



E DRIVE™

GATEWAY

A Sustainable Cities/ Sustainable Communities

Proposal

*“for using exponential growth industries
to put the **Green** into **Greensboro**”*

from the

Triad **E**lectric **V**ehicle **A**ssociation

Solar

Green

E DRIVE

Preferred State: Highly efficient electric drive using locally produced American Energy for everyone. A clean environment, sustainable jobs, training and educational opportunities. A reputation for innovation.

Goal- To be a world Beater in E Drive.

Greensboro, NC badged the “**E DRIVE GATEWAY**”

We have a vision!

We have taken the initial steps, we have the experience and leadership.

We now have the opportunity! “E Drive”

Imagine for a moment a world where cities have become peaceful and serene because cars and buses are whisper quiet, vehicles do not pollute, and parks and greenways have replaced unneeded urban freeways. OPEC has ceased to function because the price of oil has fallen to five dollars a barrel, but there are few buyers for it because cheaper and better ways now exist to get the services people once turned to oil to provide. Living standards for all people have dramatically improved, particularly for the poor. Involuntary unemployment no longer exists. Houses, even low-income housing units, can pay part of their mortgage costs by the energy they *produce*; there are few if any active landfills; worldwide forest cover is increasing; dams are being dismantled; atmospheric CO2 levels are decreasing for the first time in two hundred years; and effluent water leaving factories is cleaner than the water coming into them. Industrialized countries have reduced resource use by 80 percent while improving the quality of life. Among these technological changes, there are important social changes. The frayed social nets of Western countries have been repaired. With the explosion of family-wage jobs, welfare demand has fallen. A progressive and active union movement has taken the lead to work with business, environmentalists, and government to create "just transitions" for workers as society phases out coal, nuclear energy, and oil. In communities and towns, churches, corporations, and labor groups promote a new living-wage social contract as the least expensive way to ensure the growth and preservation of valuable social capital. Is this the vision of a utopia? In fact, the changes described here could come about in the decades to come as the result of economic and technological trends already in place. www.natcap.org

E Drive could also decrease by up to tenfold each of four key parameters of manufacturing. These are:

- the time it takes to turn a conceptual design into a new vehicle,
- the investment required for production (which is the main barrier to new firms' or models' entering the market and the main source of automakers' financial risk),
- the space and time needed for assembly,
- the number of parts in the vehicle. Together, such decisive advantages would give early adopters a significant economic edge in what is now a trillion-dollar industry.

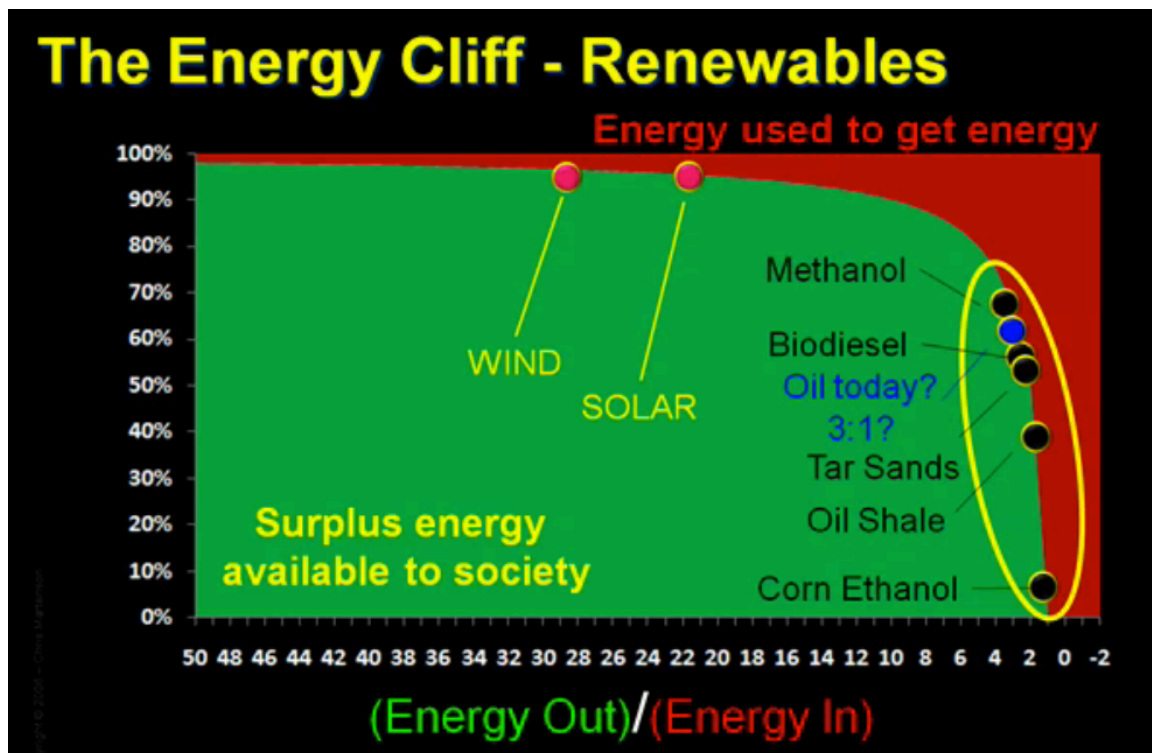
An Exponential Industry growing 40-90% annually, with doubling times of 18 to 8 months. This is the type of opportunity we desire. E Drive is this opportunity.

- New technologies first reach a critical price on par with the technology they challenge.(the majority of new E Drives (EVs) are below the average new car price of \$32,000)

- The second step is to reach a critical mass. (250,000 new vehicles purchased in the past 4 years, expected to double in 2016)
- The Third step is the displacement of the old technology (replacing fossil fueled internal combustion engines with E Drive).
- The fourth step is price reductions toward commodities. (Tesla offers free lifetime use of Electric Superchargers-Austin, Texas offers free nighttime recharging, and half of all Electric Vehicles are charged using Renewable Energy.

