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The Future of Mobility is Slowly Coming into Focus

Two Ends Forming Around a Big Middle

A PERFECT STORM of climate change anxiety, urban core business blossoming and the arrival of two-wheeled electric transport came together in 2019. Hinterlands would be emptied as everyone moved to the metropolises, claimed the clairvoyant business analysts, and these high-density centers would all be connected by high-speed railways and personal aerial devices. Four-wheeled, driverless electric vehicles would provide for all the transport needs that could not be accommodated by surface and underground fixed rail, bicycles, scooters and our own two feet. Mobility-as-a-service would provide the business model to tie everything together, perhaps as an extension of your phone/broadband subscription. Private car ownership would soon be a relic of a bygone age.

This is an interesting narrative, but is not a correct one. Even before COVID-19 changed how people have been living outside of China since Friday, the 13th of March 2020, the picture of everything happening in high density cities was a rumor that companies like WEWORK spread to build their houses of cards. Urbanized areas in North America and Europe were growing before the pandemic hit, but not from the core. They were expanding into the the rundown edges and near suburbs. New arrivals in the big cities were no longer the poor from the countryside or immigrants from abroad; they were college-educated with high enough incomes to move into former working class neighborhoods like South Boston, Södermalm in Stockholm and Sunset Park in South Brooklyn where prices mushroomed.¹ These areas are being, or already are, gentrified.² Those people who lived in the gentrified areas before being displaced by the new, wealthy arrivals did not and are not moving to the inner suburbs. There are no affordable apartments or homes there. The displaced are either squeezing into the last remaining enclaves remaining for the poorer citizens, or they are joining the new immigrants North America and Europe in small towns

1. If Brooklyn were a city and not a borough of New York City, it would be the fourth largest city in the U.S., after Chicago and before Houston. It's time to bring the Dodgers back from Los Angeles to their real home in Brooklyn and raise up Ebbets Field.



2. Gentrification is a process in which a poor area (as of a city) experiences an influx of middle-class or wealthy people who renovate and rebuild homes and businesses and which often results in an increase in property values and the displacement of earlier, usually poorer residents.

Definition: Merriam-Webster

and cities that many thought (hoped?) had simply ceased to exist. Places like Scranton are getting a new lease on life (see *Musing of a Dispatcher* in this issue).

One result of the pandemic is the acceleration of moves of young families out of inner city condominiums to homes with yards and garages in the suburbs. Decoupled from the requirement to be present and accounted for in the office and weary of the constant and necessary attempts to avoid crowds when the whole point of moving to the city was to be in a crowd, they are cashing out and moving on. In preparation for another pandemic strike, they want to be prepared with an idyllic enclave where their children can play, they can work outdoors and they can barbecue in peace with family and friends. The distance families move is determined by the combined incomes of the family heads and the perceived need to have more than a casual connection to a place of work.³

The ink's barely dry on the latest big city narrative

This is quickly changing the picture of transport's future from one in which the private, family-owned car would gradually fade out of existence for everyone—who needs a car in a city?—to a much more nuanced state of affairs in which big cities, small cities and large, low-density areas provide different sets of transport requirements for daily life. Access to various types of work, education, commercial and recreational opportunities, both near and far, present a very different set of transport requirements in these three different environments. Let us together look at each of these places where people live so that we can better understand what improvements need to be made, both to transport and to the way each of these unique places are planned, built and managed. We'll start with big cities.

Everyone has their own As and Bs and they change over time

Once upon a time there were centers of work in cities, like the docks, the high street, the financial district. And there were places where the people who worked in these centers lived, like the fashionable suburbs, the inner-city mansions and apartments, the working-class terraces and the tenements at the edges. This is still the case in some countries, but in northern Europe and the largest cities in North America this has not been true for more than half a century. Over 60% of workplaces are outside of cities in suburbs and exurbs. Yes, there is a renaissance in places like Manhattan and Brooklyn, San Francisco and London, but neither people nor businesses are making a mass migration to cities. Transport solutions that were built in the aftermath of the First Industrial

Brooklyn Is Constantly Evolving



This photo was taken in front of the entrance to Nicola and Pasqualina Sena's home at 831 Bedford Avenue, Brooklyn, New York. It was the summer of 1941. My great uncle and great aunt bought the four-storey brownstone in Bedford-Stuyvesant on Brooklyn's longest street just after the end of WWI. They had arrived in America from Italy with their first of eventually seven children in 1904. On the top floor, Zia Assunta, Zia Pasqualina's sister, lived with her husband, Zio Patsy. My father took the photo. The first young woman to the left of the photo is his sister. The second young woman is my mother.

