Script Key:
- **NARRATION**
- ***On Screen Visuals***
- Annotation

TEASE

Panting sled dogs, hot breath steaming the cold air, race through the Alaskan woods, carrying Gwen Holdmann (seen later in the Chena Hot Springs sequence—in her "day job" she heads up the UAF Alaska Center for Energy and Power) on her training for the Iditarod. The runners slice through fresh snow, rasping noisily over ice patches:

AMERICANS USED TO RELY ON ANIMAL POWER FOR TRANSPORTATION AND TO CARRY GOODS FROM PLACE TO PLACE.

A whaleboat crew rows towards a strike, and lets fly a harpoon. A whale oil lamp, and artifacts with labels promote the benefits of spermaceti oil:

For stories about America's past sources of energy, see Richard Alley, *Earth: The Operators' Manual,* Norton, 2011, Chapter 3, "Peak Trees and Peak Whale Oil."

…AND OIL FROM WHALES TO LIGHT OUR EVENINGS.

Night-time scenes of brightly lit highways and a city skyline. Shock cut to crowded NYC, car and truck congestion, and gas pumps: David Crane, CEO of NRG Energy speaks:

TODAY IT'S GASOLINE AND MOTOR VEHICLES, AND VAST AMOUNTS OF ELECTRICITY TO LIGHT OUR CITIES AND POWER OUR ECONOMY.

BUT ONE STUDY CLAIMS THAT AMERICANS SPEND JUST *SIX MINUTES A YEAR*, FOCUSING ON ENERGY!

Crane:

The American public does not like to think about its energy use …The one place Americans do think about energy use is when they're standing at the pump.

GLOBAL DEMAND MAKES *OIL PRICES RISE AND FALL* IN RESPONSE TO EVENTS BEYOND OUR BORDERS AND OUT OF OUR CONTROL.

See RPI President Shirley Jackson interacting with students and a professor in a high-tech biological lab on campus:

Shirley Jackson VO:

We worry about how our economy gets buffeted.

Aerial of a Texas Interstate with backed up traffic:

Shirley to camera:

And the only way we do something about that is to take into our own hands our destiny.

CU of a research "wafer" in the RPI Smart Lighting lab, and the biomass boiler in Tanana, Alaska:

IN THIS PROGRAM, WE LOOK AT HOW AMERICA USES ENERGY.

Scenes in Baltimore, Kansas and Alaska:

AND WE'LL MEET PEOPLE LIKE YOU WHO ARE HELPING THEIR COMMUNITIES FIND *NEW* SUSTAINABLE RESOURCES AND *SAVE* ENERGY.

Energy expert Dan Yergin, author of THE QUEST, works at his computer, WS and CU as he types: we see a bike delivery service in Portland, OR:

Yergin VO:

I think the other big thing that people don't know is that conservation, energy efficiency, has already been something that the U.S. has had tremendous achievement in.

Yergin to camera:

It is something, as the "fifth fuel", that can be a very, very, very important fuel for our future.

Scenes from Kansas and Alaska, contrasting faces and places, but with signs reading "Take Charge! Challenge" and "Baltimore Neighborhood Energy Challenge": in Gardner, Kansas, a red ribbon is cut by giant scissors, to great applause from the crowd of kids and adults looking on: Baldwin City Mayor Ken Wagner starts VO and then to camera:

TAPPING THAT FIFTH FUEL CAN BE AS *CHALLENGING* AS DRILLING FOR OIL OR GAS.

BUT POWERING COMMUNITIES IN THESE NEW WAYS ALSO EMPOWERS PEOPLE…

Ken Wagner, Mayor, Baldwin City KS, speaks:

Ken Wagner:

We can control the things that go on in our home. We can control the things that go on in our communities.

U.S. Senator Lisa Murkowski, at the Chena Renewable Energy Festival, and scenes of Alaska, including the turbines on Kodiak Island:

I'm a Republican. What is more conservative than harnessing what is available and around us in a long-term sustainable way?

Richard Alley with the Earth jigsaw computer graphics, seen in the last segment of this program:

OUR PROGRAM'S HOST, EARTH SCIENTIST RICHARD ALLEY, KNOWS THE DANGERS OF CLIMATE CHANGE…

Richard teaching at the university:

BUT HE ALSO TEACHES ABOUT ENERGY AT PENN STATE…

Richard walking in downtown NYC, surrounded by crowds:

…AND HE'S OPTIMISTIC THAT AMERICANS CAN BUILD A SUSTAINABLE FUTURE.

Scenes from the five communities we visit during the program:

SOME STATES AND CITIES ARE ROLLING UP THEIR SLEEVES AND MOVING AHEAD.

THESE CITIZENS ARE *HEROES* OF AMERICA'S NEW ENERGY STORY… AND SHOW THE WAY TO A SUSTAINABLE ENERGY FUTURE.

Starting voice over scenes from all over, and the seen first beside his bike, and then to camera, Congressman Earl Blumenauer:

Earl Blumenauer, U.S. Representative, OR 3rd District (D) speaks:

Blumenauer:

…the good news is we don't have to wait for the national policies.

AND HELPING OURSELVES WITH CLEAN ENERGY IS ALSO HELPING EARTH'S CLIMATE…

Nancy Jackson, Founder, Climate+Energy Project, Kansas:

Nancy Jackson:

The atmosphere doesn't care one whit what people think. The atmosphere cares what people do.

Scenes from all locations covered in the program:

WE VISIT FIVE VERY DIFFERENT COMMUNITIES, FROM ALASKA TO TEXAS … PORTLAND TO BALTIMORE …PLUS KANSAS, IN AMERICA'S HEARTLAND, TO FIND OUT HOW THEY'RE DEVELOPING NEW SOURCES OF ENERGY, OR CUTTING WASTE, AND WHY STRATEGIES LIKE THOSE MAKE SENSE FOR ALL OF US.

Underwriter announcement:

"*ENERGY QUEST USA* – Earth: The Operators' Manual" IS MADE POSSIBLE BY NSF, THE NATIONAL SCIENCE FOUNDATION, WHERE DISCOVERIES BEGIN."

SERIES TITLES:

The main titles resolve with ENERGY QUEST USA above the ETOM logo and text.

ENERGY QUEST USA
Earth: The Operators' Manual

Alaska:
America's Renewable State?

422 orbital shot: the day/night terminator sweeps across the continent as city lights turn on:

SOMETIMES WHEN AMERICANS HEAR "ENERGY" THE NEXT WORD THAT COMES TO MIND IS… "CRISIS."

IT REALLY DOESN'T HAVE TO BE THAT WAY.

Shirley Jackson paces the research labs of RPI, and stops to inspect a student project:

SHIRLEY JACKSON, FORMER HEAD OF THE NUCLEAR REGULATORY COMMISSION, AND NOW PRESIDENT OF ONE OF AMERICA'S LEADING TECHNICAL UNIVERSITIES, THINKS THE UNITED STATES IS ACTUALLY WELL-PLACED.

Shirley Jackson, to camera and voice over the different regions (Alaska, Kansas, Texas cotton and wind, ocean waves):

Well, the U.S. is lucky because we have such a diversity of climate and diversity of geologies…

Turbines, ocean waves, biomass/lumber being stacked on Kodiak Island, geothermally-heated bubbles at Chena Hot Springs:

…and in the end, diversity of actual energy sources. And that, in fact, makes us very fortunate compared to other parts of the world…

They may have a given source of energy, but they don't have the multiple sources.

The Year-By-Year Reference Tables from the Annual Energy Outlook 2012 Early Release Overview give numbers for 2009 through 2013. Table A2 provides total energy consumption in quadrillion BTU/year (quads.) For 2010, this was 98.16 quadrillion.

Table A1 of that Early Release Overview shows that in 2010, liquid fuels and other petroleum provided 37.95% of energy consumption. Coal was 21.15% in 2010, natural gas, 25.2%. Nuclear was 8.6% in 2010. Hydropower, biomass, and other renewables, 2.56%, 2.93%, and 1.365%, respectively, for a total of 6.81%.

This is how all that energy was used, also for 2010: 28% for transportation, 20% industrial, 11% residential and commercial, and 40% electric/power generation. However, in 2010 energy losses in the four sectors total 39.4 quads, while the actual delivered energy was 57.2 quads. Hence of the total of 96.6 quads, losses amounted to 41%.

Aerial over Alaska:

ALASKA, LIKE THE REST OF AMERICA, HAS BEEN ADDICTED TO OIL…

President George W. Bush used this phrase in his 2006 State of the Union address to Congress.

NOW, CAN ABUNDANT SUSTAINABLE OPTIONS MAKE IT… AMERICA'S RENEWABLE STATE?

Shimmering water, and a bright yellow floatplane takes off:

KODIAK ISLAND, AT 3,600 SQUARE MILES, IS ABOUT HALF THE SIZE OF NEW JERSEY.

A Wikipedia article states that the island has an area of 9,311.24 km2 (3,595.09 sq mi). This number revises previous statements giving some 5,000 square miles for the area. An article in the Anchorage Daily News in 2010 proclaims that "David Szumigala of the Alaska Department of Natural Resources Division of Geological & Geophysical Surveys was also listed as a contributor [to the website giving the larger number for the area]. I called him and he contacted state cartographer Alfred G. Sturmann, who gave the area of Kodiak as 4,908.90 square miles – more than 800 square miles bigger than the biggest estimate for Hawaii. Before we start celebrating, note that Sturmann included both Kodiak "and surrounding small islets," of which Kodiak has many. "This number can vary depending on the accuracy of the data used. I wouldn't take it to court," he said and referred me to DNR's Division of Mining, Lands and Waters.

"It was a good referral. Within a day they'd taken a fresh look at the numbers and recalculated the area of just Kodiak Island as 3,595.09 square miles, slightly bigger than the most common number found on the Internet. But no Hawaii."

GETTING AROUND ALMOST ALWAYS INVOLVES A BOAT, OR A PLANE, OR A FLOAT-PLANE THAT'S A BIT OF BOTH.

Flying over green mountains (the island is nicknamed the Emerald Isle) and we begin to see bears in a lake below a weir:

KODIAK'S POPULATION IS LESS THAN 14,000… LEAVING MOST OF THE ISLAND UNDEVELOPED AND NATURAL.

According to Wikipedia, the U.S. Census Bureau gives the 2010 population of Kodiak Island Borough as about 13,600.

See bears at the weir, and tourists trekking towards them:

AND THAT BEAUTY IS ONE OF KODIAK'S ECONOMIC ASSETS, BRINGING TOURISTS TO WATCH BEARS, RAISING CUBS AND CATCHING FISH.

At Pacific Seafoods, fish pour down the conveyor belt on the dockside:

KODIAK'S HUMAN POPULATION ALSO CATCHES SALMON, WITH FISH *EXPORTS* PROVIDING ANOTHER KEY SOURCE OF JOBS AND INCOME.

The Kodiak Island website provides an economic profile stating that: "Kodiak's role as a center for transportation, governmental offices, timber, and tourism complements its role as one of the Nation's largest producers of seafood. The city of Kodiak has the largest and most diversified fishing port in Alaska and is consistently ranked in the top three largest fishing ports in the U.S. in terms of value landed. "Landings to the Port of Kodiak in 2010 were 313 million pounds, with a wholesale value of $132.3 million. Salmon is traditionally the largest fishery in Kodiak in terms of wholesale value …The next largest fishery was halibut (and) accounts for 24% of the total wholesale value. Salmon accounted for 22%, crab 6%, herring 2% and other species 2%. "Area residents hold 1,158 commercial fishing permits …Kodiak's processing plants employed approximately 1,598 people and have a combined payroll of over $68 million in 2010."

The website also states that "The U.S. Coast Guard and other government entities is the dominant industry, in terms of employment with 35% of the total. The seafood industry (includes fish harvesting and seafood processing) is the next largest employment sector, with 20%. Retail trade/transportation/utilities accounted for about 10%, education/health 9%, financial/information/professional & business 6%, leisure & hospitality 6%, natural resources/construction 4% and other services 3%."