(www.ted.com/talks/chris_anderson_of_wired_on_tech_s_long_tail)

Energy Return On Investment (EROI) is falling for Fossil Fuels (3:1) and rising for Renewable Energy (WIND 28/1, SOLAR 22/1).



What is E Drive?

E DRIVE consists of Motor, Controller, Energy Storage, Charging infrastructure and all ancillary equipment. E Drive vehicles can be found on the Moon and Mars. From toys to bicycles, to the largest ships and heavy equipment in the world.

The motor has one moving part-the rest is solid state electronics vs the thousands of moving parts in a typical Internal Combustion Engine and transmission.

It is Electric-powered by American Electrons produced locally. The grid gets cleaner as time passes- so do Electric Drives.

It is electric, often powered by Clean Renewable Energy which shares many components in the Balance of Systems. Today, nearly half of all EVs use Renewable Energy.

They are cheaper to run ~ >\$1/gal equivalent from NC Green Power

E Drives are long lived. And up to 5 times more efficient than ICE. The Nissan Leaf goes nearly 90 miles for >\$2. The ICE powered Versa could only go 20 miles for \$2 (\$3.50/gal.)

Dudley High School's Advanced Vehicle Technology group went over 100 miles on a kilowatt of power in the Shell EcoMarathon, equivalent to 10 watts/mile or 3700 mpg.

Vehicles range from small Remote Controlled vehicles to locomotives, from undersea to space. The field is burgeoning, growing exponentially and needing education, support, maintenance, development. We have the experienced, talented, creative people to make a sustainable future.

In this proposal half the funds will be used in developing a green electric drive campus with build it space. The other half will be made available to develop prizes for green challenges. Competitions will be handled by a committee, (examples- shuttles, downtown transit, fleets, city vehicles.)

Opportunities exist for:

- retailers and wholesalers
- warehousing
- Logistics-5 interstates, Norfolk Southern, UPS intermodal, FEDx, high speed internet,
- Suppliers- AC/DC motors, controllers, inverters, Chargers, EVSE, energy storage, BMS

Thus far we have worked with:

- 7 Manufacturers
- 7 non profits
- over a dozen events
- 9 educational institutions
- 14 Training courses
- 12 equipment manufacturers

The E Drive Campus is designed to bring these activities together for a synergistic effect to develop prototypes.

Challenges would be routinely issued to meet Greensboro Transit needs; i.e.-buses, recycling vehicles, small commuter vehicles, BRT, Solar Goose.

As businesses mature they would move out into the community, freeing space for more innovation opportunities, generating jobs, creating facilities and improving the tax base.

An **electric vehicle (EV)**, also referred to as an **electric drive vehicle**, uses one or more [electric motors](#) or [traction motors](#) for [propulsion](#). Three main types of electric [vehicles](#) exist, those that are directly powered from an external power station, those that are powered by stored electricity originally from an external power source, and those that are powered by an on-board electrical generator, such as an internal combustion engine (a hybrid electric vehicle) or a hydrogen fuel cell.[1] EVs include [electric cars](#), [electric trains](#), electric lorries, [electric aeroplanes](#), [electric boats](#), [electric motorcycles and scooters](#) and [electric spacecraft](#). [2] Diesel submarines operating on battery power are, for the duration of the battery run, electric submarines, and some of the lighter [UAVs](#) are electrically-powered. e-bicycle revenue in the U.S. alone for 2013 will be about \$82.3 million, and it is expected to reach \$152.3 million in 2020

In recent years, every form of transportation vehicles has declined in their numbers except the electric bicycle. - See more at: <http://www.electric-bicycle-guide.com/electric-bicycle-statistics.html#sthash.M3biNAiJ.dpuf>

In the US Hybrids took until their 6th year to achieve 100,000+/year in unit sales and 1% in market share of new vehicles sold.

Electrics and Plugins did that in 2013 and 2014, 2-3 years ahead of Hybrids. As of April 2014 there are over 250,000 Electric cars in the US.

EVs are currently outpacing hybrid sales growth by a stunning amount in their first three years vs the first 3 years of hybrid cars, and the rate of outperformance has been accelerating each year: EVs are 1.9x, 2.6x, and 3.4x the unit sales level of hybrids over the first 3 years.

Using US historical hybrid vehicle numbers as a benchmark that rate of outperformance would equal nearly 1 mm/year sales by 2018, and 4.2 mm EVs on the road by the end of the decade in 2020.

There are now 4 electric / plugin hybrid car platforms around the 20K+/year mark, which essentially marks the level of a “real” car:

It took hybrids nearly decade to achieve that.

- Tesla
- Ford Energi / Focus Electric (taken as a group)
- Nissan Leaf
- Chevy Volt

That means essentially 4 car companies are already at the \$500 mm to \$1 Bil/year level in EV revenues.

There are 20+ vehicle platforms behind them, and 2 of those four are in just their first full year, with the Toyota Prius plugin just beginning to rollout broadly.

Virtually every major platform has seen 20-30% price cuts, and seen drastic and rapid sales improvement when they did. The carmakers have basically found the price level to scale. The Nissan LEAF achieved it's 100,000th car sold globally in 2013. That's level where the Prius is generally acknowledged to have broken even, according to Bill Moore editor of EVWorld.com. To put in perspective, that's somewhere over \$3 Billion in Leaf revenues to date.

Our internal baseline numbers now have Hybrids at 7.4 mm fleet size in 10 years, and EVs/PHEVs at 4.1 mm. That would represent barely 6-7% market share, an extremely moderate share growth rate, and assumes heavy cannibalization of future HEV growth by EVs.

EVs may have been underselling the hype, but they are outselling the reality.