The Bedford and Stuyvesant was first settled in the 17th century by the Dutch within the incorporated Town of Breuckelen (Brooklyn). The English took New York from the Dutch in 1664. In the late 1880s, German and Irish immigrants began building large masonry row houses. They were upper-middle-class families of lawyers, shopkeepers and merchants. Working-class and middle-class Italian immigrants joined and eventually replaced the Germans and Irish in the early 20th century. During the 1930s, immigrants from the American South and Caribbean joined former residents of Harlem to increase the area's African-American and Hispanic population. By the 1960, 85% of the Bed-Stuy area was Hispanic and African-American.

In the summer of 1967, my mother, father and I drove to 831 Bedford Avenue to visit Zia Assunta, the one remaining family member residing in the house. She was in her mid-eighties and would pass away shortly after our visit. It was not a place where Whites were welcomed during the next thirty years. Starting in the 2000s, gentrification began. In 2000, less than 3% of residents were White. Today it is closer to 25%.

Revolution, and which survive today even though they have not been fit for purpose for half a century, are definitely not going to take us where we want to go as we enter the Fourth Industrial Revolution.

One effect of changes that have occurred in where people live and work in and around big cities is a phenomenon that was already well underway before the pandemic but has sped up: the demise of inner city buses. I wrote about this in the [December 2018](#) issue of *THE DISPATCHER*, *Is It Time to Throw the Bus Under the Bus?*. I wrote:

We need to start thinking outside the bus. If a city is serious about providing a useful bus service, it needs to run them everywhere and often, including at night. It must, therefore, get rid of cars driving and parking on its streets. That includes both private and commercial cars (i.e., taxis). It needs to eliminate all trucks and delivery vans parking in its bus lanes. If it cannot do these things, it should do what London and Los Angeles are doing, which is gradually taking buses out of service while their citizens find and use other options. What cities are doing today all over the world is neither providing an adequate service to their citizens nor using the money allocated for transport in a cost-effective way.

Today, a year after COVID-19 caused cities around the world to shut down, collective transport riders are still avoiding buses, trams and metros. In New York City, ridership of the subway (metro, underground transit) is only 35% of its pre-COVID levels, and bus ridership is only around 50%.⁴ Micromobility supporters would like to claim that those riders are simply staying home or have moved to bikes (self- and e-powered) and e-scooters. That is not the case. Lower numbers for transit users prior to the pandemic were the result of riders shifting to two wheels. The major reduction in ridership during the past year is due in part to some people working from home or being out of work due to COVID-19, or to riders moving to cars, either to ones they owned and which sat in their driveways and garages, or ones they newly acquired. Sam Schwartz, former NYC Traffic Commissioner, is a reliable source of New York transport information. He was quoted in the same article in *The New Yorker* referred to above as saying that “the city is facing a scary scenario this fall, unless something is done to redirect the public’s atavistic (return to a past activity) retreat to private automobiles.”

There will be calls for additional funding to support public transport to help it through this crisis. Rail rapid transit (this does

3. “Before the pandemic, about 5% of full-time-work days in America came from people working at home. It increased to 60% at the height of the pandemic and has since fallen back, but it will end up higher than pre-pandemic days. Broad adoption of remote work stands to drastically alter households’ locational calculations. Recent research suggests that people with high-productivity jobs could work remotely from anywhere, potentially severing the link between a local economy’s productivity and the demand to live there, and thus enabling a large-scale migration from high-cost cities to low-cost ones. And remote work could allow workers to spend more time at home while still occasionally commuting into the office. In that case, remote work would reduce the cost of a given commute and might thus lead metropolitan areas to become more sprawling.”

THE ECONOMIST May 8th 2021. *Free Exchange: Escape from the city*, p. 66.

