



**CALIFORNIA STATE SCIENCE FAIR  
2007 PROJECT SUMMARY**

<b>Name(s)</b> <b>Zoe E. Dubrow</b>	<b>Project Number</b> <b>J1608</b>
<b>Project Title</b> <b>Ice Expansion Generators: A Powerful New Source of Renewable Energy</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The purpose of this project is to determine if the phase transition from water to ice can be harnessed as a renewable energy source in areas of the world that the go through a daily freezing and thawing cycle. This will be determined theoretically by using the ice expansion (9%) and pressure (206MPa or 30,000psi) values from references as well as by building an ice based gravitational potential energy generator.</p> <p><b>Methods/Materials</b> The four sets of experiments completed in this project tested ice expansion with friction, ice melting rate, ice expansion under pressure, and reproducibility.</p> <p><b>Results</b> It was calculated that a single daily transition from water to ice could generate 1,335 kilowatt-hours per month in a three cubic meter space.</p> <p>It was proven experimentally that expanding ice can force a pin out of a tube with over 206megapascals of pressure.</p> <p><b>Conclusions/Discussion</b> The hypothesis that the expansion of ice could be used as a new source of renewable energy appears to be realistic.</p> <p>The energy generated from the water to ice transition could be used in about 25% of the worlds land mass.</p> <p>In this project, design guidelines were created to determine the optimum tube size to be used for generating ice energy.</p>	
<b>Summary Statement</b> The purpose of this project is to determine if the phase transition from water to ice can be harnessed as a renewable energy source in areas of the world that the go through a daily freezing and thawing cycle.	
<b>Help Received</b> When none of my experiments were working, my father suggested that that I mathematically model the optimum tube size for an ice expansion generator, taking into account friction and burst pressure.	