See the ferry come in: A fuel truck arriving at the KEA facility: hear the truck.

THE ISLAND WANTS TO LIMIT IMPORTS OF DIRTY AND EXPENSIVE FOSSIL FUELS, AND TAP NATURAL RESOURCES TO SUPPLY AS MUCH CLEAN AND LOCALLY-GENERATED ENERGY AS POSSIBLE.

Scenes around the port of Kodiak, and the island. Cars driving, etc. Gassing up a vehicle, with the words, Kodiak Island, printed above the gas tank.

Cliff Davidson, Board Chairman, Kodiak Electric Association

Cliff Davidson speaks:

Fuel prices, because we live on an island, are very expensive …y'know, you learn pretty quickly that you need an alternative.

See the three current turbines on Pillar Mountain, easily seen from the town of Kodiak:

KODIAK WAS THE FIRST PLACE IN ALASKA TO MAKE WIND POWER A SUBSTANTIAL PART OF THE ENERGY MIX, WITH ITS *THREE 1.5 MEGAWATT TURBINES* ON PILLAR MOUNTAIN.

Darron Scott, President & CEO, Kodiak Electric Association

Darron Scott:

So getting good quality, low-cost sustainable power, is really necessary for the long-term viability of the economy of Alaska.

Scenes at Terror Lake, and the Pillar Mountain turbines:

UPGRADES AT THE TERROR LAKE HYDRO-ELECTRIC PLANT…

Looking down on the site of the new turbines:

…PLUS PLANS FOR THREE MORE TURBINES LEAVE THE KEA CO-OP CONFIDENT THEY CAN HIT 95% RENEWABLES BY 2020.

The KEA substation, downtown, with the chimneys, and another shot of the fuel delivery truck:

THOUGH KODIAK USES DIESEL AS A BACKUP AND DURING REPAIRS, THE WIND TURBINES SAVE THE ISLAND 800,000 GALLONS OF *EXPENSIVE, IMPORTED FUEL EACH YEAR*.

AND THIS MATTERS TO THE LOCAL BUSINESS COMMUNITY.

See John Whiddon on the production line, inspecting the fish: Scenes around the Pacific Seafood processing plant. Fish being offloaded, and the interior shots:

John Whiddon, General Manager, Island Seafoods

John Whiddon:

This morning, we're offloading pink salmon and red salmon, chum salmon and Coho that came from the west side of Kodiak …it keeps us busy, the plants work 24 hours a day, and it's a very, very big industry for Kodiak.

THIS PROCESSING PLANT RUNS 100% ON RENEWABLE ENERGY, SO KODIAK'S WIND POWER PROVIDES A CLEAN, GREEN MARKETING HOOK.

John shows us one of the packages of salmon, with the iconic Pillar Mountain turbines:

Whiddon:

The package says, sustainable seafood, produced in Kodiak, Alaska, with wind-generated renewable energy.

Dramatic shots of the sunlit turbines and Darron close to the Terror Lake dam:

Darron Scott:

You got some folks in the community that are really concerned about price. You know, they just want the lowest cost power at their house or at their business.

Rotating turbine blades cast shadows on the green hillside:

Well, the wind does that. It's less than 50% of the cost of power versus diesel.

See some of the boats at the dock, and leaving to fish:

Then you got folks in the town that are very just, environmentally concerned. And they are incredibly excited, because it's a whole lot cleaner than diesel is.

And then you've got the majority of folks who want both, which is great as well.

Aerial shows the Kodiak coast. Cut to high speed river travel, and see the heavily laden barge:

KODIAK IS A GENUINE ISLAND, SURROUNDED BY OCEAN, BUT VAST AREAS OF BUSH ALASKA ARE ALSO "ISLANDS" OF HABITATION, SMALL COMMUNITIES SURROUNDED BY OPEN COUNTRY AND DENSE FORESTS

Dramatic shots of the banks and even the Sun, as on the trip to the fishwheel:

MANY HAVE NO ROAD ACCESS, AND THE ONLY WAY IN, IS VIA RIVERS LIKE THE YUKON.

Continue with river travel shots, but now see Bear on board the boat. Impressive top shot from up the hill, looking down on the two rivers.

"BEAR" KETZLER IS CITY MANAGER OF TANANA, A REMOTE AND MAINLY NATIVE ALASKAN VILLAGE AT THE CONFLUENCE OF THE YUKON AND TANANA RIVERS.

Infoplease.com gives the pronunciation as "**Tanana** (tăn'unô)."

The list of longest United States rivers has these in the top three: Missouri, 2341 miles; Mississippi, 2202 miles; Yukon, 1979 miles.

We can see the laden barge here:

Al "Bear" Ketzler, Jr.:

90% of our bulk freight that comes in, comes by the barge.

See houses and external fuel tanks:

THAT INCLUDES DIESEL FOR THE POWER PLANT AND HEATING OIL FOR HOMES.

DIESEL PRICES INCREASED 83% BETWEEN 2000 AND 2005, AND UTILITY COSTS CAN SOMETIMES BE *MORE THAN ONE THIRD OF A HOUSEHOLD'S INCOME*.

See Bear driving, City Hall shot, Post Office and flag:

Al "Bear" Ketzler, Jr.:

The increase of energy costs, it jeopardizes everything. It jeopardizes our school, it really jeopardizes the ability for the city to function effectively.

Fishwheel shots:

COMMUNITIES LIKE TANANA RELY ON THE RIVER FOR THE FISH PROTEIN THAT'S A LARGE PART OF A SUBSISTENCE DIET.

See the fallen trees, and shots of timber in the river, and log piles:

AND THE RIVER ALSO PROVIDES A CHEAP AND LOCAL SOURCE OF ENERGY.

Al "Bear" Ketzler, Jr.:

We have abundant resources of wood, biomass. Wood that floats down the river, in the spring and the fall time.

Shots of wood stacked outside the "Washeteria," clothes outside the entrance, and shots of the water treatment equipment. Plus stoking the boilers, and comments from Dennis:

TIMBER IS INCREASINGLY REPLACING OIL AND DIESEL IN TANANA'S COMMUNAL BUILDINGS, LIKE THE "WASHETERIA," A COMBINATION LAUNDROMAT, PUBLIC SHOWERS AND WATER TREATMENT PLANT.

Dennis Charley, City of Tanana:

Dennis at the boiler:

Right now we don't even need oil, we're just running the whole place off this one wood boiler, which is just amazing.

USING BIOMASS AND SOLAR, THE "WASHETERIA" NOW USES ONLY ONE QUARTER AS MUCH HEATING OIL.

Source for these statistics is Jeff Weltzin, energy consultant to the city, in a personal communication.

INSTEAD THE CITY PAYS RESIDENTS TO GATHER SUSTAINABLE TIMBER, KEEPING DOLLARS IN THE LOCAL COMMUNITY.

Cut lumber fed into the boiler at the Washeteria:

AND USING BIOMASS AT THE "WASHETERIA" HAS PROVEN SO COST EFFECTIVE THAT THE CITY IS PLANNING TO INSTALL BOILERS IN OTHER PUBLIC BUILDINGS.

School refurbishment shots: lots more dynamic, welding, more active shots:

Al "Bear" Ketzler, Jr.:

We're going to be one of the first communities on Yukon River that is installing a biomass system on the school.

See windows, etc., being fitted: finishing walls in the interior, and welding CUs outside:

In October of this year we're hoping to have the wood system on line, so instead of burning 15,000 gallons of oil throughout this winter, we're hoping to burn about 60 cords of wood. And, keep that money local, and create a little bit of an economy here.

See a clean outlet, with Bear's hand behind it:

THE BOTTOM LINE FOR TANANA: SAVINGS FOR THE CITY… BIOMASS IS CHEAPER, LOCAL, CLEANER AND MORE SUSTAINABLE.

Al "Bear" Ketzler, Jr.:

Even though we are a very rich state, very blessed to have the oil development that we do have, those days are diminishing.

See the old folks home exterior, and the older female Elder, and also use the plane arriving:

Al "Bear" Ketzler, Jr.:

If we're going to make it in rural Alaska, we have to move towards renewable resources… I think we have, you know, less than 10 years to move in that area.

Bush plane takes off: dissolve to winter scenes of Gwen Holdmann, mushing:

WINTER IN ALASKA PRESENTS EXTREME CHALLENGES.

Helpers ready the sled:

ON THIS JANUARY DAY, IT WAS CLOSE TO MINUS 50 DEGREES

Tilt up to see Gwen, her face almost covered by the fur of her blue parka:

GWEN HOLDMANN IS AN ENGINEER WITH THE UNIVERSITY OF ALASKA'S "CENTER FOR ENERGY AND POWER."

SHE AND HER HUSBAND RAISE SLED DOGS, AND BOTH ARE MUSHERS WHO HAVE RACED IN THE "IDITAROD."

The sled passes alongside the Trans-Alaska Pipeline, TAPS:

TODAY'S RUN TAKES HER PAST THE ALASKA PIPELINE, WHICH HAS TRANSPORTED MORE THAN 16 BILLION BARRELS OF OIL SINCE IT OPENED IN 1977.

The website of the Alaska Resource Development Council states that "Alaska's oil and gas industry has produced more than 16 billion barrels of oil and 6 billion cubic feet of natural gas, accounting for an average of 20% of the entire nation's domestic production (1980 – 2000). Currently, Alaska accounts for approximately 13.2% of U.S. production." The Alyeska pipeline website, which includes transmission figures through January 2012, states that "Since pipeline startup in 1977, Alyeska—TAPS' operator—has successfully transported more than 16 billion barrels of oil."

Panting dogs… enjoying the ride. Racing through the woods, we emerge beside the Trans-Alaska Pipeline:

DESPITE THE FACT THAT ALASKA *IS* RICH IN FOSSIL FUELS, GWEN KNOWS THEY'RE LIMITED AND EXPENSIVE.

SHE WANTS TO TAKE ADVANTAGE OF EVERY OPPORTUNITY TO TAP RENEWABLE ENERGY.

Gwen, VO pipeline shots, and mushing through the woods, backlit by the low, winter Sun:

We are an isolated part of the world, and we are still very much dependent on imports and so becoming more self reliant on energy is a real goal here.

The lead dog reaches out to lick Gwen's face at the end of the run. Cut to scenes of the Chena Hot Springs Resort, near Fairbanks, Alaska:

GWEN WAS PART OF THE TEAM THAT BUILT THE *FIRST* GEOTHERMAL POWER PLANT IN ALASKA, AT "CHENA HOT SPRINGS."

Shock cut to Bernie Karl playing an ice xylophone:

BERNIE KARL RUNS THE CHENA RESORT, AND CAME UP WITH THE IDEA OF CREATING AN ICE MUSEUM FROM THE HEAT ENERGY OF THE SPRINGS!

Bernie in the Ice Museum:

Now you've heard of the Great Wall of China. This is the Great Wall of Chena. There's 800 tons of ice here.

BERNIE IS A REAL AMERICAN PIONEER… A SHOWMAN, AN ENTREPRENEUR, A TINKERER …AND ENTHUSIAST FOR RECYCLING OLD MACHINERY, BECAUSE IT'S CHEAPER.

Wide shot of the hot springs at Chena area: tourists relax on the rocks:

HE AND GWEN SUCCESSFULLY TRANSFORMED THE HOT SPRINGS INTO A *GEOTHERMAL RESOURCE* THAT NOW GENERATES POWER FROM LOWER TEMPERATURE WATER THAN ANYWHERE ELSE ON EARTH.

Bernie Karl, owner, Chena Hot Springs Resort, in the generator room:

What you're looking at is something that's impossible, I went to the world's best manufacturer of geothermal equipment and they said, "Can't be done." The word "can't" is not in my vocabulary.