The J.D. Power and Associates *2011 US Green Automotive Study* indicates major growth in consumer interest in green cars—including hybrids, clean diesel, plug-in hybrids and pure electric cars. The market research firm expects as much as 10 percent of sales to come from vehicles with these fuel-efficient technologies by 2016. That would represent a four-fold increase in the sales numbers for green cars compared to 2010

[Hybrid Electric](#)

"Hybrid vehicles are the fastest growing segment of the light-duty vehicle market" 2011, National Research Council ([Assessment of Fuel Economy Technologies](#))

"The number of registered HEVs in the U.S. grew to nearly 2 million [in 2012]" ([State Clean Energy Index](#))

"Nine of the ten most fuel efficient vehicles today are hybrids or electric vehicles" ([Top Ten Lists](#))

[Plug-In Hybrid](#)

"Over the next two to three years, all major automakers—and some start-ups—intend to put [Plug-in Hybrid Electric Vehicles] PHEVs on the road" ([An Action Plan](#))

"Plug-in vehicles can be driven for roughly one-third to one-fourth the cost of a gasoline-powered vehicle" ([Transportation Electrification](#))

"If the plug in hybrid vehicle is plugged in every day, as recommended, it may be possible to drive 1000-2000 miles or more between fill-ups" ([Plugging-In](#))

"PHEVs reduce greenhouse gas (GHG) emissions by 32% compared to conventional vehicles" ([Lithium Ion Batteries](#))

"Pike Research estimates an annual sales growth rate of 106% for PEVs between 2010 and 2015" ([Plug-in Electric Vehicles: A Practical Plan for Progress](#))

[Extended-Range EV](#)

"If the [electric] vehicle is plugged in every day, as recommended, it may be possible to drive 1000-2000 miles or more between fill-ups" ([Plugging-In](#))

[Battery Electric](#)

"[Battery Electric Vehicle] BEV emissions are estimated [...] to be 75% lower than the average conventional gasoline-powered vehicle, and 55% lower than the average conventional hybrid vehicle" ([Ready, Set, Charge, California!](#))

[Fuel Cell Electric](#)

"Air Products reports 347,000 hydrogen fuelings per year" ([Fuel Cells in America](#))

"Major corporations like IKEA, FedEx, Hilton Hotels and Coca-Cola [use fuel cell vehicles in their fleets]" ([The Business Case for Fuel Cells](#))

[Competitiveness](#)

"Between 2003 and 2010, jobs in fuel cells grew 10.3% annually, and jobs in electric vehicle technologies grew 6.3%. The average national job growth during this period was 4.2%" ([Sizing the Clean Economy](#))

"Typical wages in the clean economy exceed those in the aggregate U.S. economy by roughly 13 percent" ([Sizing the Clean Economy](#))

"Electric vehicle technologies [...] export roughly \$63,000 per job" ([Sizing the Clean Economy](#))

"Approximately 26 percent of all clean economy jobs are involved in manufacturing, compared to just 9 percent of jobs in the economy as a whole" ([Sizing the Clean Economy](#))

"In 2010, U.S. patents awarded for hybrid and electric vehicle technologies reached an all-time high, jumping 60 percent from the year before" ([Supplying Ingenuity](#))

"The U.S. filed more fuel cell patents than any other country [in 2010]" ([Fuel Cells in America](#))

"[There was] \$154 billion in private capital invested worldwide in 2010 in renewable energy alone" ([Sizing the Clean Economy](#))

"Manufacturing makes up 59 percent of EV industry jobs and grew 132 percent 2004 to 2010" ([Powering Innovation](#))

"The U.S. market for supply and installation of residential charging points alone is expected to reach almost \$1 billion by 2020" ([Electric Vehicles: Reducing Foreign Oil Dependence](#))

[Energy Security](#)

"[There is] \$1 billion that American families and businesses send overseas every day for oil" ([Gobbling Less Gas for Thanksgiving](#))

"Oak Ridge National Laboratory estimates the combined total [foreign oil expenditure] has reached more than \$5 trillion since 1970" ([An Action Plan](#))

"OPEC [Algeria, Angola, Ecuador, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela] accounts for 40% of the world's yearly oil production [...] and this dependence is projected to increase to more than 50% by 2025" ([Plug-in Electric Vehicles: A Practical Plan for Progress](#))

"70% of the oil consumed in the United States is used for transportation" ([Will Electric Cars Transform the U.S. Vehicle Market?](#))

"Oil demand [is] projected to grow by 1 percent per year on average from now to 2030—reaching 105.2 million barrels per day in 2030" ([Changing the Game](#))

"The transport sector [is] the main driver of this growth [in oil demand] (accounting for 97 percent)" ([Changing the Game](#))

"Electric vehicles –if widely adopted – could reduce petroleum fuel consumption by 70 to 90%" ([Plugging-In](#))

"PHEVs are expected to displace the use of 380 million gallons of gasoline in 2015, increasing to 1.4 billion gallons in 2020" ([Transportation Electrification](#))

"American troops are deployed on oil-security missions, costing U.S. taxpayers \$67 billion to \$83 billion a year" ([Electric Vehicles: Reducing Foreign Oil Dependence](#))

"The U.S. passenger vehicle fleet accounts for more than 40 percent of U.S. oil demand" ([An Action Plan](#))

"In the United States, 94 percent of cars, trucks, ships and planes depend on oil" ([Electric Vehicles: Reducing Foreign Oil Dependence](#))

[Clean Environment](#)

"In 2009, transportation accounted for approximately one-fifth of global primary energy use and one quarter of all energy-related carbon dioxide (CO2) emissions" ([EV City Casebook](#))

"[The transportation] sector accounted for about 27% of total U.S. greenhouse gas emissions in 2008" ([Will Electric Cars Transform the U.S. Vehicle Market?](#))

"[The U.S. passenger fleet] emits 16 percent of U.S. greenhouse gas emissions" ([An Action Plan](#))

"PHEVs are expected to reduce carbon emissions by 2.1 million metric tons in 2015, increasing to 48 million metric tons by 2030" ([Transportation Electrification](#))

"Motor vehicles are currently responsible for one-half of smog-forming air pollutants and about 75 percent of carbon monoxide emissions" ([An Action Plan](#))

"A typical passenger vehicle emits about 5.1 metric tons of carbon dioxide per year. [...] A vehicle that can only operate on electricity will not emit any tailpipe emissions" ([Greenhouse Gas Emissions from a Typical Passenger Vehicle](#))

"PHEVs reduce greenhouse gas (GHG) emissions by 32% compared to conventional vehicles" ([Lithium Ion Batteries](#))

"BEV emissions are estimated [...] to be 75% lower than the average conventional gasoline-powered vehicle, and 55% lower than the average conventional hybrid vehicle" ([Ready, Set, Charge, California!](#))

[Safety](#)

"On average, the odds of being injured in a crash are 25 percent lower for people in hybrids than people traveling in nonhybrid models" ([Hybrid Models Have Lower Injury Odds](#))

The [Nissan Leaf](#) and [Chevrolet Volt](#) are both named Top Safety Picks by the Insurance Institute for Highway Safety.

