protective jacket (sabot) for injecting targets.

4. **Chamber**
   - Developed an integrated, self-consistent model that calculates the output of the fusion target (neutrons, x-rays and charged particles) and used this to predict the response of the reactor chamber wall. Established a potential “operating window” that allows successful target injection, long-term wall survival, and reasonable plant efficiency.

5. **Final Optics**
   - Measured laser damage threshold on aluminum coated mirrors. Mirrors are five times more resistant to damage if they are angled sharply as envisioned for a fusion power plant. Defined acceptable thickness for a fused silica optic, based on radiation self-healing.

6. **Materials**
   - Used the Sandia Z and RHEPP facilities to expose candidate fusion materials to relevant x-rays and energetic ions to evaluate fusion chamber wall concepts.