Gwen:

It wasn't obvious at first that it could be done, because these are low, really moderate temperatures for geothermal. The water that we're talking about here is about the same as a good hot cup of coffee, and generating power from that isn't a trivial thing.

Scenes of Chena in deep mid-winter, piles of snow everywhere, a few hardy souls braving the frigid walk to get to the steaming hot springs.

NORMAL, FOR MID-WINTER CHENA, IS 3-4 FEET OF SNOW, SUBZERO TEMPERATURES AND ONLY A FEW HOURS OF DAYLIGHT.

HEATING AND LIGHTING COSTS WERE STAGGERINGLY HIGH.

BUT NOW THE RESORT RUNS YEAR-ROUND, WITH OVER 90% OF ITS ELECTRICITY COMING FROM THE HOT SPRINGS.

Winter scenes of the greenhouse, flanked by snowbanks.

BERNIE'S LATEST "IMPOSSIBLE" IDEA IS TO USE THE YEAR-ROUND HEAT TO MAKE THE RESORT SELF-SUFFICIENT IN FOOD, EVEN WHEN IT'S MINUS 50 OUTSIDE.

In the greenhouse. Shots of extremely verdant groceries.

Bernie Karl:

We have 85KW of lights in here (he points to the ceiling) high pressure sodium. We're changing it to 8.5 KW of LED's …Now this takes 1/10th the electricity…

Place and date locator: 6th Annual Chena Hot Springs Renewable Energy Fair, August 14th, 2011

Scenes of the Chena Energy Festival. The plastic to oil demo (Japanese researchers), the wooden turbine, etc.

FOR THE PAST 6 YEARS CHENA HAS HOSTED A RENEWABLE ENERGY FAIR.

Bernie shakes hands with a guest. See Bernie talking to Lisa Murkowski.

ONE KEYNOTE SPEAKER WAS U.S. SENATOR LISA MURKOWSKI.

Lisa Murkowski, U.S. Senator, Alaska (R):

I'm a Republican. Republicans by definition are seemingly more conservative. What is more conservative than harnessing what is available and around us in a long-term sustainable way?

Flying over Kodiak:

We have more renewable opportunities here in Alaska than any other place in the world.

Looking down from a hilltop to the Tanana and Yukon Rivers:

We've got incredible river systems.

Flying over Kodiak:

We have 33,000 miles of coastline …the power of the tides, the power of the currents.

Pellet factory:

…we have biomass potential that is just beyond belief.

Murkowski speaks voice over shots of Kodiak aerials, fuel prices, reprise shots from anywhere in Alaska:

Lisa:

As diverse and as big and remote and as costly as things are in Alaska, if we can demonstrate it can be done here, think about the hope that it provides…

On camera:

They'll look at us and say "Wow, if Alaska can do it, we can do this. We can take control of our energy future."

America's Energy Past

Richard walks down the beach in Hawaii, gathering wood, and making a campfire. He lights it up:

BUT TO HAVE A SUSTAINABLE ENERGY FUTURE, WE HAVE TO DO THINGS DIFFERENTLY THAN IN THE PAST. RICHARD ALLEY EXPLAINS…

Richard begins VO:

We've been burning whatever was at hand for a long, long time.

Pokes the fire, with closeups of the burning wood:

But as we see repeatedly with energy, you can burn too much of a good thing. And there are patterns in the human use of energy… and if we're stupid enough to repeat them, burn all the fossil fuel remaining on the planet, and put the CO2 into the air, we will cook our future.

Take what we did to trees in North America, for example.

Dense woods, in the Joyce Kilmer Memorial Forest, NC, one of the few patches of old growth forest remaining on the East Coast:

WHEN THE FIRST SETTLERS ARRIVED ON AMERICA'S EAST COAST, THE FORESTS WERE SO THICK, YOU COULD BARELY SEE THE SKY.

CGI animation, showing a magical trip through time, flying over the disappearing East Coast forests. We hear sawing, chopping and hammering.

THAT SOON CHANGED AND THE FORESTS ALMOST COMPLETELY DISAPPEARED AS MORE AND MORE TREES WERE CUT DOWN TO MEET THE HEATING, COOKING AND BUILDING NEEDS OF A GROWING POPULATION.

The old stone furnace at the approach to Penn State:

MAKING IRON NEEDED LOTS OF *FURNACES*, AND THE FURNACES RAN ON CHARCOAL, MADE FROM TREES.

A website of the U.S. Dept. of *Agriculture's Forest Service* states that "To fuel the furnaces, the forests were repeatedly cut, and the wood converted to charcoal. Each furnace required cutting 300 to 350 acres of timber [Note: 640 acres per square mile] annually to keep up with the demand. Charcoal made from second or third growth wood was said to be superior to that made from virgin timber. Even so, the forests couldn't grow fast enough to keep up with the furnaces, and an ever-widening circle of land was required to cut and haul wood."

Close-up shots of charcoal making: flames seen through chinks in a furnace:

YOU CAN TRACE THAT HISTORY IN TELL-TALE PLACE NAMES FROM MY HOME STATE OF PENNSYLVANIA.

CGI map, created for ETOM by Crazybridge Studios, zooming out with the names appearing in sync with the script:

SO FAREWELL VIRGIN FORESTS, HELLO *PENNSYLVANIA FURNACE, LUCY FURNACE, HARMONY FORGE*, AND *VALLEY FORGE* OF REVOLUTIONARY WAR FAME.

CGI shot showing patches of deforestation around several furnaces:

LARGE AREAS OF FOREST WERE SOON DEPLETED, AND CHARCOAL-MAKING AND IRON PRODUCTION MOVED ON …TO REPEAT THE PROCESS ELSEWHERE.

The earlier fly-over of the deforested East Coast continues, to see the maximum extent of forest loss:

"*PEAK WOOD*"—MEANING THE TIME OF MAXIMUM PRODUCTION—CAME AS EARLY AS THE FIRST DECADES OF THE 19TH CENTURY, OR EVEN BEFORE THAT, FOR SOME PARTS OF THE EAST COAST.

Majestic slo-motion waves roll towards shore:

THE PATTERN OF USING UP AN ENERGY RESOURCE UNTIL IT WAS NEARLY GONE WAS REPEATED AT SEA.

Whaleboat scenes, heaving at the oars: this recreation was taped at Mystic Seaport, CT, the "Museum of America and the Sea":

AS AMERICA'S POPULATION GREW, SO DID THEIR NEED FOR FOR A BETTER WAY TO LIGHT THE NIGHT.

SO WHALING CREWS WENT TO SEA, ON THE HUNT FOR THE VERY BEST SOURCE OF ILLUMINATION…

Bos'n:

"Stand up and give it to 'im!"

…WHALE OIL.

A harpoon strike, above and below water: bubbling sounds.

AT FIRST, LARGE NUMBERS OF WHALES WERE FOUND NEARBY. THEY COULD JUST BE TOWED TO SHORE.

A series of prints and paintings of whaling vessels in icy polar waters:

BUT BY THE 1870'S WE'D BURNED SO MANY WHALES TO LIGHT OUR EVENINGS, THAT ALL THE "EASY" WHALES WERE GONE.

WHALE-OIL PRICES ROUGHLY DOUBLED.

NOW SHIPS HAD TO TRAVEL CLOSE TO THE POLES IN SEARCH OF BOWHEAD WHALES.

THEIR OIL WASN'T AS GOOD…

Period paintings of ships crushed in the ice: the source of many of the prints and painting seen in this sequence is the wonderful New Bedford Whaling Museum:

…AND CONDITIONS WERE REALLY DANGEROUS.

Creaking sounds… timber cracking… ice rasping:

IN 1871, UP IN THE ARCTIC, 33 SHIPS WERE TRAPPED IN THE ICE AND CRUSHED.

JUST AS HAPPENED WITH AMERICA'S FORESTS, WE'D EXPLOITED THE MOST EASILY ACCESSIBLE RESOURCES, AND HADN'T STOPPED UNTIL WE'D ALMOST USED THEM UP.

Drake Well discovery photos:

LUCKY FOR US, IN 1859 A CHEAPER, AND MORE ABUNDANT SOURCE OF ENERGY HAD BEEN DISCOVERED, WITH EDWIN DRAKE'S SUCCESSFUL OIL WELL, DRILLED IN TITUSVILLE, PENNSYLVANIA.

Pump jack and coal shot:

AND FOR 150 YEARS, AMERICA RAN AND GREW ON OIL AND COAL.

TODAY, IN SOME WAYS, WE'RE IN DANGER OF REPEATING THE PAST.

Prudhoe Bay oil derricks, snow and ice on the ground:

AS EASY OIL WAS ALL USED UP, WE'RE DRILLING IN CHALLENGING CONDITIONS, UP IN THE ARCTIC.

Aerials over vast excavations and giant machines at work: This footage was licensed from Greenpeace Canada, and you can see more from the movie, Petropolis, here.

WE'RE CONSIDERING AN INCREASING RELIANCE ON TAR SANDS, WHICH ARE PLENTIFUL IN OUR NORTHERN NEIGHBOR, CANADA, BUT WHICH ARE DIRTIER TO PROCESS.

Aerial of Fort Worth rig site: cut to industry computer graphics, zooming to the well-head:

BUT ONCE MORE, AMERICA HAS BEEN FORTUNATE TO FIND A NEW, ABUNDANT, DOMESTIC—AND POTENTIALLY—CLEANER SOURCE OF ENERGY.

CGI map of U.S. shale plays: we see the words Bakken, Marcellus and Barnett:

SEVERAL REGIONS, FROM NORTH DAKOTA ***(the Bakken formation and name appears),*** **TO THE MID-ATLANTIC AND NORTHEASTERN STATES** ***(ditto for "Marcellus"),*** **HAVE LARGE AMOUNTS OF NATURAL GAS DEEP UNDERGROUND, IN SHALE ROCK FORMATIONS.**

Dissolve to aerial footage:

AND THE CITY OF FORT WORTH SITS LITERALLY ON TOP OF THE BARNETT SHALE.

Spin around various drill sites, and scenes of drilling operations:

FOR THE FIRST TIME, A NEW SOURCE OF ENERGY IS EMERGING WHEN THERE'S AN AWARENESS OF THE URGENT NEED FOR SUSTAINABILITY.

CAN FORT WORTH, AND AMERICA, FIGURE OUT HOW TO MAKE SHALE GAS A SIGNIFICANT PART OF OUR ENERGY FUTURE, WITHOUT REPEATING THE MISTAKES OF OUR ENERGY PAST?

CHAPTER HEAD:

Gas, Waste and Water

Fort Worth:
Gas, Waste and Water

In the iconic Stockyards district, a herd of longhorns approaches down the street:

FOLKS USED TO CALL THIS "COWTOWN"…

Cut to drilling for natural gas scenes: surface shots:

TODAY, THERE ARE MORE THAN 2,000 GAS WELLS RIGHT UNDER THE CITY OF FORT WORTH

Mayor Betsy Price, Fort Worth, Texas

Mayor Price:

City's grown by 200,000 people in 10 years and estimate it will gain another 200,000...

An August 2011 study, "A Decade of Drilling," (PDF) says (pp. 3-4) that "The Perryman Group estimated the 2011 total effect of Barnett Shale activity to include $11.1 billion in annual output and 100,268 jobs in the region. While the majority of the stimulus comes from exploration and drilling, pipeline development and royalty and lease payments also contribute to the overall impact." A story in the *Fort-Worth Star-Telegram* from 2011 states that "The Barnett Shale natural gas drilling boom has had a cumulative economic impact of $65.4 billion in North Texas over the past decade…"

Aerial, with slowing traffic:

THAT GROWTH HAS BROUGHT CONGESTION ON THE ROADS…

River aerial, and Texas drought scenes:

AND PRESSURE ON FRESH WATER AT A TIME OF RECORD DROUGHT ALL ACROSS TEXAS.

