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THE CLEAN TECH IMPERATIVE AND U.S. NATIONAL SECURITY

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Gov. Jim Doyle, Minister Tony Clement, Director Oded Distal, distinguished guests, ladies and gentlemen. It is an honor to join you at Watec.

Now, I'm from Texas, and as you know, there is not a lot of water there, certainly not like Wisconsin or Canada. But we do have oil and we sure know something about the business of energy. And so I will focus my remarks today on U.S. energy policy and "clean tech."

For 40 years, the U.S. has aggressively pursued policies to (a) redress adverse environmental and health effects of polluted air, land, and water, (b) to regulate harmful chemicals, and (c) to balance effectively economic growth and environmental conservation.

These policies changed the way Americans live, drive, and do business, and were not without cost. On balance, they proved to be generally positive from economic and social standpoints and effective, by any objective measure, at improving the quality of our air, water, and land.

But we now face a task that makes prior environmental advances, big advances at that, seem very small. This task is to tackle both the primary environmental challenge and the primary national security imperative facing the U.S.: we must end our dependence on fossil fuels by developing secure, abundant, and clean energy resources.

Concerns in Washington as to the possibility of man-made climate change presently are providing great impetus for government and private industry to transition from hydrocarbons to a clean energy economy. The climate change bills pending in the U.S. Congress to regulate emissions of the greenhouse gas CO2 will, if passed, greatly reduce U.S. fossil fuel consumption.

These bills have spawned fierce debate over economics, science, and the proper role of government in a free society. But, no serious person denies that clean energy lies at the heart of the U.S.'s most fundamental national security and economic interests. We must solve the political, environmental, and technological problems caused by over dependence on fossil fuel, both domestic and imported, if we are to maintain our leading role in the international security and economic systems.

To frame the discussion, two historical vignettes.

25 July, 1944. American forces ruptured German defenses on the western end of the beachhead at Normandy, France.

The U.S. 3rd Army, under command of Gen. George Patton poured through the gap, turned the flank of the entire German line in Normandy, and tore into the German rear. The Germans collapsed and retreated. Third Army pursued, inflicting massive losses.

However, a little more than a month later, by 28 August and as it reached the German border, 3rd Army literally ran out of gas. The simple truth: gasoline was plentiful in Normandy, but no way existed to move enough of it to the front lines. The upshot: for 5 days the 3rd Army came to a screeching halt--no gasoline! Patton's troops hijacked some gasoline from the Germans and from other Allied army supply depots, and some came in by air, but not nearly enough to move 3rd Army.

If Patton had the gasoline he needed, WWII could have ended in November 1944, saving hundreds of thousands of lives, and preventing the Soviet takeover of a large portion of Eastern Europe, among other things. The lesson here could not be more stark: "tactical" issues of energy supply and distribution have far-reaching and long term strategic consequence.

6 October, 1973. Egypt and Syria attacked Israel - - the Yom Kippur War. Three days later, 9 October, once the scope and pattern of Israeli battle losses emerged, President Nixon ordered resupply of all destroyed equipment from U.S. stockpiles, using the U.S.'s very best weapons. He then asked Congress for an emergency appropriation of $2.2 billion to fund aid to Israel. The next day, Saudi Arabia's King Faisal embargoed oil to the U.S..

Had the U.S. in 1973 not been able to withstand that embargo, Israel, with obvious consequences, would have been denied essential tanks, aircraft, and munitions. Again, there is a crystal clear lesson: dependence on others for vital energy sources cripples the strategic posture of an entire nation.

The lessons of George Patton and 1973 frame the immense scope of our clean energy imperative. We must develop, in some ways from scratch, advanced generating technology and delivery infrastructure to produce and distribute huge amounts of clean energy from domestic sources efficiently and cost-effectively. And we must accomplish these tasks without triggering massive economic and social dislocation.

Let us all be clear here, this will be a very heavy lift. During my term as Chairman of the Panama Canal Commission, we agonized over conservation and spent huge amounts to improve efficiency. I learned first hand how difficult and expensive these steps can be.

For starters, the U.S. Department of Energy's Information Agency reports over 50% of U.S. electricity is generated from coal. Over 90% of our transportation is fueled by petroleum, most of it imported.

The U.S. today is blessed with huge coal reserves, but extracting energy from coal historically has been an exceedingly dirty job. Coal mining harms wilderness areas and existing coal combustion technology releases large amounts of pollutants and the greenhouse gas CO2 into the atmosphere.

Oil dependence is even more problematic. Historically, transportation has been a major air pollution source; gasoline, diesel and aviation fuel causes about 1/3 of U.S. greenhouse gas emissions. However, the national security consequences of our oil dependency for transportation are even bigger and more dangerous.

