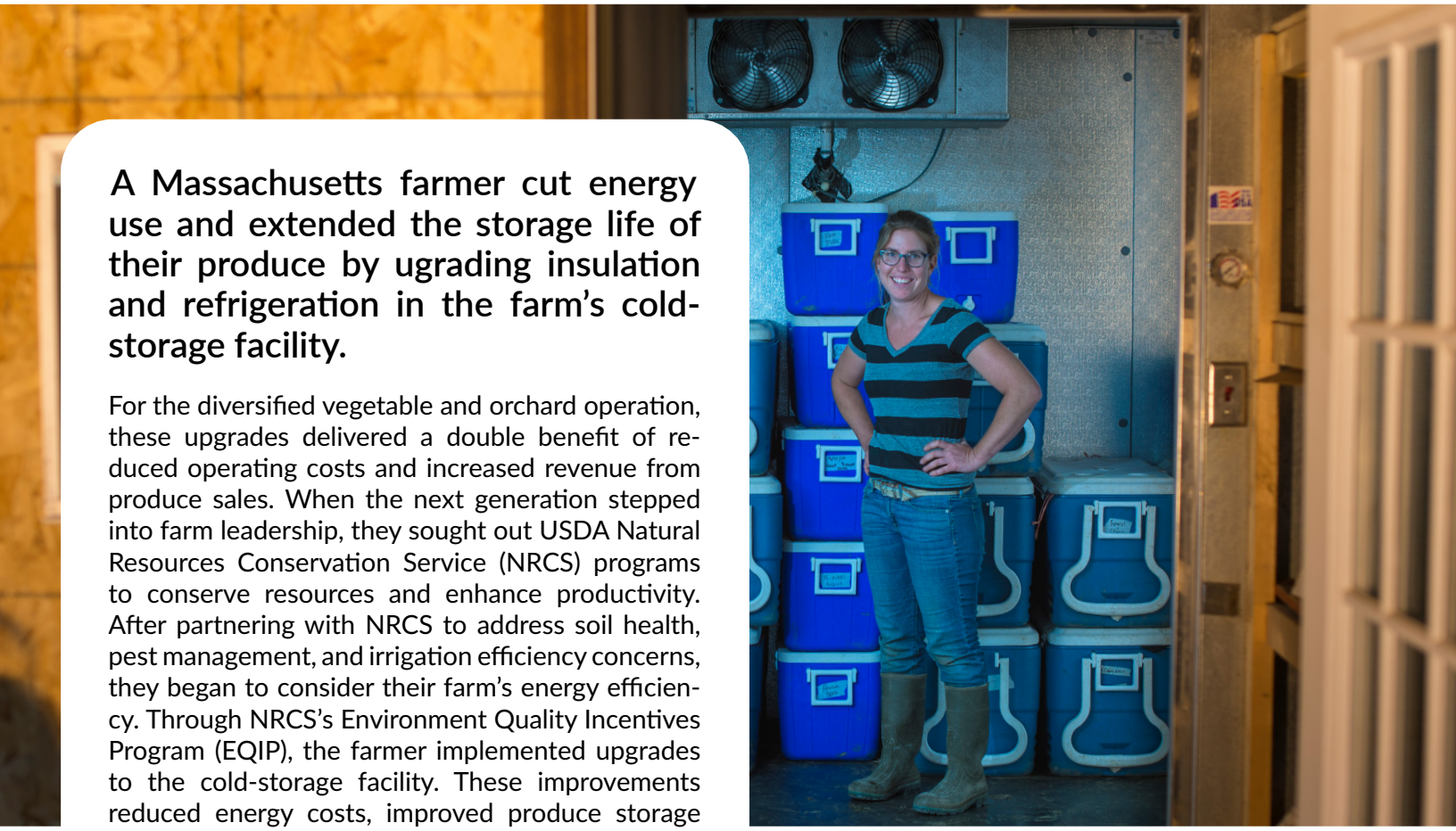
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COLD STORAGE INFRASTRUCTURE UPGRADES YIELD RESULTS IN MASSACHUSETTS



A Massachusetts farmer cut energy use and extended the storage life of their produce by ugrading insulation and refrigeration in the farm's cold-storage facility.