"Sustainability Roundtable" scenes, taped at the Fort Worth Museum of History and Science, an outreach partner of the ETOM project:

THAT HAS MOTIVATED THE CITY TO JOIN THE "SUSTAINABILITY ROUNDTABLE," BRINGING TOGETHER DEVELOPERS AND PLANNERS, ENERGY EXECUTIVES, UNIVERSITY RESEARCHERS AND EVEN THE COMMANDER OF THE LOCAL NAVAL AIR STATION.

Betsy VO Roundtable scenes:

We have to begin to develop a master vision for how do we be sustainable?

Betsy on camera:

It has to be a concentrated effort on every department's part to think about their water use, their electric use.

ROUNDTABLE MEMBERS REALIZE THEIR PUSH FOR SUSTAINABILITY IS HAPPENING AGAINST THE BACKDROP OF THE NATURAL GAS BOOM.

Fort Worth aerials:

Daniel Yergin to camera and VO drilling scenes:

It's quite remarkable how rapidly shale gas has developed from being basically 0% of our production to being more than a third of our total natural gas production and going up…

DEPENDING ON HOW QUICKLY WE USE IT, EXPERTS SAY AMERICA COULD HAVE ENOUGH GAS FOR SEVERAL DECADES.

See Larry Brogdon teaching a course at Texas Christian University:

TO SOME, THIS IS A HUGE BONANZA…

To students:

"We've found so much gas here and in other areas, that the price has been driven down…"

For those wishing to wrestle with the complex and somewhat controversial question of just how much natural gas may exist, and be technically recoverable with today's technologies, at today's prices, please see "What the Frack? Is there really 100 years' worth of natural gas beneath the United States?" by Chris Nelder. His *Slate* byline identifies him as the co-author of *Profit From the Peak* and *Investing in Renewable Energy* and an energy analyst and journalist. The post, which includes useful graphs and maps, is worth reading in its entirety. Nelder notes that "Arthur Berman, a Houston-based petroleum geologist and energy sector consultant, along with petroleum engineer Lynn Pittinger, has long been skeptical of the claims about shale gas. Their detailed, independent work on the economics of shale-gas production suggests that not only are the reserves claims overstated, but that the productivity of the wells is, too."

Nelder's post continues: "The claim of a 100-year supply originated with a report released in April 2011 by the "Potential Gas Committee," an organization of petroleum engineers and geoscientists. President and Chairman Larry Gring works with Third Day Energy LLC, a company based in Austin, Texas, that is engaged in acquiring and exploiting oil and gas properties along the Texas Gulf Coast. Chairman of the Board Darrell Pierce is a vice

president of DCP Midstream LLC, a natural-gas production, processing, and marketing company based in Denver. The report's contributors are from the industry-supported Colorado School of Mines. In short, the Potential Gas Committee report is not an impartial assessment of resources. Its website consists of a single press release announcing the April report, with a link to a brief summary slide deck. A more detailed slide deck issued by the committee presents some optimistic estimates of potential resources, including a "future gas supply" estimate of 2,170 trillion cubic feet (tcf). At the 2010 rate of American consumption—about 24 tcf per year—that would be a 95-year supply of gas, which apparently has been rounded up to 100 years.

"But what is that estimate based upon? Those details haven't been made freely available to the public, but their summary breaks it down as follows here and in the graph below: 273 tcf are "proved reserves," meaning that it is believed to exist, and to be commercially producible at a 10% discount rate. That conforms with the data of the U.S. Energy Information Administration. An additional 536.6 tcf are classified as "probable" from existing fields, meaning that they have some expectation that the gas exists in known formations, but it has not been proven to exist and is not certain to be technically recoverable. An additional 687.7 tcf is "possible" from new fields, meaning that the gas might exist in new fields that have not yet been discovered. A further 518.3 tcf are "speculative," which means exactly that. A final 176 tcf are claimed for coalbed gas, which is gas trapped in coal formations. (Note: The PGC reports the total for probable, possible, and speculative coalbed gas as 158.6 tcf, but adding up their numbers for each category, we find the correct total is 157.7 tcf. We haven't been able to reach the PGC to discuss the discrepancy.) Adding the 18.6 tcf of proved coalbed gas reserves reported by the EIA in 2009—the most recent data it offers—to the 157.7 gives a total of 176.3 tcf for all categories of coalbed gas."

Nelder's crucial conclusion follows: "By the same logic, you can claim to be a multibillionaire, including all your "probable, possible, and speculative resources." Assuming that the United States continues to use about 24 tcf per annum, then, only an 11-year supply of natural gas is certain. The other 89 years' worth has not yet been shown to exist or to be recoverable."

Shock cut to YouTube protest clip:

TO OTHERS, SHALE GAS IS AN ENVIRONMENTAL DISASTER WAITING TO HAPPEN.

Boisterous, chanting, shouting sync!

"Get the frack out! Get the frack out!"

Shirley Jackson:

There has to be a more robust discussion with the public about risk and risk benefit. Very few discussions start that way. Most of them start with, "Here's a source we must use." Or "Here's a source of energy we must not use." The real issue is, what is our desired end state?

Aerial over Fort Worth, and then cut/zoom to CGI, showing deep layers:

GEOLOGISTS HAVE KNOWN ABOUT SHALE GAS FOR MORE THAN 20 YEARS…

BUT THAT DIDN'T MEAN THE GAS WAS *EASY* OR *ECONOMICAL* TO EXTRACT.

IN THIS INDUSTRY VIDEO, YOU CAN SEE THAT HYDRAULIC FRACTURING, OR "FRACKING," USES A MIXTURE OF WATER, SAND AND CHEMICALS.

THIS IS INJECTED DEEP UNDERGROUND TO BREAK UP THE ROCK AND LET THE GAS FLOW UP TO THE SURFACE MORE EASILY.

Betsy Price:

We say we've been punching holes in the ground in Texas for 100 years.

Aerials and stills showing drill sites right next to homes and offices:

WHAT *WAS* NEW WAS DRILLING DOWN, AND THEN OUT HORIZONTALLY, AND THE LOCATIONS OF THE PAD SITES.

Price:

We've been fracking wells for 50, but we've not done it in your backyard.

Larry teaching:

***LARRY BROGDON* IS AN OIL AND GAS MAN WHO MADE MONEY BY ACQUIRING AND SELLING DRILLING RIGHTS.**

NOW HE TEACHES A COURSE THAT TOUCHES ON ENERGY, ECONOMICS AND ENVIRONMENT AT TEXAS CHRISTIAN UNIVERSITY.

Brogdon VO and to camera:

The economic benefit to this area in the last 10 years has been about over $65 billion…

AND WHEN NATURAL GAS IS USED TO GENERATE ELECTRICITY, SOME ESTIMATES ARE THAT IT'S 50% CLEANER THAN COAL.

Daniel Yergin:

…the advantage that natural gas has is that it's much lower carbon in terms of its footprint.

INDUSTRY INSIDERS SAY AMERICANS NEED TO RECOGNIZE THAT THE POWER WE ALL USE HAS TO COME FROM SOMEWHERE.

Brogdon VO students listening, taking notes, writing:

On camera:

Somebody goes over there and they flip on that light switch, and they think they're just using electricity. Well, natural gas is generating a whole lot of that electricity.

YouTube protest clip: see gas masks and the signs, "Get the Frack Out!!!" etc.

HOWEVER, PUBLIC CONCERN, HERE IN FORT WORTH AND NATIONALLY, HAS FOCUSED ON WORRIES THAT THE ENTIRE CYCLE OF DRILLING, FRACKING, PRODUCTION AND FLUID DISPOSAL CAN CONTAMINATE DRINKING WATER, TRIGGER EARTHQUAKES, AND LEAK METHANE.

Yergin, over aerial and surface shots of the drilling:

Daniel Yergin:

It is an industrial activity, and that means the management of water. That means air quality.

Aerial stills emphasizing the closeness of the pads to homes:

And the third thing is just the community impact, that suddenly areas that were not being developed for natural gas now have this development coming in.

See Yergin in the C-Span clip of a Senate hearing on the Shale Gas Production Subcommittee 90 and 180 Day reports:

DANIEL YERGIN WAS A MEMBER OF A SPECIAL COMMITTEE TASKED BY THE U.S. SECRETARY OF ENERGY TO STUDY THE POTENTIAL ENVIRONMENTAL IMPACTS OF NATURAL GAS DRILLING.

Yergin testifying: highlighted details of the report:

THE COMMITTEE CAME UP WITH 20 RECOMMENDATIONS OF "BEST PRACTICES", WITH NUMBER ONE BEING BETTER SHARING OF INFORMATION WITH THE PUBLIC…

…NUMBER 14, DISCLOSURE OF FRACKING FLUIDS…

AND NUMBER 11, STUDIES ABOUT POSSIBLE METHANE CONTAMINATION OF WATER SUPPLIES.

Use the various stages of drilling (the Trinidad site, the various aerials—and stills—at various stages of completion, the fracking animation, and the completed pad sites) to illustrate the full life cycle: Shirley to camera and VO:

Shirley Jackson:

One has to do the full life cycle analysis, kind of "cradle to grave" kind of thing to really understand where the points of vulnerability are, including full environmental costs, and to then weigh the risks and the benefits. And that will help us lay out what the panoply of sources would look like.

Pan to drill rig:

ONLY IF SAFEGUARDS ARE IN PLACE CAN THIS FOSSIL FUEL REALLY SERVE AS A BRIDGE TO A MORE SUSTAINABLE FUTURE.

Yergin:

…right now "best practices" would focus on things like how do you handle the water that is produced out of the well as the result of hydraulic fracturing, and making sure that it's disposed of in a very environmentally sound way.

AS THE NAME "*HYDRAULIC* FRACTURING" IMPLIES, MASSIVE AMOUNTS OF WATER ARE REQUIRED FOR FRACKING, AND IN TEXAS, WHERE WATER IS A PRECIOUS RESOURCE, THIS IS A MAJOR CONCERN.

Mayor Price:

Water is huge, facing the city. And I think that water is one of those things that most people don't think long term about…

ALTHOUGH MAYOR PRICE SAYS LOCAL BREWERIES USE MORE WATER THAN THE DRILLERS, WITH SUSTAINABILITY IN MIND, THERE'S NO REASON WHY FRACKING HAS TO USE POTABLE WATER.

Mary Gugliuzza, Communications Coordinator, Fort Worth Water Department.

Mary Gugliuzza:

So now we're able to use reclaimed water to frack these wells and thereby use less of our potable water. And it can take three million gallons of water to frack one well.

Aerials of the Village Creek Water Reclamation Facility:

ONCE THOUGHT OF AS A SEWAGE TREATMENT PLANT, "VILLAGE CREEK" IS NOW THE WATER *RECLAMATION* FACILITY.

The City of Forth Worth website says that the Village Creek plant serves a population of 900,000, including 22 communities.

See the purple pipes at Village Creek:

TILL RECENTLY, 50% OF FORT WORTH'S POTABLE WATER WAS USED FOR IRRIGATION.

Sprinklers turn on at golf courses, with signs about the reclaimed water, and we see the DFW "water wall" at the airport:

NOW THE CITY'S DISTRIBUTING TREATED "GREY WATER", IN DISTINCTIVE PURPLE PIPES, TO IRRIGATE GOLF COURSES AND PLAYING FIELDS, AND FOR INDUSTRIAL USES AT THE GIANT "DALLAS-FORT WORTH" AIRPORT.

See—and hear—the dirty and industrial scale processes at Village Creek, including human waste and treatment:

Sebastian "Buster" Fichera, Assistant Water Director, Fort Worth Water Department:

Buster to camera, and VO the noisy, gritty processes:

Every day in the city of Fort Worth, about a million people put water down the drain. This is where it ends up.

Surface and interior shots of Village Creek, and aerials flying over the plant:

THE WATER TREATMENT PROCESS ITSELF IS BECOMING MORE SUSTAINABLE AND LESS ENERGY-INTENSIVE.