One hard fact of life right now in the U.S.: we lack readily available clean energy substitutes for coal and oil to fuel our economy and we lack the means needed to efficiently distribute that energy. For example, in 2004, Lawrence Livermore Nat'l

Laboratory – a premiere center for advanced energy research – conducted a domestic energy efficiency analysis.

This slide **[see slide on page 11 below]** reflects the sobering results. Nearly 60% of all energy generated in the U.S. is "lost" due to inefficiencies — primarily in generation and transmission.

To address the "Patton Problem" of distribution the U.S. needs efficient, secure and reliable interstate power transmission networks incorporating renewable collection lines and extra-high voltage (EHV) backbone facilities to deliver huge domestic renewable energy resources now stranded in remote areas, far from population centers. We also need "Smart Grid" technologies that adapt transmission and distribution grids to renewable power and enable greater energy efficiency.

For transportation, we need an "open fuel" infrastructure adapted to new liquid fuels like advanced forms of ethanol. Visions of Americans universally driving electric vehicles – a vision, by the way, that is closer to reality here in Israel thanks to the pioneering work of Shai Agassi and a Better Place and others – are still far from reality.

Also, existing legal requirements governing energy generation, transmission and use require major overhaul if the U.S. is to construct the power and transportation fueling infrastructure needed for clean energy. Why? Because state and federal "environmental protection" rules generally passed in the 1970s have been used to block any meaningful upgrade of the U.S. electric grid, refinery system, nuclear energy, and domestic energy exploration programs.

Clearly, we face sizeable barriers. So then, in the infamous words of that famous capitalist Vladimir Lenin, what is to be done?

To begin with, U.S. government policy from top to bottom must aggressively promote and accelerate the transition to a clean energy economy. Our Federal Government has wisely chosen a 2-track approach of practical incrementalism, on the one hand, and a strong commitment to advanced technology research on the other, to foster innovation and thereby solve the key issues of supply, distribution, of security and storage. The Federal government's policy is implemented through a host of funding programs, tax incentives, and government mandates. These incentives and measures are not glamorous and, unfortunately, no single "one size fits all" solution exists.

For the long term, the U.S. has renewed commitment to advanced research in environment and energy. For example, the Dept of Energy launched "ARPA-E", the Advanced Research Projects Agency – Energy, with $400M in funding. ARPA-E, modeled on our own Defense Advanced Research Projects Agency, or DARPA, will fund energy technology projects that translate scientific discoveries and cutting-edge inventions into technological advances, including those in high-risk areas that industry is not likely to pursue independently.

Now, U.S. policy is very much a work in progress. Key legislation and regulations are still being written. The initial round of stimulus grants has been made, but funding for future projects remains available through the administrative agencies and through federal and state legislative appropriations.

This uncertainty opens a window to new ideas, new approaches, and new technology. However, only those who effectively and successfully participate in the policy-making and grant application processes will be guaranteed a chance to have their voices heard before that window closes.

An effective incrementalist needs patience and a long view. Focusing first what is easy – identifying and picking "the lowest hanging fruit" -- he builds on prior successes as technology advances. The clean energy transition requires this approach. Private companies, universities, governments, militaries (for example, DARPA is a world leader in clean energy and advanced battery technology research) and entrepreneurs worldwide are feverishly seeking to solve supply and delivery challenges. Some Israeli companies offer impressive "Smart Grid" solutions, yet my sources suggest that the "game-changing" technological breakthrough is still out over the horizon.

Moving forward, we need federal, state, and local efficiency measures and mandates that make economic and environmental sense. Right now we can take steps and employ technology for a reasonable cost, to reduce our dependence on fossil fuels.

A November 2009 Scientific American article has two scientists making the case that within a single generation wind, water, and solar energy can fully replace all fossil fuels using existing technology. Now, these scientists make some, I will say, exuberant economic and political assumptions. Nevertheless, simple measures such as feed-in tariffs, favorable, or at least equal, tax treatment for renewable energy sources, and a streamlined approval process for clean energy projects will produce huge benefits. And from these simple measures we can turn to more complex questions of advanced infrastructure and clean energy technology development.