The Society of Automotive Engineers (SAE) primarily defines the standards and recommended practices for product function. For more information, visit their [website](#).

Underwriter's Labs (UL) primarily writes standards to which products can be tested for safety. For more information, visit their [website](#).

The National Electric Code (NEC) is published by the National Fire Protection Association (NFPA), and describes how electrical products must be installed in vehicles. For more information, visit their [website](#)

[Sustainability](#)

"Approximately 86% of a vehicle's material content is recycled, reused or used for energy recovery" ([Automotive Recycling Industry](#))

"Each year the [automotive recycling] industry collects and reuses or recycles 96% of all lead acid batteries" ([Automotive Recycling Industry](#))

"Steel is recycled at a rate of more than 18 million tons each year from end-of-life vehicles" ([Automotive Recycling Industry](#))

"50% or more of the lithium in [an electric vehicle's] battery can be recycled" ([Will Electric Cars Transform the U.S. Vehicle Market?](#))

"Vehicle production contributes on the order of 10 to 20 percent of overall emissions" ([Full Fuel Cycle Assessment](#))

[EV Fleets](#)

"Major corporations like IKEA, FedEx, Hilton Hotels and Coca-Cola [use fuel cell vehicles in their fleets]" ([The Business Case for Fuel Cells](#))

"Frito-Lay, Staples, and FedEx have all ordered electric delivery trucks" ([Deployment Rollout Estimate of Electric Vehicles](#))

"General Electric announced that they will purchase 25,000 EVs by 2015" ([One Million Electric Vehicles by 2015](#))

"Enterprise Holdings, the largest rental car company in the nation, has announced that it plans to introduce [...] Nissan LEAF models and Coda EV sedans [to its fleet]" ([Deployment Rollout Estimate of Electric Vehicles](#))

"Vehicles in taxi fleets accumulate mileage at a very high rate, generally in excess of 50,000 miles annually" ([Ready, Set, Charge, California!](#))

"The fleet market makes up about 70% of the global NEV marketplace" ([Executive Summary: Neighborhood Electric Vehicles](#))

"Some [Electric Vehicle] EV cost of operation estimates for a five- to six-year period are up to three times less than those for similar [Internal Combustion Engine] ICE vehicles" ([The Shift to Electric Vehicles](#))

"It is clear from data collected to date, that battery performance is sufficient to provide stable vehicle fuel economy over a 160,000 mile [Hybrid Electric Vehicle] HEV life" ([Department of Energy](#))

"Plug-in vehicles can be driven for roughly one-third to one-fourth the cost of a gasoline-powered vehicle" ([Transportation Electrification](#))

"Fueling a PEV costs only 3 to 5 cents per mile. In contrast, fueling a gasoline car that has a fuel economy of 27.5 mpg costs about 14 cents per mile" ([Plug-In Electric Vehicle Handbook](#))

"Buying electricity [for an electric vehicle] is approximately equivalent to buying gasoline at \$1 per gallon" ([Plugging-In](#))

"If the [electric] vehicle is plugged in every day, as recommended, it may be possible to drive 1,000-2,000 miles or more between fill-ups" ([Plugging-In](#))

"The number of registered [Hybrid Electric Vehicles] HEVs in the U.S. grew to nearly 2 million [in 2012]" ([State Clean Energy Index](#))

"Consumers who consider themselves knowledgeable [about electric vehicles] are more than two and a half times more likely to consider an EV than those who believe they know 'nothing' about EVs" ([The Shift to Electric Vehicles](#))

"The average car trip length in the United States is 9.34 miles, within the [electric] range of most PEVs" ([An Action Plan](#))

"Increasing the electricity cost by 100% (from \$0.12 to \$0.24 per kWh) increases the net present cost of an EV relative to a conventional gasoline powered vehicle by \$1,606, but raising gas prices by 100% (from \$3.75 to \$7.50 per gallon) increases the net present cost of a conventional vehicle by \$6,453" ([Will Electric Cars Transform the U.S. Vehicle Market?](#))

"Driving a BEV 12,000 miles per year, as opposed to 6,000 miles per year costs about \$1,000 additional in operating costs. By contrast, driving a conventional gasoline powered vehicle 12,000 miles per year, as opposed to 6,000 miles per year costs about \$4,000 additional in operating costs" ([Will Electric Cars Transform the U.S. Vehicle Market?](#))

"Some EV cost of operation estimates for a five- to six-year period are up to three times less than those for similar ICE vehicles" ([The Shift to Electric Vehicles](#))

[Consumer Acceptance](#)

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[Electric Utility Readiness](#)

"73 percent of the nation's light vehicles could be recharged with existing excess utility capacity" ([Impacts Assessment](#))

"Approximately 160 million vehicles in the United States could be powered solely from existing off-peak generating capacity" ([How the Smart Grid Enables Utilities to Integrate Electric Vehicles](#))

"The U.S. average annual residential electricity consumption is 12,231 kWh, while the Chevy Volt's annual electricity consumption is only 1,890 kWh" ([Marrying Electric Transportation to the Electric System](#))

[EV-Friendliness](#)

"Walgreens announced plans to offer EV charging stations at approximately 800 locations across the country" ([Walgreens](#))

"Today, 64% of all travel kilometers made are urban" ([The Future of Urban Mobility](#))

[EV Infrastructure](#)

"Vehicles, on average, spend 66% of their time parked at home, and 14% of their time parked at work" ([Transportation Electrification](#))

- See more at:

<http://www.electricdrive.org/index.php?ht=d/sp/i/27132/pid/27132#sthash.IK0rcvGt.dpuf>

Who are we?