AND, IN A TWIST, THIS NEW APPROACH RELIES ON A *TRULY* NATURAL GAS.

Aerial spin around the Village Creek plant:

METHANE IS THE PRIMARY COMPONENT OF NATURAL GAS.

Village Creek scenes: aerials and then transitioning to location shots:

BUT IT'S ALSO A BY-PRODUCT OF OUR DAILY LIVES…FOUND IN HUMAN WASTE.

Richard Alley writes, "The methane being produced by the bio-digester is essentially identical to the natural gas produced by fracking, natural gas being almost all methane. There are tiny differences in ethane content, and a couple of others, but to first approximation, Fort Worth is getting methane from below the ground, unsustainably, and above the ground, sustainably."

ONE OF THE FIRST STEPS IN THE PROCESS IS TO REMOVE SOLIDS FROM THE WASTE, AND PUT IT INTO DIGESTERS, WHERE METHANE GAS IS GENERATED.

Buster:

Under normal circumstances, you may consider methane to be a greenhouse gas, which would be bad for the environment, but here we're using it as a renewable resource to power our engines, possibly getting up to as much as 90-95% of the energy required for the operation of this facility.

Village Creek is also capturing waste heat from its blowers, as part of a co-generation effort to tap otherwise unused energy, in a process known as "Combined Heat and Power" or CHP. The website states that "by 2008 the total installed CHP capacity had risen to 85 GW and 8% of U.S. electricity generation at over 3,300 facilities." Another website says that "in 2008, co-generation accounted for 9% of total U.S. electricity generating capacity. A recent study by the Oak Ridge National Laboratory calculated that increasing that share to 20% by 2030 would lower U.S. greenhouse gas emissions by 600 million metric tons of CO2 (equivalent to taking 109 million cars off the road) compared to 'business as usual.' "A third website presents this as "in 2008, the Oak Ridge National Laboratory outlined a scenario in which policies encourage aggressive efforts to deploy cogeneration. In that scenario, 20% of U.S. power could be produced using cogeneration by 2030."

FORT WORTH IS AIMING FOR SUSTAINABLE GROWTH AND AN ENERGY *BOOM* WITHOUT A FOLLOWING *BUST*.

BUT THE ENERGY WE ALL SURELY NEED WILL MORE EASILY BE FOUND BY TAPPING ANOTHER RESOURCE THAT'S FOUND IN FORT WORTH, AND EVERY COMMUNITY.

Daniel Yergin to camera and VO shots of the various sources of energy:

When we talk about energy, we talk about the various major energy sources. You talk about oil …natural gas …coal …nuclear. Increasingly also, of course, the renewables, wind and solar.

Yergin to camera:

But there's one fuel that gets left out of the discussion and yet it's one that has enormous impact in the future. That's the "Fifth Fuel", energy efficiency, conservation.

CHAPTER HEAD:

Conservation - The "5th" Fuel

Kansas:

Conservation – The "5th Fuel"

Kansas scene-setters: blowing grasses, cows, a lonesome locomotive rolls towards camera:

KANSAS, A LAND OF WHEAT, AND CORN, AND CATTLE.

IN THE HEART OF THE COUNTRY, IT'S NUMBER 48 OUT OF ALL FIFTY STATES IN ENERGY EFFICIENCY.

Vertical wind turbine at one of Peach Madl's gas stations/convenience stores:

SO THIS IS A PLACE WHERE ENERGY CONSERVATION CAN REALLY MAKE A DIFFERENCE.

The American Council for an Energy-Efficient Economy's study provides a map with Kansas ranked number 48.

Cattle rancher, driving, calls out to cows:

"C'mon, girls!"

Nancy Jackson, Founder, Climate+Energy Project:

Nancy to camera and VO:

Our region is a region of farmers. We are famously conservative and…

On camera:

…we have talked from the beginning about putting the "conserve" back in "conservative."

In Kansas, horses are led into a barn. Cut to U.S. buildings by day and night: then flying over the United States at night, seeing what it looks like from the International Space Station: this and other stunning NASA imagery can be viewed and downloaded, as stills and HD movies, here. Thanks, NASA, for this amazing resource!

ACCORDING TO A STUDY BY THE *NATURAL RESOURCES DEFENSE COUNCIL*, IMPROVEMENTS IN ENERGY EFFICIENCY HAVE THE POTENTIAL TO DELIVER MORE THAN *$700 BILLION* IN COST SAVINGS IN THE U.S. ALONE.

Street scenes in NYC, showing pedestrians looking around:

BUT, THEY SAY, "MOTIVATING CONSUMERS TO TAKE ACTION …IS THE KEY TO UNLOCKING THIS POTENTIAL."

Scenes from all over Kansas, starting with Baldwin City:

AND THAT WAS THE AIM OF NANCY JACKSON'S "CLIMATE AND ENERGY" PROJECT, WITH ITS "*TAKE CHARGE! CHALLENGE*."

For more on the TC!C, and other innovative energy saving initiatives, see the Driving Demand report from Lawrence Berkeley National Lab.

Flags over motorbikes, Chanute, woman and worker at the hydro plant: a youngster rolls a drum containing raffle tickets.

Nancy Jackson:

Kansans are patriotic, Kansans are hardworking, Kansans are humble. Um, Kansans are faithful.

AND KANSANS ARE COMPETITIVE.

Statements from all over about wanting to win, a quick montage of different people and places, starting in Gardner, KS:

Dorothy Barnett, Executive Director, Climate+Energy Project:

Y'all are competing against Ottawa, Baldwin City, and Paola. So really, ya' gotta beat those guys, yes?

Applause:

Female student volunteer in Lawrence:

Do you wanna help us beat Manhattan?

Signs at events and CGI map showing the whole state and the 4 regional groupings:

2011 WAS THE SECOND YEAR FOR THE "TAKE CHARGE! CHALLENGE", A FRIENDLY COMPETITION AMONG 16 COMMUNITIES, ARRANGED IN FOUR REGIONAL GROUPS, AIMING TO REDUCE THEIR LOCAL ENERGY USE.

Larry Wittmer at an event in Iola shows how to weather-strip windows:

Ray Hammarlund, Fmr. Director, State Energy Office with Kansas Corporation:

Hammarlund:

Some of the lowest cost, some of the most effective ways that you can take ownership of your energy future, is taking ownership of the efficiency.

Place locator: Iola, Kansas, during the "Fight the Energy Hog Festival":

…and the conservation of your house, or your business.

Place locator: Lawrence, Kansas. A typical TC!C outreach event, with local coordinators engaging the public:

RAY HAMMARLUND'S OFFICE USED FEDERAL STIMULUS DOLLARS TO FUND FOUR PRIZES OF $100,000 FOR EACH OF THE...

Place locator: Baldwin City, Kansas

…FOUR REGIONS IN THE COMPETITION.

Place locator: Chanute, Kansas. A face-painted boy holds up a "Take The Challenge" sign: see several of the TC!C coordinators, hard at work:

JUST AS IMPORTANT AS THE GRAND PRIZE, $25,000 WENT TO EACH COMMUNITY TO FUND LOCAL COORDINATORS WHO TOOK THE LEAD IN GALVANIZING GRASSROOTS EFFORTS.

HERE'S HOW THE CHALLENGE WORKED IN IOLA.

Judy Brigham, Fmr. City Manager, Iola, KS:

Judy:

The challenge started in January of this year and ends October 1. You're required to have three community events …we're going to have a lot more than that.

Jeff Risley, Fmr. Exec. Director, Climate+Energy Project

Jeff Risley:

Today, we are at the "Fight the Energy Hog Festival."

Rebecca Nilges, Team Leader, Iola Take Charge! Challenge

Becky Nilges:

I love the hog. He was just so ugly that he is cute. He represents energy hogs in your home. You would probably let him in but you don't know the damage he's going to do.

Scenes from the Iola festival, including swapping out incandescent bulbs for CFLs:

COMPETING TOWNS SCORED POINTS BY COUNTING HOW MANY CFL BULBS AND PROGRAMMABLE THERMOSTATS WERE INSTALLED, AND WHEN PROFESSIONAL HOME ENERGY AUDITS ARE DONE.

See Russ Rudy at work with "Lodge" proprietor, Peach Madl, in Baldwin City:

Russ Rudy, Energy Auditor

Russ, to camera and VO audit action:

Our job as energy auditors, both for commercial buildings as well as residential buildings is, we're essentially detectives...

Russ uses an infrared detector to track air leaks and gaps in insulation: for more see DOE's Energy Savers site, with text and video.

What's happening here? Is there a great deal of air leakage?

And we're finding that the majority of the houses that we're dealing with actually use a lot more energy than they need to.

Trinity Episcopal Church, Lawrence, KS:

IN LAWRENCE, A *HOUSE* OF WORSHIP DID AN ENERGY AUDIT, MADE CHANGES, AND GOT A PRETTY NICE DONATION IN ITS COLLECTION PLATE.

David Owen, Environmental Stewardship team, Trinity Episcopal Church, Lawrence, KS:

David:

One part of the audit was to contact the power company …Well, during that process we discovered they've been overcharging us. And so we got a check, a rebate check from them for $4,466.

Lighting fixtures in the nave and choir:

OTHER CHANGES START SMALL, BUT ADD UP.

Lights in various sections of the church:

David Owen:

We were a little bit worried at one point that the congregation would not accept the very bright, white type lights. So as an experiment, we took one of these chandeliers and changed all the bulbs in it to the CFLs.

And then we took the priest over here and we said, "Which one did we do?" And he could not tell us. So that told us it was OK to do them all. (Laughs.)

Montage of deeply-colored stained glass windows:

CHANGING LIGHTS, ADDING INSULATION AND UPGRADING WINDOWS PAID OFF.

David Owen:

Even though it's an old building, we saved 64% on the consumption of energy in this room.

Display of different types of lights, from traditional to more energy efficient, as used in TC!C outreach events:

LIGHTING MAKES UP ABOUT 15% OF A TYPICAL HOME'S ELECTRICITY BILL, AND LIGHTING ALL OF OUR RESIDENTIAL AND COMMERCIAL BUILDINGS USES ABOUT 13% OF THE NATION'S TOTAL ELECTRICITY.

A 2011 report from the Energy Information Agency states that "EIA estimates that in 2010, about 499 billion kilowatt-hours (kWh) of electricity were used for lighting by the residential and commercial sectors. This was equal to about 18% of the total electricity consumed by both of those sectors and about 13% of total U.S. electricity consumption." This study also states that "In 2010, the average annual electricity consumption for a U.S. residential utility customer was 11,496 kWh," and that 208 billion kWh out of a total of 1363 billion kWH of electricity used in residences went to lighting—15.2%.

Guitar music at community festival, kids ride a mechanical pig (no, really), munch BBQ, etc. Cut to the "Bulb Eater" at the Chanute Festival:

BUT CHANGING OUT OLD BULBS IS A LOT EASIER THAN PAYING FOR AUDITS AND THE ENERGY ENHANCEMENTS THEY RECOMMEND.

Baldwin City event, and speeches by the Mayor: cheerleaders hold up signs outside The Lodge to attract folks to the event:

HERE'S WHERE THE 2011 "TAKE CHARGE! CHALLENGE" PROMISED MATERIAL ASSISTANCE, USING FEDERAL STIMULUS FUNDS.

Ken Wagner, Mayor, Baldwin City, KS:

Ken Wagner:

It's a $500 audit that costs you $100. The rest of that $500 is covered under the Take Charge! Challenge program through the Kansas Energy Office.

It's a beautiful sunny day, with flowers blooming and kids pedaling hard to illuminate lights in a display:

Ken, from interview, and VO scenes of the community event:

…we really love the competitive spirit of the program, and I think it's really raised a whole awareness of energy efficiency and the importance of energy efficiency to a lot of segments in our community here.

EVEN BALDWIN CITY BANKERS WERE GRATEFUL FOR FINANCIAL ASSISTANCE FROM STATE AND FEDERAL GOVERNMENTS!