For the diversified vegetable and orchard operation, these upgrades delivered a double benefit of reduced operating costs and increased revenue from produce sales. When the next generation stepped into farm leadership, they sought out USDA Natural Resources Conservation Service (NRCS) programs to conserve resources and enhance productivity. After partnering with NRCS to address soil health, pest management, and irrigation efficiency concerns, they began to consider their farm's energy efficiency. Through NRCS's Environment Quality Incentives Program (EQIP), the farmer implemented upgrades to the cold-storage facility. These improvements reduced energy costs, improved produce storage reliability, and increased farm revenue from produce sales.

Effective cold storage is essential to maintain produce quality after harvest. With modern, energy-efficient refrigeration equipment, producers can reduce energy costs and minimize spoilage. Preston Keres, USDA.

Cold Storage Support

The cold-storage building is a central component of the farm's vegetable and apple storage infrastructure. However, the 1970s-era refrigeration system was severely out-of-date and unreliable. During a site visit, the NRCS District Conservationist (DC) who was working with the farm also noticed that the building's insulation was visibly deteriorated. Due to the insufficient wall and ceiling insultation, the aging refrigeration unit ran almost continuously to maintain the set temperature. The ineffective temperature regulation was not only costly but also limited how long apples and vegetables could be stored.

Recognizing the potential for substantial energy savings, the NRCS DC recommended an Agricultural Energy Management Plan (AgEMP). The AgEMP identified opportunities to reduce energy costs and improve product storage outcomes. The AgEMP offered two clear interventions: (1) improve the building envelope through spray-foam insulation, and (2) replace the inefficient reciprocating compressors with high-efficiency scroll compressors. Both upgrades aligned with the producer's goals of reducing operating costs and improving cold storage reliability.

Implementing the Upgrades

To address significant heat loss issues identified in the AgEMP, NRCS and the producer decided that spray-foam insulation would be the best method of improving the building envelope (NRCS Practice 672 – Building Envelope Improvement). By applying two inches of spray foam on the walls and three inches on the ceiling, the farm could meet the practice standard insulation values of R20 and R30, respectively. R-values measure a material's ability to resist heat flow and indicate insulation performance. Contractors quickly installed the material, sealing numerous gaps and fully insulating the entire structure. The resulting robust thermal envelope reduced cold air loss and reduced the refrigeration system's workload.

The second upgrade focused on the refrigeration equipment itself. Although NRCS could not fund a full replacement of the refrigeration unit, it could support installing new scroll compressors. New scroll compressors typically use 15-20% less energy than older reciprocating compressors. By pairing NRCS EQIP funding with a state energy grant, the producer replaced the entire refrigeration system with minimal out-of-pocket expense. The NRCS DC highlights this as a perfect example of how state and federal programs can work together to maximize benefits to the producer.

NRCS staff also worked with the producer to redesign the new refrigeration system to achieve optimal energy savings. Instead of replacing the old 15-horsepower (HP) refrigeration unit with a new one of the same size, the producer installed two 7.5 HP high-efficiency refrigeration units. When produce comes in from the field, both units turn on to cool the facility to the set temperature. Once the set temperature is reached, only one 7.5-HP unit needs to run to maintain temperature. This design choice saves more energy than replacement of the 15-HP unit replacement alone, since the two smaller units can operate independently. System redesigns like this show how energy efficiency upgrades can go beyond 1-to-1 equipment replacements to generate maximum energy and cost savings.

High-efficiency refrigeration units can cool storage rooms faster and with less energy than older models. Sufficient insulation keeps cold air contained and further reduces the energy used by cold storage facilities. Lance Cheung, USDA



Payback Beyond Energy Savings

The NRCS DC shared that the producer was thrilled with the project results. In addition to the immediate energy savings, the most significant co-benefit was reduced spoilage. Before the upgrades, stored apples often began to rot by December due to cold-storage air leaks and inconsistent facility temperatures. Now, the farm can maintain apple quality well into March and April. Gaining three to four more months of cold storage for apples has extended sales into late winter and generated additional revenue which far surpasses the value of the energy savings alone.

NRCS staff emphasized that a strong relationship with the producer was key to the implementation of the project. Success with soil and irrigation projects laid the foundation for producer trust during later conversations about energy use. The NRCS DC also helped the producer understand the expected payback period, demonstrating that the insulation investment would pay for itself within a few years. Altogether, this enabled the farm to implement meaningful upgrades that reduced energy costs, improved storage performance, and strengthened long-term viability.

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Energy Efficiency Success Stories are a product of the Climate Education and Outreach Project with the USDA Northeast Climate Hub. Funding support comes from USDA Natural Resources Conservation Service (agreement #23IA11132650-423). USDA is an equal opportunity provider, employer, and lender.