The SC 2 Team

Triad Electric Vehicle Association

Dr. Jack Martin STEM Cycle Challenges
www.linkedin.com/pub/jack-martin/15/323/bb1

Dr. Don Gerhardt Light Electric Vehicle Association
www.linkedin.com/pub/don-gerhardt/3/671/734

Ricky Lewis Dudley High School, Advanced Vehicle Technologies
www.linkedin.com/pub/ricky-lewis/50/129/b86

Ken Clayton Green Cycle Design Group
www.linkedin.com/pub/ken-clayton/1a/13a/88a

What are the SC 2 Challenges?

- Developing the long term vision of the E DRIVE Gateway
- Capitalizing on the universities and colleges in the greater Greensboro community and high-impact collaborations between these institutions and the private sector; Our proposed campus center will be a focus to combine the synergies of business, industry, manufacturing, training/workforce development, and educational support.
- Attracting people, businesses, and investment in the downtown area; Our proposed campus will be a industrial incubator where space can be rented out to develop prototypes. Once mature, the company will move out into the near by buildings to manufacture and service their products. We hope to use Indiegogo, KickStarter, Sustainable Jobs Fund (<http://www.sjventures.com>) and Self Help Credit Union (<https://www.self-help.org/>) to align investment.
- Enhancing the arts and other quality of life features; Clean tech offers to improve the environment. Cleaner air, water, land.
- Improving the impact of Piedmont Triad International Airport and airport area infrastructure to support the new E Drive industry
- Workforce development; We offer advance training in E Drive both recognized nationally (National Alternative Fuels Training Consortium) and internationally (Light Electric Vehicle Association).

- Advanced manufacturing. E Drive Gateway is a vision to develop innovation, service and an exponentially growing industry to the Greensboro area.
- *What Steps have already been taken?*

NC is a leader in E Drive

- Triad Electric Vehicle Association (originally founded At NC A&T SU)
- Green Cycle Design Froup, Ion Motorcycles, FFR Trike, Organic Transit
- E drive workshops
- curricula
- 40% of EAA educational Chapters located in NC
- Dudley High School Advanced Vehicle Technologies curriculum for NC
- National Alternative Fuels Training Consortia members
- Largest Odyssey Events in US “(4)
- Trainers in First Responder for Alternatively Fueled Vehicles
- Light Electric Vehicle Association
- International Training Program for electric vehicle service
- Gerhart Engineering
- Lean Machine
- Solar Sprint
- Students Fueling the Future (hydrogen power)
- National Science and Technology Competitions
- EVChallenge
- STEM Cycle Challenges

TEVA’s Competitions Cloud

*2 **STEM Cycle Challenge***

4 Students Fueling the Future

4 NC sustainable design competitions, 9 US

EPA-P3 competitions

2 NC Science Technology Bowls (Host)

8 EVChallenges, *2 SMART Challenges, 4 NEAT*

Challenges, 4 Power Of DC events, 3 NEDRA events,

Judges for Various Science and Technology Fairs

5 solar challenges, 3 Tour de Sol, 21st Century Automotive Challenge, 4 Greensboro Alternative Fuels Odyssey, 5 Maker Faires 2 Solar Decathlon, 3 Electrathon, 4 Shell Eco-Marathons

We have three winners of Progressive X prize

The winners of the competition were announced on 16 September 2010.

- Team Edison2 won the \$5 million Mainstream competition with its four-passenger [Very Light Car](#), obtaining 102.5 MPGe or just below 69 MPG running on [E85](#) fuel. Lynchburg Virginia.
- Team [Li-Ion Motors](#) won the \$2.5 million Alternative Side-by-Side competition with their aerodynamic Wave-II electric vehicle achieving 187 MPGe. Mooresville, NC
- Team [X-Tracer Switzerland](#) won the \$2.5 million Alternative Tandem competition with their 205.3 MPGe faired electric motorcycle. (Greensboro, NC)

http://en.wikipedia.org/wiki/Automotive_X_Prize

Cannes Film Festival Award

Dudley High School's Advance Vehicle Technology group is making news on the international scene yet again. DHS has done 10 vehicles in 4 years for the Shell Eco Marathon. It has helped Duke University the past 2 years (Duke U came in 2nd and DHS 9th in the electric prototype and 5th in the urban concept categories). Articles in Wired Magazine and National Geographic have highlighted DHS using recycled materials. Shell produced the "Road to Houston" video series about Brazilian, Canadian and US teams. Dudley was the US team. The documentaries were released onto the web. They were subsequently entered into the Cannes Film Festival where they won the Silver Dolphin Award out of 712 entries from 40 countries.

Maker Spaces are popping up everywhere- (The Forge) Greensboro, (Family WORKS) UNCG, Raleigh, Burlington, Saxapawhaw, Winston-Salem and Asheville.

San Francisco Maker Faire Awards

Gridbeam, Boxbeam, QuikStyx, Matrix- call it what you want, the adult erector set which provides the basis for Dr.Martin's STEM Cycle Challenges recently won three prestigious awards at the San Francisco Maker Faire. Richard and Phil Jergenson were present to receive out of 1100 exhibitors, the Wired Magazine's Editor's Choice, Educator's Choice, and the Maker's Faire "Best in Class". <http://gridbeam.com>

The Jergenson's book How to Build with GRID BEAM; A Fast, Easy and Affordable System for Constructing Almost Anything, a New Society Publication ISBN 9780865716131 has been included into the Whole Earth Catalog follow on, COOL TOOLS- a Catalog of Possibilities, <http://kk.org/cooltools/archives/13307>

Kevin Kelly's # 1 best seller in Amazon's Catalogs and Directories. ISBN 1940689007. Dr. Jack Martin was a contributor ,Technical Editor and Reviewer for the Grid Beam book.