Dave Hill, interviewed at the same event: exterior and interior scenes of the bank and its customers.

Dave Hill, Mid-America Bank, Baldwin City, Kansas

Dave Hill:

Nine months ago, we installed a 14 KW solar power system. I believe the initial cost of the system was basically $65,000, and then we got a substantial grant from USDA, I believe it was $20,000. We have about $18,000 of our own money invested in the system, after all the deductions. We think it will pay out in about 7 to 8 years.

See David Crane on the trading floor of NRG for the VO intro.

DAVID CRANE OF NRG ENERGY THINKS THAT KIND OF APPROACH MAKES GOOD BUSINESS SENSE.

Crane over solar panels:

What I say to every businessman who has a customer-facing business is, "think of a solar panel

See the bank roof:

…not only as a source of electricity, think of it as a billboard. You don't even have to write your name on it. Just put it on the top of your store and it will be sending a message to your customers that you're doing the right thing when it comes to sustainable energy."

Low-angle shots of the ribbon being cut, plus scenes inside of the American Energy Auditors facility in Gardner, KS, where you see folks being ushered through displays of insulation, and through a mock blower test. A few cute shots of kids being held up to feel the draughts.

"1-2-3!" Ribbon cut heard

Place locator: Gardner, Kansas

Citizens tour the AEA facility, and see displays of different kinds of lighting:

SURVEYS OF WHY CONSERVATION IS HARD TO ACHIEVE HAVE FOUND THAT PEOPLE WANT ONE-STOP SHOPPING, A PLACE WHERE THEY CAN FIND OUT *WHAT TO DO, AND* GET PRACTICAL RECOMMENDATIONS ABOUT WHO TO HIRE, *AND* WHAT IT ALL MIGHT COST… JUST WHAT THIS NEW FACILITY WAS TO OFFER.

Place locator: Heritage Hall, Topeka, KS

From all across the state, representatives of competing cities gather in Topeka, the state capital:

NOW… IT'S MID-OCTOBER… TIME FOR THE RESULTS OF THE 2011 "TAKE CHARGE! CHALLENGE."

Moderator:

"Fort Scott!"

Winning communities #1 & #2 come up, collects their award, and pose for photos:

MC:

"And the winner is… Baldwin City!"

See Nancy Jackson applauding at the Awards: to camera and VO awards activity:

Nancy Jackson, Founder, Climate+Energy Project, Kansas:

Over 100 billion BTUs were saved as a result of this Challenge and millions and millions of dollars in each community.

See Mayor Wagner, and banker Dave Hill, from the winning community of Baldwin City:

Nancy:

Those savings come from measures that have been installed that will guarantee those savings for years to come. So the savings are enormous over time.

Wagner to camera and VO his team posing with the huge $100K check:

Ken Wagner:

$100,000 has a nice ring to it, and it's a nice cash award for a community of our size.

See the Baldwin City folks celebrating, getting their "Publishers' Clearinghouse"-sized $100K check, and then having their photos taken by their poster/banner:

Ken continues:

Our challenge now, is to continue on with energy efficiency and encourage our community to save…

Nancy continues over scenes of the TC!C in operation, flyers and raffle tickets being handed out: Dorothy Barnett wrangles the Colby winners for their photo op:

One of our real goals was to help people, to stop thinking about energy efficiency as the things they* shouldn't *do, as what not to do, and think about it instead as a tremendous opportunity to both save money in the near term, and to make our electric system more resilient in the long term.

On camera:

So it's about what we can do, both individually and together, and for us, that feels like the real win.

Daniel Yergin:

The United States today is twice as energy efficient as it was in the 1970s.

And I think we have the capability in the decades ahead to become twice as energy efficient again.

For DOE's comprehensive report on Energy Efficiency Trends in Residential and Commercial Buildings, see here (PDF). Yergin's chapter 31 in *THE QUEST*, "*The Fifth Fuel-Efficiency*" has an accessible overview.

Nancy on camera:

We believe this is something that can be done really anywhere, with great success.

Baltimore:
Conservation in a Big City

Driving through a typical neighborhood: drum music from the block party seen later in the program:

BALTIMORE, MARYLAND.

Driving past typical East Coast row homes:

ACCORDING TO ONE STUDY, THE AIR IN MARYLAND IS THE 5th DIRTIEST IN THE NATION. *(PDF)*

A view of the Greenmount neighborhood:

ARE THERE WAYS FOR AMERICA'S 21st LARGEST CITY TO CUT EMISSIONS, AND SAVE ENERGY AND MONEY?

Alice Kennedy, Sustainability Coordinator, City of Baltimore:

Alice:

Baltimore is unique in that it has over 225 neighborhoods, within the city limits.

VO over Greenmount event:

LIKE KANSAS, IT'S BEEN USING COMPETITION TO JUMP START THE PROCESS OF SUSTAINABILITY.

Alice driving:

"Miss Robb?"

Alice continues driving and we see crowds milling about at the racetrack: we see a Pimlico sign and a closer look at the stylized racehorse:

Place locator: Pimlico Race Course, Park Heights neighborhood

BNEC, THE "BALTIMORE NEIGHBORHOOD ENERGY CHALLENGE," USED EXISTING EVENTS—LIKE THIS ANTI-CRIME RALLY IN THE PARK HEIGHTS NEIGHBORHOOD—TO LET CITY RESIDENTS KNOW ABOUT OPPORTUNITIES TO SAVE ENERGY, AND TO SHARE THE "TOP TEN" THINGS TO DO. *(PDF)*

Alice at the booth at Pimlico, talks to the Park Heights "Energy Captains":

"You signing people up?"

Alice interacting with an Amtrak employee:

Alice speaking voice over:

We are willing to go and talk to anybody, anywhere, where we can get some face time with people to talk about energy savings, and conservation.

And if it means going to an event talking about crime, we will go to an event talking about crime.

If it's about a neighborhood block party, we will go to a neighborhood block party. We find people where we can get 'em.

A marching band, with strutting cheerleaders, approaches at a lively block party:

Place locator: Greenmount West neighborhood, Baltimore

Alice (over loud music) handing out a bag of free energy saving incentives:

And the toilet tank bag, and the draught stopper gaskets, as well.

A man mumbles his thanks.

Alice:

You're welcome.

Family group walking on street. Alice and Robbyn and others walk the Patterson Park neighborhood streets:

Place locator: Patterson Park neighborhood, Baltimore

IN ADDITION TO SHARING INFORMATION, THE BALTIMORE CHALLENGE ENLISTED "ENERGY CAPTAINS" TO CANVASS THEIR OWN NEIGHBORHOODS, TAKING THE CONSERVATION MESSAGE DIRECTLY TO HOMEOWNERS.

Guitar dude:

OK, on this side as well???

THAT'S SOMETHING THE CHALLENGE'S UTILITY PARTNERS KNEW *THEY* COULDN'T DO…

Guitar dude:

I'm on the BNEC Challenge pledge!

See Robbyn and neighbors canvassing:

Ruth Kiselewich, Baltimore Gas & Electric Co.

Ruth:

If somebody just comes to your door and asks you to sign a petition to help the environment, to reduce your energy use, or if you see a message even from the local utility about all these great things you can do, it's not enough.

Robbyn talks to the guitar dude and his wife:

Robbyn:

My sister Tracy, Alice Kennedy from the Baltimore City Sustainability Commission…

Thomas Stosur, City Planning Director, Baltimore.

Thomas:

Unique thing about BNEC is the fact that it builds on this neighbor-to-neighbor advocacy and communication for energy conservation.

It goes right down to the household level, y'know, neighbors talking to each other across the yard.

Robbyn Lewis, Energy Captain, Patterson Park neighborhood.

Robbyn asks:

What do you guys do to save energy at home?

Elderly black couple: man is speaking.

Leave the lights off. During the day we turn the lights off. When we're not looking at TV, we turn the TV off. So the TV cannot watch itself.

Tracy cutaway: he nods.

That's basically what we do.

At the older white couple's front door:

TO JUMP START ENERGY SAVINGS, THE CHALLENGE HAS *A BAG OF FREE STUFF* INCLUDING "INDOOR/OUTDOOR" CFLs… JUST RIGHT FOR THE PORCH LIGHTS SO CHARACTERISTIC OF BALTIMORE.

Alice and Robbyn speak, voice under:

Robbyn speaks: she hands over a CFL.

Would you be interested in trying that? You can get up there…

The older homeowner looks up to the porch light area and turns to her husband. Robin asks the woman can he get up to do that and she points out, the husband said he will.

He will!

Wonderful!

Another homeowner says:

Everyone's household's budgets are shrinking, right now too, so I think that if we all just can be wise about what were doing, we're all going save a little bit of money.

Robbyn:

So, you're all signed up?

Inez Robb at Martha's Place, Robbyn at "Big Antoine's":

THE CHALLENGE FOUND THAT NEIGHBOR-TO-NEIGHBOR SHARING COULD BE EVEN MORE EFFECTIVE WHEN THE ENERGY CAPTAINS WENT INSIDE HOMES TO DEMONSTRATE QUICK AND EFFECTIVE STEPS, IN A SIMPLIFIED PEER-TO-PEER "ENERGY AUDIT."

Inez Robb, Energy Captain, Fulton Community Association

Inez:

Then when you're not here, not using it, turn the power strip off.

Inez and Robbyn both do the toilet bladder demo:

FOR BALTIMORE RESIDENTS SAVING WATER ALSO SAVES SUBSTANTIAL DOLLARS, AND THIS SIMPLE BLADDER REDUCES THE AMOUNT USED IN EACH AND EVERY FLUSH.

People gather at the Park Heights Awards ceremony: Park Heights captains gather for the next stage of the Challenge.

WHAT IMPRESSED THE ORGANIZERS OF THE FIRST YEAR'S CHALLENGE WAS THAT PARK HEIGHTS, HOME TO THE PIMLICO RACETRACK AND ONE OF THE *MOST UNDERSERVED* NEIGHBORHOODS, SAVED THE MOST ENERGY, *NEARLY 13%*.

THE ORGANIZERS SAID THE MAIN REASON WAS THE ENERGY AND ENTHUSIASM OF THE PARK HEIGHTS ENERGY CAPTAINS.

The Park Heights "Captains" meet at the Zeta Senior Citizens Center, and review the various:

Thomas Stosur:

They actually saw, those residents who participated there, the largest benefit of any of the neighborhoods …to see this very grassroots effort take off and outperform any other neighborhood was really impressive.

THE PARK HEIGHTS CAPTAINS WERE ALSO SUCCESSFUL IN APPLYING FOR FOLLOW-ON FUNDING, TO CONTINUE THEIR CONSERVATION EFFORTS.

Place/time locator: Zeta Senior Center, Park Heights

THE ANNOUNCEMENT OF THE 2011 "*COMMUNITY ENERGY SAVING GRANTS*" BROUGHT OUT U.S. SENATOR BEN CARDIN, AND BALTIMORE MAYOR, STEPHANIE RAWLINGS-BLAKE.

Stephanie Rawlings-Blake, Mayor, Baltimore MD

Mayor Blake, with cutaways:

Saving energy means lower utility costs, and after the heat wave we've had, I'm sure everyone is interested in lower utility costs.

On camera:

…and the knowledge about energy savings is contagious.

City Hall exterior: and the City Hall ceremony, with the "Energy Vampire": Signs and press photographer, etc.

BALTIMORE CITY ITSELF TOOK LESSONS FROM THE CHALLENGE, AND STARTED PITTING CITY DEPARTMENTS AGAINST EACH OTHER, IN A COMPETITION TO CATCH SO-CALLED "ENERGY VAMPIRES" AROUND CITY BUILDINGS…

Park Heights planning meeting:

USING THEIR NEW GRANT, THE PARK HEIGHTS CAPTAINS STARTED PLANNING A NEW OUTREACH CAMPAIGN, USING JUNIOR "ENERGY AMBASSADORS" TO REACH OUT TO SCHOOLS AND OTHERS.