4. *THE NEW YORKER*. April 26 & May 3, 2021. *Scooter City*. John Seabrook.

not include surface trams running in the middle of streets) moves large numbers of people quickly and should not only be supported but expanded in large cities. On the other hand, propping up big buses and building tram lines in big cities is throwing good money away. In the best of cases they are overcrowded during rush hours and empty most of the day and evening. In the worst of cases they are underused at all times.⁵

Bite the bullet and get private cars off the big city streets

The reasons that people who live in cities began to buy cars was that they needed them to get to their jobs, the ones that began moving out of the cities in the '60s to 'campuses' where there were no transit links. Then they needed them to drop off their children to day care centers since both parents worked. Then they needed them to drop off their older children at their schools because the schools they attended were no longer in their neighborhoods, either due to efforts at desegregation or because free school choice/vouchers replaced local schools. Then, as local super markets and other stores disappeared, they needed them to do the regular shopping and other chores. Cities transformed themselves and people organized their lives around the fact that having a car in the middle of a city which could be parked on the street or in a basement garage was a possibility—and a necessity.

Simply taking away the cars without making the changes that caused people to acquire them in the first place won't solve the problems caused by cars in cities. It would be like trying to clean a polluted river by dredging the sludge from the bottom without removing all of the sources of the pollution. Structural changes to the cities must occur simultaneously with changes in the transport systems. The prime ministers of Sweden and the UK have a free place to live within a short walking distance of their place of work. The President of the U.S. lives down the hall from his Oval Office. Members of the EU Parliament have travel budgets for getting to and from their seats. Those of us who must live with decisions made by politicians, such as banning cars, don't have those advantages. The clock must be turned back on the situations that have developed in big cities that make private cars the most viable transport option for many city dwellers. Making those cars zero emissions at the tailpipe is merely dredging the sludge. You want to ban cars, provide a good alternative.

Big cities need to consolidate parking for their residents' private (owned, shared, subscribed to or rented is immaterial) automobiles at their edges, at metro stations, into parking

5. The Case for Empty Buses

There is a reason why there are large buses running full or empty around big cities. Here is a quote by someone who works as a "transit consultant", Jarrett Walker:

"In 20 years as a transit network design consultant working across North America, Australia, and New Zealand, I've never encountered a transit agency that pursues a ridership goal as its overriding purpose. Transit agencies are always required to provide large amounts of service despite predictably low ridership, for reasons including basic access for seniors and the disabled and the perception that service should be delivered "equitably." While equitable is a slippery word that means different things to different people, its effect is to justify service spread all over an urban region, even into areas where ridership is inevitably low (usually due to a combination of low density and street networks that discourage walking)."

In other words, cities run buses in-case people want to ride them. He continues:

"In my own work, I refer to these predictably low-ridership services as coverage services because they are tied to a coverage goal that conflicts with a goal of maximum ridership. Typically the coverage goal is stated in the form "___% of residents and jobs shall be within ___ feet (or meters) of transit." This goal requires service to be spread out over areas where prospects for ridership are poor."

What I find odd is that the people who would seem to need transport the most, those who live farthest from where buses go, use it the least. Are there only 'seniors' and 'disabled' at the ends of the lines?

Mr. Walker provides the common rebuttal to people who complain about empty buses, which was posted on his blog site: "I see a lot of cars in *rush hour* running at just 20% capacity. Such a waste of taxpayer-funded road space."

garages. These parking garages would also serve as collection centers for cars coming to the cities. Transport to and from destinations in the city would be by various sizes of vehicles that will eventually be driverless. There would be small, low-speed service vehicles for residents to travel from and to their homes that would have the equivalent of a private car's cargo space. There would be larger vehicles for shared rides to destinations around the city, and minibus vehicles for transport to major transport stops. How would these cars be paid for. Dismantle the congestion charging infrastructure and have people pay the equivalent for parking. With the added savings gained from eliminating the cost of operating these systems, they will pay for themselves.