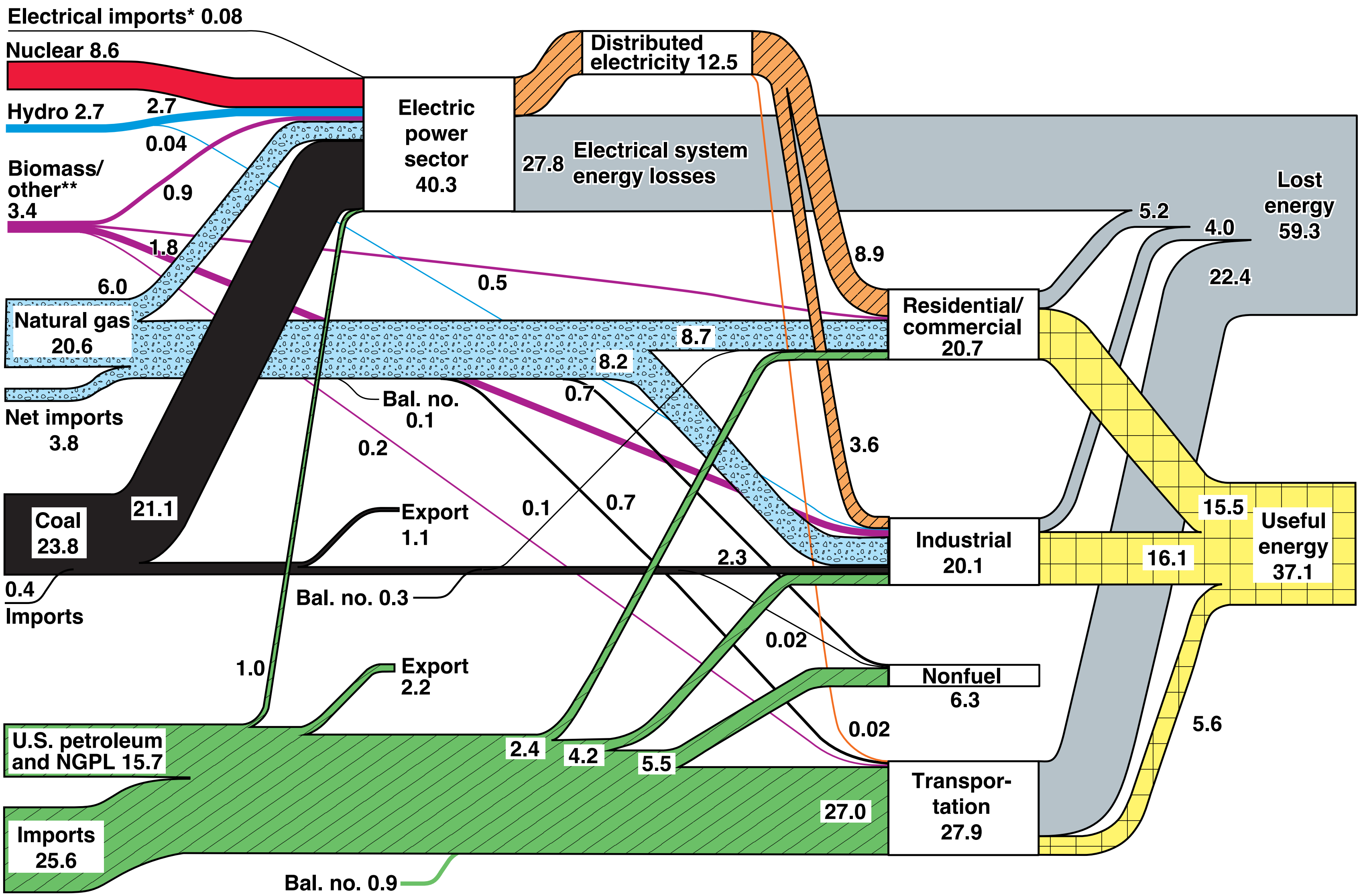
At every step, we must preserve and maintain a legal and regulatory environment friendly to clean energy technology and to private sector investment, research, and development of clean tech. The Industrial Revolution did not result from government directives. Nor did the Internet Revolution occur because the Congress demanded it to be so. As we make the Clean Tech evolution, we must remember government bureaucracy and "five year plans" are the mortal enemy of progress, innovation, and success.

For decades, Israel and the U.S. have collaborated closely on advanced military, medical, and computer technology, and both are the better for it. Now, we must collaborate on clean tech. Transitioning to clean energy may make the Manhattan Project and the Apollo Program look like only a "good start." But given the fundamental national security threat posed by our dependency on fossil fuels, we have no other choice to secure our future and our prosperity.

Our work will not be easy and change will not come without a price. But I for one am confident that past is prologue. Together, we will meet this challenge and unleash the clean energy future.

END

Figure 2. U.S. Energy Flow Trends – 2002
Net Primary Resource Consumption ~103 Exajoules



Source: Production and end-use data from Energy Information Administration, Annual Energy eview 2002.
*Net fossil-fuel electrical imports.
**Biomass/other includes wood, waste, alcohol, geothermal, solar, and wind.

June 2004
Lawrence Livermore National Laboratory
http://eed.llnl.gov/flow