1. Energy storage applications in distributed power system management
   - ENVATUULI
   - ENVADE and ENVADE+

2. What is integrated with DSM

DG	x
Energy storage	x
Smart grid technologies	

3. What is the level of commercialization

Research project	x
Demonstration	
Field test	
Existing practice	

4. Where to find more information?
   - Raili Alanen, VTT
     raili.alanen@vtt.fi
   - http://akseli.tekes.fi/opencms/opencms/OhjelmaPortaali/ohjelmat/DENSY/en/Closing_Seminar_2007.html → Final Report

5. Objectives of the case
   Study different energy storages and their solutions in different power distribution tasks.

6. Business rationale/model

7. Technologies used
   Different energy storages.

8. Short description of the case
   In the DENSY program, VTT has had research projects ENVATUULI, ENVADE and ENVADE+, which have included various technoeconomical studies, simulations and demonstrations of energy storage technology and its solution in different power distribution tasks. The main research areas have covered energy storages for the network management with wind power systems and UPS, with power quality systems/ stations, in DC distribution systems and microgrids; one of the research areas has also been the control and improvement of the operation and maintenance reliability of a weak electrical network. The research has been made in cooperation between Helsinki University of Technology, the University of Vaasa and VTT.

Environmental questions, open electricity market and the need for more reliable and efficient electricity distribution are among the driving forces for distributed energy generation and systems. Energy storage is seen as a key technology for promoting the wider implementation of distributed energy systems. The use of energy storages would provide a proper energy management, power quality and improve energy efficiency.

Energy storages can also be a solution for different network management problems and can also improve the efficiency, flexibility and convenience of the overall use of electrical and thermal energy, and they can also support the existing qualifying standards, regulations and recommendations for network power quality and control.

9. Achieved/expected results (operational savings, CO_2, efficiency enhancement)
   Increased reliability of power distribution and higher power quality.

10. Lessons learnt
    Problem is often the high cost of the energy storages.