Energy Wrap: a thin-film for cooling or harvesting power from waste heat

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Technology

Energy Wrap is a new, thin-film technology for refrigeration, air conditioning and generating electrical power from waste heat.

Energy Wrap wins in efficiency and cost

	Energy Wrap	Thermo-electrics
Efficiency vs. Carnot	Can be >60%	~10%
Cost	~$10/kW	~$100/kW
Materials	Non-toxic plastics and liquids	Ceramics with heavy metals
Manu-facturing	Roll-to roll	Batch
Key Physics	Voltages change temperature	Currents carry heat

These devices, which are less than a millimeter thick, use films of pyroelectric materials to perform all the functions of conventional thermoelectrics, while being more efficient, less expensive to manufacture and more adaptable.

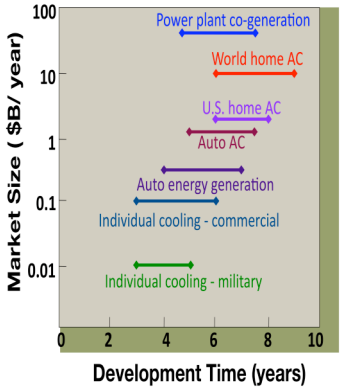
The flexible, low-weight and durable thin-film format opens many new opportunities for cooling buildings, electronics and perishables and for harvesting power.

Importantly, the materials used in this technology are environmentally benign.

Markets

Energy Wrap is a disruptive technology that potentially will be cheaper and more efficient than all existing technologies for cooling and energy scavenging. The ultimate market for this technology is >$30B

Energy Wrap is a disruptive energy technology



The first niche markets(~$10M) would exploit the special properties of thin-film coolers: their low weight and flexibility. This would include thermally controlled clothing, blankets, and furniture. The first customer is likely to be the U.S. military, who would be interested in improving the effectiveness of soldiers in harsh environments.

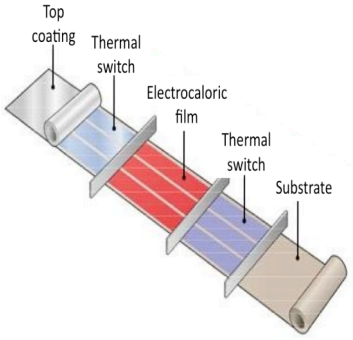
As the efficiency of the devices improves, this technology could make headway into areas where conventional coolers and energy harvesting devices are now used.

Commercial Readiness

It will take several years and substantial investments (>$20M) to develop the materials and cost effective manufacturing capabilities to bring this technology to market.

An investment of less than $2M could facilitate the production of prototype devices and the creation of new IP that could then be sold to a larger company.

Energy Wrap can be produced by low-cost roll-to-roll manufacturing



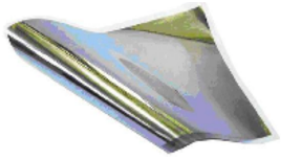
Energy Wrap thin-film coolers are well suited to industrial scale manufacturing. The materials used (polymers, liquid interfaces, metal films, etc.) are amenable to low-cost, large-scale processes based on roll-to-roll manufacturing.

Intellectual Property

The essential intellectual property for protecting the development of thin-film heat engines and heat switches is currently covered by two pending utility patents filed jointly by the University of New Mexico and Los Alamos National Laboratory.

ThermoDynamic Film, LLC has the option for exclusive licensing of these patents.

Energy Wrap: A thin foil that replaces bulky, expensive machine



The two patents, which have been published under the Patent Cooperation Treaty, are:

"Electrocaloric Refrigerator and Multilayer Pyroelectric Energy Generator"

"High-Frequency, Thin-Film Liquid Crystal Thermal Switches"

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