Alice Kennedy's office: she and her staff study computers, and Excel spreadsheets:

WITH HOMEOWNERS' PERMISSION, CHALLENGE STAFF COULD ACCESS UTILITY BILLS, AND SO PLOT ENERGY SAVINGS, NEIGHBORHOOD BY NEIGHBORHOOD.

Alice, to camera and VO:

So we actually are able to show that we have proven savings by looking at utility usage data and showing that some of these little actions in the home can save money and save energy.

BOTTOM LINE… THANKS IN PART TO THE CHALLENGE, BALTIMORE IS ON TRACK TO MEET ITS GOAL OF *REDUCING CARBON EMISSIONS AND ENERGY USE* BY 15% BY 2015… AND THE UTILITIES CAN CUT BACK TOO.

Ruth:

As we reduce energy use and energy demand what we're doing is we're eliminating the need for a new medium-size power plant.

Ruth VO scenes from all over BNEC and the city:

Particularly in hard economic times, this Challenge helps build a sense of I can accomplish something individually. I can impact my life in a very positive way.

Mayor Blake (at the Park Heights award event) VO and to camera:

Saving energy means a reduced strain on our power grid, lower utility costs as well as reduced greenhouse gas emissions.

On camera here:

Which means, for generations to come we will have better air quality and a cleaner and more sustainable Baltimore.

BNEC, like all successful social initiatives, learns, morphs and changes as it evolves. The new Baltimore Energy Challenge will be making schools the center of community energy savings, engaging parents through their youngsters. Stay tuned for new developments in the years ahead!

CAN WHAT CITIES DO *LOCALLY* MOVE THE DIAL TOWARD NATIONAL SUSTAINABILITY?

PORTLAND, OREGON, SHOWS WHAT'S POSSIBLE…

CHAPTER HEAD:

"The Trip not Taken"

Portland, Oregon:
"The Trip Not Taken"

Generic traffic scenes, cars, from anywhere in the U.S.: SFO, NYC, etc.

70% OF ALL THE OIL CONSUMED IN AMERICA IS USED FOR TRANSPORTATION.

A more usual but vaguer statement seems to be "more than two-thirds." But Table A2 of the EIA study (PDF) says that in 2010, transportation in the U.S. used 26.9 quads of oil in all forms; Table A1 states that the consumption of liquid fuels and other petroleum was 37.25 quads. On these numbers, transportation took 72.2% of all oil.

Congestion shots, and tailpipe belching emissions:

BUT CONGESTION WASTES A HUGE AMOUNT, PERHAPS 16% OF ALL THE OIL IMPORTED FROM THE PERSIAN GULF.

The nonprofit group, Securing America's Future Energy, produced a study entitled *Congestion in America: A Growing Challenge to U.S. Energy Security stating that* "in 2010, drivers in U.S. urban areas were estimated to have wasted 1.9 billion gallons of fuel. In the absence of substantial and effective policy intervention, estimates suggest 29 and 65 percent increases in wasted fuel, and equally large increases in travel delays, by 2015 and 2030 respectively." Since the transportation sector consumes about 220 billion gallons of liquid hydrocarbon fuel per year, this wastage is a bit under 1% of the total usage. The EIA website states that Persian Gulf oil imports for 2010 were 624 million barrels (14.5% of all oil imports). Since each barrel (42 gallons) of crude produces about 19 gallons of gasoline, Persian Gulf oil imports produced about 11.9 billion gallons of gasoline. Congestion in 2010 therefore wasted an amount equivalent to 16% of the gasoline derived from Persian Gulf oil imports.

Earl Blumenauer, Congressman, Oregon 3rd District (D)

Blumenauer:

Despite our best efforts, we are still taking 10% of the world's petroleum supply just to get back and forth to work every day.

Earl talking, and a still photo, showing him standing by his bike near the U.S. Capitol:

CONGRESSMAN EARL BLUMENAUER REPRESENTS OREGON'S THIRD DISTRICT, INCLUDING PORTLAND.

HE HEADS UP THE CONGRESSIONAL BIKE CAUCUS…

Classic Portland shots: spin around the Portland Theater sign, and bridges and bikes:

…AND HIS CITY STARTED FINDING SOLUTIONS SOME 30 YEARS BACK.

Blumenauer's website is full of interesting statistics about dollars saved through bikes and mass transit, and even the health benefits of cycling and walking. It's well worth a visit.

City scenes, downtown, and Susan VO and to camera:

Susan Anderson, Bureau of Planning and Sustainability, City of Portland

Susan:

Y'know, one of the things we did was we have an urban growth boundary, and what that is, is a ring around the city of Portland and its surrounding suburbs.

Shots from the aerial tram that shows the entire city, with trees, the river, etc.

So that we cannot kind of sprawl out and we can't become Los Angeles.

BETWEEN 1950 AND 1990, AMERICA'S URBAN POPULATION GREW BY 90%.

BUT CITIES' LAND AREA GREW MORE THAN 250%.

REMARKABLY, PORTLAND BUCKED THAT TREND OF URBAN SPRAWL.

Please see U.S. Urbanized Areas, which provides data on population and land area for the dates referenced.

Additionally, Table A-1 (PDF) on the website collects United States census data that shows an 87% increase in the U.S. population from 1950 to 2000, but a 130% increase in the urban population. So we can say that "Between 1950 and 2000, the United States population grew by 87%, but the population in urban areas (or cities) grew by 130%."

Sam Adams, Mayor, Portland (D)

Sam Adams:

Key decisions made include a move from investment in freeways into transit and also to integrate transit planning with land use planning.

ALONG WITH REGION-WIDE THINKING, PORTLAND NOW HAS AN INFRASTRUCTURE THAT EMPHASIZES MASS TRANSIT.

Period photos from the "Good Roads" era:

…ALONG WITH SOMETHING THIS CITY PIONEERED IN THE 19TH CENTURY… BICYCLES.

Hipsters drink beer, with loud music at the "Oregon Manifest" welcome party:

IT MAY BE EASY TO PARODY PORTLAND'S LOVE AFFAIR WITH ALL THINGS GREEN, INCLUDING THE CYCLING COMMUNITY.

On a Portland rooftop, the Manifest judges inspect a sample bike:

BUT PUTTING BIKES TO WORK HAS PRACTICAL ADVANTAGES, IF THEY CAN BE MADE INTO SOMETHING USED FOR MORE THAN PURE RECREATION.

See the bikes with the biggest cargo racks, and the judges marking down scores:

THAT'S THE PURPOSE OF WHAT'S CALLED THE "*OREGON MANIFEST*", A DESIGN CHALLENGE TO COME UP WITH CLEVER AND PRACTICAL WAYS TO TRANSPORT PACKAGES AS WELL AS PEOPLE.

Stephanie Noll, Bike Transportation Alliance.

Stephanie starts speaking over the Manifest bikes:

A decade ago it was hard to find a bike that was not a racing bike or a mountain bike or a touring bike. Now, any bike shop that you walk into, in the city of Portland anyway, you'll find city bikes, bikes that are really made for commuting to and from work, from riding to the park to the grocery store.

Freeways, cars and bikes: a tail-pipe pumps out vapor in a snow-storm:

HALF OF U.S. CAR TRIPS COVER LESS THAN 10 MILES AND SHORT TRIPS, WHERE ENGINES MAKE A COLD START, ARE THE MOST GASOLINE INTENSIVE, AND POLLUTING.

A U.S. Department of Energy website gives average trip distances for recent years."

SO IF CITY BIKES LIKE THESE BECAME MASS-PRODUCED AND POPULAR, AND IF EVERY ONE OF THE NATION'S MORE THAN ONE HUNDRED MILLION HOUSEHOLDS SUBSTITUTED ONE FIVE MILE TRIP EACH DAY, THE NATION WOULD SAVE 36.5 BILLION DOLLARS ON GASOLINE.

If one assumes an average of 5 miles, then a saving of 1825 miles per year, with an average of 20 miles per gallon per vehicle, would save about 90 gallons per year per household, or a total of 104 billion gallons for the 114 million households in the United States. At $3.50 per gallon, the total savings would amount to $36.4 billion. Double the daily mileage saved, would double that figure.

ALREADY ONE YOUNG ENTREPRENEUR HAS PUT PORTLAND'S NON-POLLUTING PEDAL POWER TO WORK, AND MADE A BUSINESS OF IT.

See the two "B-Line" delivery women, and the produce they pick up and deliver:

Franklin Jones, Owner, B-Line Urban Delivery.

Franklin Jones, to camera and VO:

We use these large tricycle trucks to deliver products into a two mile radius of the urban core for Portland. We deliver everything from bread and produce, to office products to water to cycle parts. Each trike can carry about 800 pounds. They're all electric-assisted. So, it's a hybrid… human and electric power.

Mayor Adams VO cycling shots:

Sam Adams:

The less congestion we have, our goods and services move faster. We're an international global city. We have to be scrappy, so bicyclists are about reducing congestion.

Franklin:

Over the past two and half years, we've helped displace over 25,000 truck or van-based deliveries. And when you start to look at the overall greenhouse gas reduction and avoidance, day by day, it's not very much, but cumulatively, it really starts to stack up.

At first see bikes alongside buses and streetcars, but then emphasize the multitude of mass transit options.

CYCLING MAY BE AN OUTWARD AND VERY VISIBLE SIGN OF A TRANSITION AWAY FROM CARS, BUT THE REGION'S MASS TRANSIT NETWORK ALSO HAS SERIOUS NUMBERS.

George Beard, Office of Research and Strategic Partnerships, Portland State U.

George:

We have been electrifying our transportation for 30 years here. And today there are literally about 150,000 boardings per day. And that means that people who otherwise might be traveling around in cars…

See him on camera for this:

…are traveling around in electrons.

For a useful overview of transportation in Portland, see Wikipedia.

Earl Blumenauer:

As a result of how we put the pieces together in Portland over the last third of a century, Portlanders voluntarily drive 20% less than the national average.

This translates into a dollar savings for the typical household of more than $2,500 a year.

Cyclists commuting during the city's annual Bike Commute Challenge:

And that's money that stays in our community. It is not going to Houston or Saudi Arabia, Japan or Germany.

Blumenauer and his Livable Communities Task Force colleagues provide additional statistics and backup in "Freedom from Oil."

Pedestrians in urban village scenes:

PORTLAND'S LEADERS TALK ABOUT "THE TRIP NOT TAKEN" AS SOMETHING THAT SAVES MONEY, AND BENEFITS THE ENVIRONMENT.

City scenes, cycling and mass transit:

CURRENTLY MORE THAN A QUARTER OF PORTLAND'S WORKFORCE COMMUTES BY BIKE, CARPOOL OR MASS TRANSIT.

Portland's website gives the total length of urban bike-ways as 324 miles.

A recent study puts Portland bike commuters at 5.8%. A 2007 article lists Portland's mass transit commuters as 13.3%. A Federal Highway Administration study put Portland's carpoolers in 2000 at 12.1% of all commuters. This total comes to 30.2% for carpoolers, mass transit users, and cyclists.

BUT PLANNERS ARE WORKING ON THE NEXT GIANT STEP IN LOW CARBON TRANSPORTATION…

An all-electric plug in pulls into "Electric Avenue":

…ELECTRIC VEHICLES.

NRG's David Crane:

I think we get to the point where electric vehicles will be able to do, y'know, 98% of the personal transportation needs, and of course that's mainly in the cities and the suburbs.

AN AVERAGE PORTLANDER'S *DAILY COMMUTE OF 20 MILES* COULD EASILY BE POWERED BY A SINGLE BATTERY CHARGE.

SO "*ELECTRIC AVENUE*" IS A TEST SITE, TO GET GROUND TRUTH ON HOW PEOPLE MIGHT USE E-VEHICLES.