International Plug In Conference

Dr. Martin of the Home Power Hour radio series attended the Plug In 2014 Conference July 28-30, San Jose, CA. The event was organized by the Electric Power Research Institute with many corporate sponsors. Major topics were the economics of Vehicle-Grid Integrations- Costs, Benefits & the Evolving Market. The program was divided into Cars and Charging track and People and Policy track. Information will be incorporated into the ASU Sustainable Transportation class.

What is Proposed?

Vehicles range from small Remote controlled vehicles to locomotives, from undersea to space. The field is burgeoning, growing exponentially and needing education, support, maintenance and development. We have the experienced, talented, creative people to make a sustainable future.

Half of the funds will be used in developing a green electric drive campus with build it space, used for building prototypes, providing education and community outreach. The other half will be made available to develop prizes for green challenges. Competitions will be handled by a committee, (examples- shuttles, downtown transit, fleets , city vehicles.)

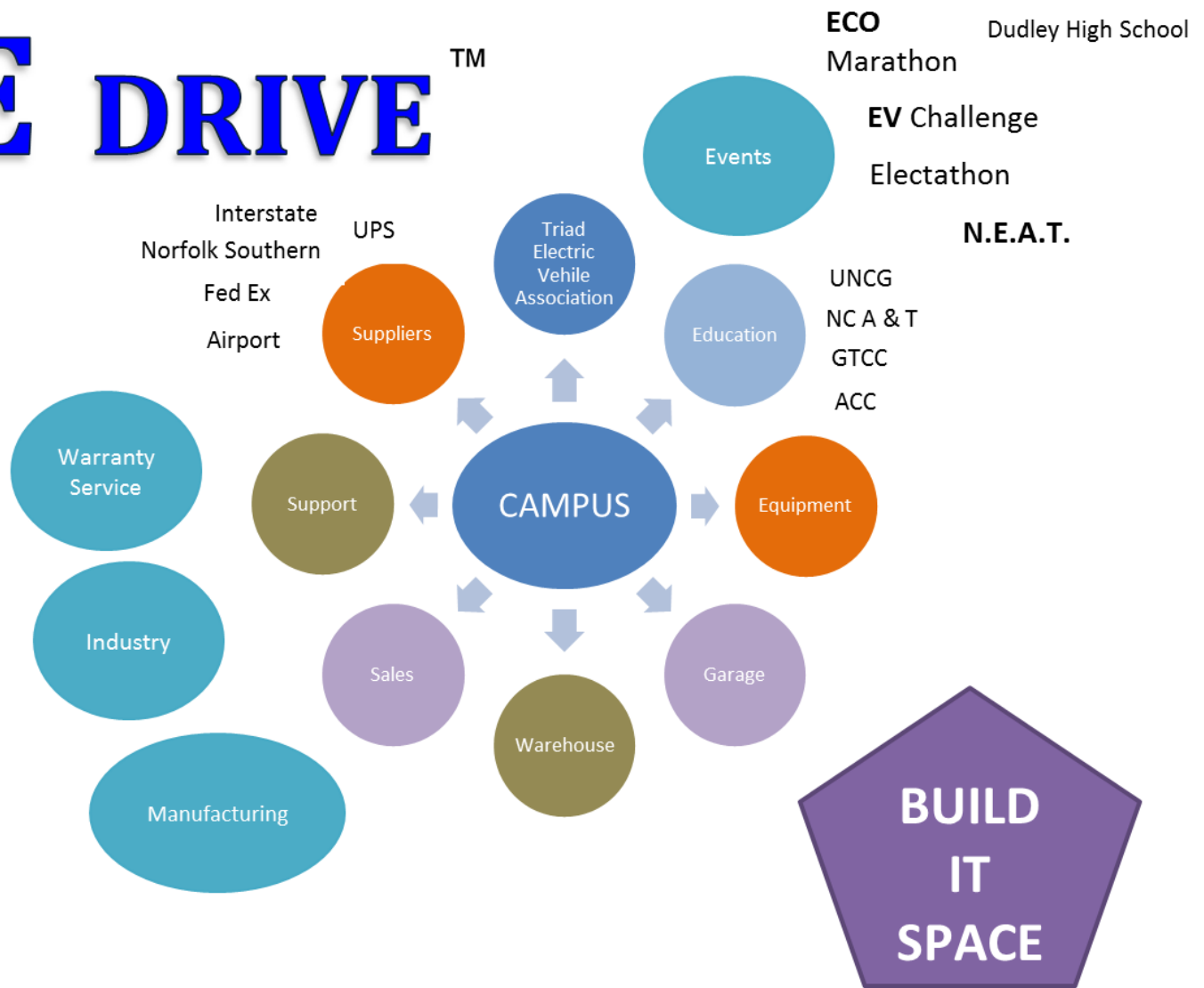
E Drive Campus

E Drive Campus is designed to bring these activities together for synergistic effect to develop prototypes.

We would routinely issue challenges to meet Greensboro Transit needs, buses, recycling vehicles, Small commuter vehicles, BRT, Solar Goose.

As businesses mature they would move out into the community, freeing [space](#) for more innovation opportunities.

E DRIVETM



SC2 campus building

- Lots of garages (The old downtown Post Office would have been superb)
- Safe outdoor storage
- Secluded parking area
- Parking lot
- Meeting rooms/classrooms
- Conference room
- Business cubicles
- Reception area
- Bathrooms
- Lunch area
- Mechanical
- Storage areas
- Inside displays
- Outside displays
- Tow dollies
- Trailers
- Pickups

- High security area
- Board/Receptionist area

Paid for by grants and donations and rents



<http://www.whitehouse.gov/economy/business/startup-america>

What might happen?