With private cars off the roads and all curbside parking eliminated, city streets can be better controlled and adapted to a human scale. Pedestrians of all ages and physical abilities need to be protected at all costs. Period. *Tour de France* bikers, if they are going to be allowed, need to be restricted to special bike paths with no interaction with pedestrians or other two-wheeled vehicle users. E-scooters, if allowed, must have pot-hole-free paths, otherwise there will be more faceless (literally) citizens in our cities.⁶ Designated, fenced-in and covered parking locations for two-wheel bikes, three-wheel cargo bikes and scooters must be provided in what were curbside parking locations. This will prevent the all-too-common accident of a person stumbling over a scooter or bike that has been carelessly left on a pathway. There should be no on-street parking with doors opening into bike lanes. And there should be stop lights for bikes, scooters, pedestrians and all vehicles that MUST be respected and enforced.

For goodness sake, do not put back the parking meters

Some cities (Stockholm is one example) are trying to do their part to move everyone to battery electric vehicles by suggesting that on-street parking spaces are fitted with charging stations. This is extreme retrograde thinking. After finally getting rid of parking meters, it makes no sense to put back the equivalent with the added mess that will be caused by charging cables. Talk about uglifying a city! What happens when someone comes up with the invention that will eliminate all tailpipe emissions from ICE vehicles? Instead of promoting on-street parking while removing off-street parking as a requirement for residential and business building permits (which Stockholm is also doing, ostensibly to encourage people to take public transport to their places of

6. The author of *THE NEW YORKER* article referenced earlier describes his own fall on an e-scooter he had bought for his wife. She wouldn't use it. A doctor he interviewed talked about 'brain bleeds' that occur when people land on their heads after a fall caused by driving into a pothole.



*The world's first parking meter, known as **Park-O-Meter No. 1**, is installed on the southeast corner of what was then First Street and Robinson Avenue in Oklahoma City, Oklahoma on July 16, 1935.*



Is this what we want our cities to look like, with charging stations and dirty cables forming the edge of sidewalks and e-scooters littering pedestrian pathways?



work), cities should be closing many of its streets to all private motorized vehicular traffic. The last thing they should be doing is encouraging more curbside parking.

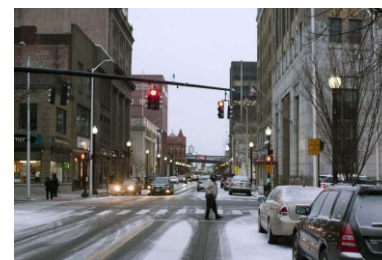
Small-to-medium-sized cities are another story

Of the 317 incorporated places in the U.S. with populations of 100,000 or more, 200 have less than 200,000 residents. There are 4,115 cities with between 10,000 and 100,000. Scranton, PA is among this latter group. If it stayed at its peak population of just over 140,000, it would be number 185 on the list today, about where Bridgeport, Connecticut is. Scranton looks a lot like Bridgeport, although it's now half its size. People in both cities live in single-family homes, duplexes, row houses or small-to-medium-sized apartment buildings. Many have off-street parking with carports and garages. Apartments have parking lots. There are bus systems in both cities.⁷

Before the pandemic, roughly 5% of each city's population rode the bus on a daily basis. It is less than half of that now. According to the U.S. Census, in 2019 65% of Bridgeport work trips were made by people driving alone, and an additional 15% were made in a carpool. It was respectively 70% and 15% for Scranton. In New York, NY it is 22% and 4%. Two different worlds. Bridgeport and Scranton will not become New York City. The people who live in smaller cities and towns are now dependent on cars. It does not matter whether the cars run on electric batteries, hydrogen fuel cells or petroleum derivatives powering internal combustion engines. It does not matter if the cars are new or used, purchased outright, leased, rented or shared. Even *THE ECONOMIST*, cheerleader for the anti-car lobby, recently had to admit the following:

"Individually owned cars will remain a big part of the new ecosystem. They are still the world's preferred means of transport. For every ten miles travelled, Americans use the car for eight, Europeans for seven and Chinese for six. Even in Europe, which is friendlier to public transport than America or China, only one in six miles was travelled on buses, trains and coaches in 2017. Uber accounts for just 1.5% of total miles driven in its home market, the U.S. The pandemic has in some ways cemented the car's pole position. Many people have shunned shared vehicles, be they cabs or buses, for fear of infection. A survey of American travel habits by LEK, a consultancy, showed that car journeys declined by just 9% last year (2020), compared with 55-65% for public transport and ride-hailing."⁸

If we buy into the belief that urban areas are the future of the world, then in most countries, most urban areas will have 150,000



Drop me into the center of Bridgeport, CT (above) and I'd swear I was in Scranton, PA (below).