CUs of the e-vehicles and signs:

George Beard:

We think the next 10 to 30 years is going to be focusing on individual passenger vehicles like the ones behind me, and also on urban freight and service vehicles, those parcel delivery trucks, the post office.

Regular trucks and vans on the roads:

THOSE VEHICLES ALSO MAKE LOTS OF SHORT TRIPS, WITH STARTS AND STOPS, PRODUCING EMISSIONS AND USING UP A LOT OF FUEL.

Fritolay scenes:

NATIONALLY, COMPANIES LIKE *FRITOLAY* ARE COMPETING WITH OTHERS, LIKE *FEDERAL EXPRESS*, TO SEE WHO CAN DEPLOY THE MOST LOW EMISSIONS DELIVERY VEHICLES.

David Crane:

Tailpipe emissions are the single greatest source of emissions in our major cities. So I think, probably, every Mayor, everywhere, supports the idea of getting more vehicles on their local roads that don't have tailpipes.

In his interview for ETOM, just a small part of which appears in the program, Crane argues that most cars in the U.S. are only used for transportation for one and a half hours per day. And if they were e-vehicles, they could be used as battery storage for the "smart grid" of the future, balancing out—for example—fluctuating wind and solar sources.

The total travel distance of cars in the U.S. is about 250 billion miles per month, and there are about 250 million vehicles in the country, of which almost 200 million are cars and light trucks. This implies an average vehicle usage of a bit over 12,000 miles per year, or about 33 miles per day. The hour-and-a-half figure, which implies an average speed of 22 mph, can't be far off, as most vehicles are driven in urban areas. Of course, the car's 22½ hours at rest may not all be in the same place, but it's not unreasonable that we could have plugs everywhere in the future.

PORTLAND'S ORIGINAL PLANS CONCENTRATED ON LAND USE AND TRANSPORTATION.

THE FOCUS FOR THE FUTURE IS *THE NEIGHBORHOOD*.

Scenes of neighborhoods and youngsters learning bike safety:

THE GOAL IS WHAT'S CALLED A "TWENTY MINUTE NEIGHBORHOOD" WITH MOST EVERYTHING A FAMILY NEEDS IN EASY WALKING OR BIKING DISTANCE…

Biking kids:

…WHERE KIDS COULD LEARN HOW TO BIKE SAFELY TO AND FROM SCHOOL.

See folks going to coffee shops, etc. Kids in the "We all can ride" sequence.

Earl:

This effort of integrating the pedestrian, streetcar, bike, along with mixed use development, it's enriching the experience of going to the store, going to visit a neighbor, and makes us a more sustainable, cost-effective community.

PORTLAND'S TRANSPORTATION INNOVATIONS HAVE DIRECT ECONOMIC BENEFITS.

We see solar panels being installed by Imagine Energy: Canoeists on the river.

Susan Anderson:

By actually doing the right things here, we've built this base of great export. We've got solar firms, wind firms. We have firms focused on energy efficiency with hundreds and hundreds of employees. And they're locating here, or they grew up here, because we were trying to do something and we built demand here.

"With annual exports of more than $21 billion, Greater Portland was one of only four regions in the nation to double exports over the past decade." Greater Portland Inc. specifically cites the contributions of clean energy: *Market Portland's Global Edge* – Capitalize on the region's reputation and expertise in clean tech adoption, sustainable energy generation, advanced urban design and transportation through intense and proactive marketing strategy to sell Portland's Green Solutions internationally."

Cyclists bike along beside the river, in one of the city parks:

Sam:

We're one of the cheapest cities on the West Coast, because we offer options, for example, other than having to own a car to live and work and have a good life.

Susan:

I think just like anything you're trying to do, whether it's a business or a government or a city, good things don't happen by accident. You need to have some good plans.

Earl:

We can reduce that carbon footprint while we provide economic opportunities for our citizens and others.

RICHARD ALLEY AGREES SCIENCE AND SUSTAINABILITY BOTH COME TOGETHER IN AN "OPERATORS' MANUAL" FOR AMERICA.

The ETOM project has personalized Operator's Manuals, to save energy and money, available online.

CHAPTER HEAD:

AMERICA: The Operators' Manual

America:
The Operators' Manual

Richard cycling at Penn State, as he does to and from work most days, and zooming through the town:

LIKE THOUSANDS OF PORTLANDERS, I COMMUTE BY BIKE.

Richard at Kawerau Geothermal Plant:

LIKE MANY IN FORT WORTH, I'VE WORKED FOR AN ENERGY COMPANY.

Surrounded by cows:

MY UNIVERSITY RUNS A *HERD OF COWS*, SO I CONNECT WITH KANSANS…

Clambering down the snout of the Franz Josef Glacier:

I'VE SPENT TIME IN SOME PRETTY COLD PLACES, SO I KNOW SOME OF THE CHALLENGES ALASKA FACES…

Amid crowds in NYC, with faces as diverse as possible:

…AND I APPRECIATE THE IMPORTANCE OF AFFORDABLE ENERGY TO EVERYONE, INCLUDING THE CITIZENS OF BALTIMORE.

Earth orbit: the Sun rises:

SO AS WE LOOK AROUND OUR PLANET WITH EYES INFORMED BY CLIMATE SCIENCE…

Texas dawn, a red and silver Sun over the turbines: U.S. flag, and a baby is lifted at the Kodiak rock concert:

…AND WITH AN APPRECIATION OF THE VAST POTENTIAL FOR CLEAN, LOW-CARBON SOURCES OF ENERGY…

Dirty smokestacks, and timelapse cumulus clouds:

I THINK WE CAN BE *OPTIMISTIC* ABOUT OUR PROSPECTS WHILE BEING *REALISTIC* ABOUT HOW HUMANS ARE AFFECTING THE PLANET.

For Richard's mix of idealism and realism, please see the opening and closing chapters of the "Earth: The Operators' Manual" companion book.

Timelapse clouds, broken ice in the Arctic, crust forming on red-hot lava:

OUR PLANET *IS* COMPLEX, LIKE A GIANT JIGSAW PUZZLE…

See Mario Molina's discussion of the Earth jigsaw in a blog at Andy Revkin's always-interesting DotEarth.

BUT EARTH SCIENCE GIVES US AN OPERATORS' MANUAL …TO HELP US SEE WHERE MOST OF THE PIECES GO.

In an interview in his office at Penn State, Richard reaches off to the side, and slides a jigsaw-shaped piece of the Earth "Blue Marble" graphic into place:

He starts VO:

Some things we know with …really high confidence.

As the jigsaw-shaped slice slides into place, Richard taps it to stop its movement. Cut to a close-up of a dynamic video graphic, Crazybridge Studios: we see the Keeling curve read on with axes simply labeled, 1957-today, and 280 up to beyond 390ppm:

Carbon dioxide levels are increasing in Earth's atmosphere, and basic physics and objective research show that CO2 warms things up.

For more see ETOM program 1, CO2 and the Ice Core Record.

Richard slides in another piece of the Earth jigsaw from the opposite side of the screen: smokestack emissions dissolve into timelapse clouds:

Analyzing the chemistry of the CO2, shows that most of the carbon is coming from our use of fossil fuel.

For more see ETOM program 1, "It's Us"

Another piece, from the other side of the screen, and as the 3rd jigsaw piece fits into place, we see a NASA satellite looking down from above: Richard gestures through the transparent piece to the lower troposphere… and then to the stratosphere:

Satellites looking down from space show that the atmosphere is warming down here ***(gesture) but cooling UP*** here ***(gesture), higher up in the stratosphere, showing the warmth isn't from the Sun.***

For NASA's own data, see here. For a layman's description, at three varying levels of complexity, see Skeptical Science.

We've seen three pieces being slid in, but now we're looking front on towards him, through the partial Earth jigsaw, and he brings in several more pieces (it's a 4 x 4 grid, of 16 jigsaw pieces), without us seeing in similar detail just what's what about each new piece. There are two missing pieces. He speaks to camera:

And we've got lots more solid knowledge that just about every climate scientist agrees on. Of course, there are some things we still don't know.

He slides in one more piece, that has a Joker-like, Riddler-like "?" on it: it transforms into clouds:

We'd like to know more about clouds…

ON BALANCE, DO THEY WORK TO MAKE CLIMATE CHANGES BIGGER, OR SMALLER?

Here is the IPCC's overview of the climate system. For a layman's perspective on the same issues, see here.

From the other side he slides in another "?" piece, and we see images of storm cloiuds and lightning:

And we'd like to know how weather extremes will change and how fast.

Start on camera, and then cut to fly-through of volcano plume:

Some things we simply can't know. When will the next big volcanic eruption spread cooling clouds of ash around the planet for a year or two?

Richard to camera: cutaway to the Earth jigsaw, rack focus to Richard through the virtual pane of glass:

But even with these uncertainties, the big picture is pretty clear.

Cut to Earth orbital timelapse: the source for this is the amazing work of NASA astronaut, tinkerer, and outreach enthusiast, Don Pettit.

Richard on camera:

But in a very real sense, the most important questions aren't about science and engineering …but society and policies. What do we want to do?

See Lisa Murkowski, the Baldwin City banker, Robbyn and Inez from Baltimore, and Steve Oatman (the wind rancher seen in ETOM program 1) in his cowboy hat:

AND ON THAT, SURPRISINGLY, THERE'S A GROWING CONSENSUS, ACROSS POLITICAL PARTIES, BUSINESSES AND COMMUNITY GROUPS WHO ARE LISTENING TO THE SCIENCE AND LOOKING TO THE FUTURE.

Shirley Jackson:

Obviously in some ways, there is a diversity of opinion about…

Timelapse clouds, storm coming:

…the degree to which man-made activities affect the climate.

Shirley on camera:

Now I happen to be on the side of those who believe there is an effect. But suppose one were not.

A soldier drives a truck across the desert at Fort Irwin, CA: warships at dock in Peral Harbor, Hawaii, and a peaceful forest scenes in Joyce Kilmer Memorial Forest:

…whether one's focus is on national security …geopolitical effect …or simply cost, or the environment…

Shirley on camera:

…in the end all of these things track in the same direction.

The United States, from orbit (422 CGI image), flags in Kansas, and scenes of Mayors and community members from all the locations we've seen: David Crane to camera, and VO:

David Crane:

Everyone's always talking about the exceptionalism of the United States and global leadership and clear thought leadership culturally, socially, and I believe in all that. But if you believe in all that, you then can't turn around and say, "Well, we're helpless and we're just a little bit of the problem and no matter what we do, China and India will go their own way." There's just no evidence that that's the case.

If the United States leads in this way, others will follow. I mean, that's what leadership is about.

Nancy Jackson:

At the end of the day the atmosphere doesn't care one whit what people think.

The atmosphere cares what people do.

Action scenes from all 5 locations seen during ENERGY QUEST USA: CFL lights illuminate, powerstrips are plugged, B-line girl rides, Dennis in Tanana stokes the furnace, Larry Brogdon teaches, Russ Rudy performs an energy audit, etc.:

We can reduce emissions in real time.

Why people do it, as long as they do it, doesn't matter to us.

422 orbital shot: our POV centers on the USA:

FOR ALL WE KNOW ABOUT THE CLIMATE…

Solar panels at Nellis AFB:

FOR ALL THE PROMISE OF RENEWABLES…

Elderly Africa-American volunteer in Portland teaching the kids to turn, and a Chamber of Commerce "suit" in Gardner, Kansas:

…PERHAPS EVEN MORE IMPORTANT IS FIGURING OUT TO HOW TO UNLEASH "PEOPLE POWER" TO ENERGIZE OUR NATION.

Richard to camera:

That's what an Operators' Manual is all about… it tells us how something works, and how to get the very best performance out of it.

Gwen sleds in Alaska, and Baltimore and Kansas scenes:

And I also have faith in how America's democracy works. We* can *make positive changes if we think clearly, and move forward together.

That's my hope. That's my faith.

For "Earth: The Operators' Manual", I'm Richard Alley.

NSF underwriter announce & end credits