Example of a service:

- An EV Drive component has problems. The component is shipped in a dedicated package by FEDx to Greensboro, NC and is received by a warranty contract facility which connects it to computerized testing equipment which runs it through protocols, identifies the problem which is fixed and shipped quickly back to the customer.
- A former warranty support company finds that it can build a better component and prototypes their unit at the innovation site. After testing and participating in several Challenges/Competitions, they have people trained and move out into the community as a manufacturer. They become a member of the E Drive community.
- The STEM Cycle kit and crew help build a prototype for a small downtown shuttle. This is tested at several events successfully and the components are selected and production is started.
- The shuttles debut at the 1st green race in Greensboro covered by ESPN.
- Tesla makes overtures to E Drive to build their new manufacturing support center in Greensboro. Citing the successful warranty support partnership they started several years before. Mr. Elon Musk stated he was pleased to have a university and nearby town named for him.

- The E Drive community coalesces into a project to build and market, and support a new vehicle. As orders come in and products go out the door they expand to a new facility in a former industrial textile site- generating jobs and increasing the tax base.
- Because of the local leadership, successful conferences, successful start up of supporting infrastructure, dedicated experienced workforce development, and opportunities for innovation- an established EV Manufacturer inks a deal to develop a new facility in the area.
- A company that started from the E Drive Gateway employs over several thousand workers, and has a budget over several billion dollars and is on the world's stock exchanges.
- E Drive Gateway initiatives garner more than 10% of the US production/support of electric drive components and has the top 3 manufacturers in the country.
- E Drive Gateway is the #1 industry cluster in the world.
- The E Drive competitions lead to NASCAR locating their burgeoning electric racing center here- joining the larger home and team centers of the International Formula E racing community.

What else can happen?

Connection between EVs and RE

The first PV installations used automotive parts, power jacks, cables, fuses, and batteries. Initially solar panels were a 12 volt appliance because that was what the majority of automotive electric was 12 volts (occasionally 24 volts)

With time DC to AC inverters were perfected and with the magic of semi-conductors, true sine-wave equipment surpassed utility quality.

Solar systems advanced to 600 volt and then 1000 volt DC, leaving automotive technology behind.

Then the new hybrid, plug in technology was offered by automakers. They used Regenerative braking- AC motors which required Inverters and Controllers. The voltage of their energy storage rose, matching not only the DC voltage of PV systems but of all electric Renewable Energy systems.

Now Vehicle to Grid and EV energy storage are all the rage.

And the technologies have begun to merge.

Motors, Controllers, Maximum Power Point Trackers, 2 way DC/AC-AC/DC Inverters, DC converters, linear boosters, Energy Storage (batteries, flywheels, hydrogen, hydraulic), charging equipment.

Utilities are proposing using EVs as energy storage for Renewable Energy. Homes are using EVs as energy storage. **Half of all EVs are charged using Renewable Energy.** Reliable, dependable warrantied batteries of EVs are preferred. And retired EV batteries will find a greater use as stationary energy storage, extending their lives, spreading their usefulness and reducing costs.

Because of Market timing, EV's will be first, but the genetic link between EVs and RE manufacturers will soon see this as a common market.

RE is growing exponentially fast as the EV market.

NC is # 2 in PV installation soon to produce 1/100th of our electricity vs > 1/1,000,000 just 5 years ago.

There are over 250,000 EVs in the US and that will easily double by 2016.

Used equipment will need servicing and replacement eventually.

A whole new Industrial Sector will develop-

E Drive

E DRIVE Gateway SWOT analysis

	STRENGTHS	WEAKNESSES
	<p>Walking the Talk TEVA does that</p> <p>International Reputation Dudley High School AVT Training programs exist locally Market growth > 40%/year Cleaner Environment Meets pollution abatement requirements A "Climate Hell" solution Can be located in eastern Greensboro Utilizes existing underused buildings Eligible for Brown Fields Restoration</p>	<p>Political Support Academic Infighting</p> <p>Ignorance</p>
OPPORTUNITIES	<p>E DRIVE FUTURE</p> <p>"E DRIVE GATEWAY" branding New Industry</p> <p>Innovation Jobs STEM Maker Movement</p>	<p>Possible time limit window</p> <p>Failure of Leadership</p>
THREATS Infighting	<p>Done somewhere else Political/Industry Pacts</p> <p>Fossil fuel/Automotive</p>	<p>Fear Political</p> <p>Disappointment/ Frustration</p>

Budget	\$2,970,000 total
Campus startup	1,485k total
Legal Start up/liability insurance	\$ 5,000 (501c3)
Building	\$890,000 (May be donated)
Repair/remodel	\$210,000
Equipment miscellaneous	\$ 10,000
Equipment	\$370,000
List	

Shop equipment	
Tables chairs, office equip.	\$ 5,000
STEM Cycle	\$ 60,000
EVChallenge	\$150,000
Eco Marathon	\$ 80,000
Car bay	\$ 75,000 (25,000x 3)

Project Rental 12 bays@\$100-2500/mon

E Drive Challenges- Greensboro G prizes	1,105k total
STEM Cycle Finals <i>Science, Technology, Engineering and Math Cycle</i>	\$ 10,000
EV Challenge Scavenger Hunt-autocross	\$ 10,000
Efficiency Logistics Challenge	\$ 10,000
Greensboro High Mileage Challenge	\$ 25,000
Big G Hyper miler	\$ 15,000
Personal Mobility Challenge	\$ 25,000
E Motorcycle racing	\$ 50,000
Formula E	\$250,000
E Car Racing	\$ 75,000
NEDRA	\$ 75,000
Drone Competitions	\$ 75,000
Shuttle of the Future	\$ 15,000
Taxi of the Future	\$ 20,000
Service truck of the Future (3-10 wheels)	\$ 65,000
Bus of the Future	\$100,000
BRT/TRIAD	\$100,000
Manned Electric Flight	\$100,000
Publicity/advertising	\$ 85,000

Conferences	\$95k total
GO Expo (Greensboro Odyssey)	\$ 5,000
E Drive Week	\$ 5,000
International Plug In Week	\$ 5,000
Plug In America Conference	\$50,000
E Drive Industry Conference	\$15,000
E Drive Industrial Association	\$15,000

Trainings	\$105k
NAFTC Trainings	\$10,000
LEVA Trainings	\$10,000
EV Seminars	\$10,000
EV Conversion Workshops	\$50,000
"Green" Service Stations	\$25,000