7. <https://censusreporter.org/profiles/16000US4269000-scranton-pa/>

8. *THE ECONOMIST* April 17th 2021. *Personal Transport: The future of getting from A to B.* pp 51-53.

inhabitants or less. Sweden's third largest city is slightly larger than Bridgeport. In Germany, it is the 53rd largest city that is Bridgeport's size. Cars are the most effective and efficient means to move in these cities to where people of all ages and incomes have to go. The problem is that not everyone can afford to buy and own a car or has the ability to drive a car. This is where on-demand transport can play an important role. Affordability is the number one criteria to ensure usage and success. Next is doing a better job than buses with delivering people from as close to where they start their journeys to where they want them to end.


As I said, it is not buses that will meet the need. Neither is it roads filled with taxis. There are taxis offering rides in Trenton and Scranton, but they are not replacing buses because they are too expensive and are often unavailable when demand for them is highest. The Uber/Lyft model can be better at meeting demand, but they are still too costly. Taking away the driver will reduce costs, but competing for rides as taxis do will still leave the most needy the least served. During the last session of this year's **PRINCETON SMARTDRIVINGCARS SUMMIT**, Professor Alain Kornhauser presented a concept that he and Jiawei Jerry He developed.⁹ It is

9. Alain L. Kornhauser, PhD, is Princeton University Professor, Operations Research & Financial Engineering, Director, Transportation Program and Faculty Chair, Princeton Autonomous Vehicle Engineering. Jeiwei Jerry He is manager of projects at the Princeton University Transportation Research Group. He has a Master of Architecture from Princeton and a B.A. in computer science and urban design from NYU.

3. Service Concept




1. Residents summon a ride at Kiosk or with smartphone.



2. Van departs from the Kiosk in less than 5 minutes.



3. Drop-off at precise destination or the nearest Kiosk.



4. Attendant / Driver on-board to mitigate any anxiety.



5. Once ODD is proven safe and familiar, attendants/drivers will expand the ODD.
Additional jobs are created.

for an on-demand mobility solution for the “mobility marginalized”. They used Trenton, NJ as the operating area, focusing first on the places where car ownership is at the lowest. As the slide from the presentation shows, it is based on taking riders from widely distributed collection points that are no more than a five-minute walk from any location in the city, to their final destinations or to the closest collection point. Kornhauser and He call them ‘mini-mobility hubs’. Residents would request a ride

either on a smartphone or from the collection points. Initially, there would be attendants in the cars.

Isn't this what Waymo is doing in Chandler? Well, yes, but Chandler, AZ is hardly Trenton, NJ. Chandler's median household income in 2019 was \$83,709, 26% higher than the state's, while Trenton's was \$34,000, 152% lower than New Jersey's.

Those who participated in the **PRINCETON SMARTDRIVINGCARS SUMMIT'S FINAL SESSION** agreed that it was time for a proof-of-concept using the Trenton model. It's the only way to determine whether the concept is practical and will be both accepted and used by the community.

Everything in between is for cars and pick-ups

Now to the vast area in between big and small cities. Drive out of any city, small or large, anywhere, and you meet fields and forest. In those fields and forests are people living in houses. We like to quote demographic experts who say that by 20XX more than 60%, 70% or 80% of all people will live in cities. Where will the other 40%, 30% 20% living and what are they doing? They will still be living in isolated houses or in small villages, and will still be growing your food, for one. (There will have to be more of them if everyone has become a vegetarian.) They'll probably still have bicycles which they will use to ride down to the end of the road to pick up their mail, or to ride to the school bus stop, but then again, there may not be mail or physical schools to go to so they might not have bicycles. Depending on the size and age of the family, the area in front of their house might look like a used car lot. And then there are the tractors, hay trailers and various other types of machinery that are needed to get the work done. In between the farms are renovated or dilapidated cottages and housing tracts carved out of former fields, orchards or pastures sold off by the farmer to keep the bills paid. They will still be there, and if more and more people feel disconnected from their former physical places of work, there will be more people in more houses out there in the fields and forests.