Staffing

\$180k total

Director \$95,000/yr
Technician A grade \$85,000/yr
Part Time from other agencies
Interns
Contract Teachers

Media Resume

Bio Jack <http://www.resilienceworkshop.org/speaker---jack---martin.html>
<http://ncsc.ncsu.edu/wp---content/uploads/2010---Mobile---CARE---award---summaries2.pdf>

NCA&TSU SME

http://sme082.com/EV09/ev091209_Teva.htm

STEM Cycle Challenges

<http://www.evchallengekids.org/electrathon---based---pilot---project/>
http://www.youtube.com/watch?v=6o90j_XUXjQ

Greensboro Odyssey expo

<http://greensboroodyssey.org>

Hypermiling

<http://www.youtube.com/watch?v=P4JHW00xItY> <http://www.videosurf.com/video/the---art---of---hypermiling---60469941>

Ryan Mcgee, ESPN mag Feb 23 2009 p30---36

<http://sports.espn.go.com/espnmag/story?id=3897918>
<http://sports.espn.go.com/espnmag/story?id=3904547>
<http://sports.espn.go.com/espnmag/story?id=3897985>

National Electric Drag Racing Association

<http://www.nedra.com/videos.html> <http://www.powerofdc.com/>

Electrathon

<http://www.youtube.com/watch?v=xOrVQ84E7---Y> <http://endless---sphere.com/forums/viewtopic.php?f=7&t=12542>
<http://www.youtube.com/watch?v=43KLaoGggRw&feature=related>

Solar car

<http://videos.howstuffworks.com/howstuffworks/178---how---solar---cars---work---video.htm> <http://www.youtube.com/watch?v=2kATVv2NzXk>

NC NOW

<http://video.unc.tv/video/2220391268>

Shell Eco Marathon

<http://www.wired.com/autopia/2011/04/shell---eco---marathon/?pid=965>
<http://news.nationalgeographic.com/news/energy/2011/04/110418---shell---ecomarathon---houston---winners/>

Road to Houston parts 1,2,3

<http://www.youtube.com/watch?v=JBOZbLUYHTI>
http://www.youtube.com/watch?v=SK8_9CmXiTA
<http://www.youtube.com/watch?v=kYGKLBDagps>

Greencycle Design

<http://www.greencycledesigngroup.com/gcdg/>

Organic Transit TEDx

<http://www.organictransit.com/>
<https://www.youtube.com/watch?v=YoQQwElIrlI&feature=plcp>
<https://www.youtube.com/watch?v=iS1MjRLhdRA&feature=endscreen>

Electric TT

<http://www.youtube.com/watch?v=rogV80QfLYQ>
http://www.youtube.com/watch?v=y8_oD0WadUs&feature=player_embedded

Ion motorcycle

<http://green.autoblog.com/2009/09/02/tom---micelis---ion---an---eye---catching---electric---motorcycle---indeed---w---v/> <http://www.youtube.com/watch?v=RUFYkvSPldI>

Electric vehicle

<http://www.youtube.com/watch?v=k62FzVuSF58>

Training and workshops

http://www.naftc.wvu.edu/curricula_training/course_workshop_information
<http://www.levassociation.com/member---promotion>

Research

http://www.afdc.energy.gov/fuels/electricity_related.html
<http://nccar.us/images/overall.pdf> <http://www.avrc.com/posts/news/>

ACC conversion

http://www.youtube.com/watch?v=bowJXqza4_8
<http://www.youtube.com/watch?v=ek1Vo4EeyaU>

ACC repair videos Solar Water Heating and Wind

<http://www.youtube.com/watch?v=c779---buM---zk>
<http://www.youtube.com/watch?v=Bdu06oDuRyM>

TEVA

www.tevanc.org <http://localaction.biz/TEVA/>
<http://www.localaction.biz/TEVA/members.htm>

FFR Trike video

<http://www.citizen---times.com/article/20120705/NEWS/307050018/FFR---Trikes---tackle---Pike---s---Peak---grueling---hill---climb>

EVChallenge

<http://dev.sandbox.green.autoblog.com/2011/07/21/plug---in---2011---ev---challenge---puts---high---school---students---into---the---dr/>

Biofuels

<http://www.permaculture.com/node/355>
<http://www.news.appstate.edu/2010/04/29/epa---p3---sustainability---award/>
<http://www.biodieselmagazine.com/articles/7573/piedmont---biofuels---unveils---details---of---enzymatic---processing>

ATMAE <http://atmae.org/itinsider/13---02.pdf> p13 workshop Renewable energy Electric vehicle and P3 2012 ATMAE conference , Nashville, TN Sustainable Energy Education Training, NREL, Golden, Colorado ACC Sustainability and Renewable Energy Curriculum Development

Electric Auto Association Educational Chapters EAA seeks to partner with educational institutions which want to provide this sort of educational experience to their students and encourage the next generation of Electric Vehicle enthusiasts and engineers. *Dr. John Martin, Appalachian State University*

EPA Annual P3 (People, Prosperity, and the Planet) Award Competition The EPA's Annual P3 competition lets students research, develop and design solutions to sustainability challenges, and compete for the P3 Award and an additional \$85,000 in funding to move their designs to the marketplace or implement them in the field. *Dr. John Martin, Appalachian State University*

References

Eric Ryan, Director, EVChallenge, 415.710.1566

NC Center for Automotive Research, (252) 308-0516

John Hill, Independent Garage Owners of NC, 336 274 7872

Ken Dulaney, Vice President, Advanced Energy 919.857.9055

Mike Smithe National Alternative Fuel Training Consortia, (304) 293-7882

Ken Clayton, Mike Rollins, Greencycle Design 336.407.4322

Ewan Pritchard, FREEDM Program NCSU 919.819.0098

Chris Carter, Home Power Hour, 336.269.1753

Rob Cotter, Organic Transit, 919.414.5528



E DRIVE™

Video at: <https://www.youtube.com/watch?v=dypTNc0ooY8&feature=youtu.be>