People who live in sparsely-populated areas and small villages depend on cars and trucks and school buses to get them to where they need to go. Discussions about congestion charging and mobility-as-a-service and BEV versus ICE may be a matter of educational interest to the people living in these places, like the state of the ground water level might be to the people living in big cities, but such discussions are of no relevance to their daily lives. If

Home on the Range

The total land area of the United States is 2.3 billion acres (931 thousand hectares). 1.9 million is in the lower 48 states.

Range and Pasture – 788 million acres

Forest – 747 million acres

Cropland – 349 million acres

Rural Residential – 73 million acres, of which 44 million acres is in lots of 10 acres or more

Developed (cities and towns) – 66 million acres, which is 3% of the total land area. 75% of the population lives on this land area.

Area of paved roads and parking lots – Approximately 40 million acres



A one-hundred-year-old farmhouse in rural Minnesota with cars and tractor, a wind-powered well and a little red wagon. A family lives here.

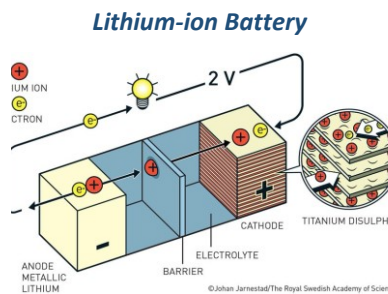
all they can purchase is BEVs in the future because a state or country government has made that a law, they'll make due with used cars until those are also made illegal and then they'll figure out a way of juicing up their vehicles so they can go on living where they live to produce the food we eat, chop down the trees we use to build our buildings or do all the other things that people do outside of cities and towns.

Any car manufacturer who decides today that their future depends on car sharing or cars-on-demand, and who begins to wind down their sales, service and parts business to meet this future, will not be around in ten years. I began writing *THE DISPATCHER* almost eight years ago with the message that driverless vehicles would not be the future of the car industry by 2020. As we have seen, it wasn't then and won't be for a very long time. I'm saying now that the future of the car industry will not be based on delivering mobility to people living in big cities. It will be based on delivering vehicles that people will drive or be driven in, just like they are today, until people can figure out a way of moving by the force of their own will rather than by an external force.

Not everyone is an actual or wannabe Brooklyn hipster

It should be a requirement that publications like *THE ECONOMIST* and *THE ATLANTIC*, newspapers like the *NEW YORK TIMES*, TV news channels, investment firms and marketing companies hire staff who live permanently in small-to-medium-sized cities and in villages out in the countryside, rather than hiring people who only live in large cosmopolitan cities where these organizations have their headquarters. This could possibly provide a needed perspective on what is actually happening in places outside Brooklyn or Islington. It might save us all from reading and believing a story that a journalist has written after looking out of her window or talking to his neighbor. I say 'possibly' because if the person living in Scranton or Trenton or Bridgeport is permanently glued to his social media interface and escapes to New York or Philadelphia or Boston on the weekends, he may not be able to fully appreciate the local conditions. The new hires should serve at least a year's internship working at the local WALMART or HOME DEPOT, be forbidden to order in all their meals and required to do all their shopping in physical local stores. They should be dropped in without a car just to experience the public transport systems and determine whether it's possible to make it through the year without their own car. It's not. My guess is that they'll end up liking it a lot.





This is the diagram that accompanied the Nobel Prize produced by the Royal Swedish Academy of Sciences. Battery cells consist of three basic components: two electrodes, the negative anode and the positive cathode, separated by a chemical "soup", called the electrolyte. When lithium-ion batteries are charged, lithium ions are forced to migrate to the negative electrode where they are deposited. During discharge the lithium ions reverse direction for the cathode.

10. Gottfried Leibniz was the philosopher who coined the term "best of all possible worlds" in his 1710 work *Théodicée*. His theory in a nutshell was that since God knows what he's doing and is good and really smart by definition, he looked at all the possible worlds he could have created and decided on the best possible world for us.

Better Batteries Are on the Way

BATTERY ELECTRIC VEHICLES (BEVs) exist because of the invention of lithium-ion rechargeable battery cells. They were first proposed in the late 1970s. In 2019, the *NOBEL PRIZE IN CHEMISTRY* was awarded to three scientists for their work in developing the battery. The recipients were John B. Goodenough, Stanley Whittingham and Akira Yoshino. Whittingham, a British chemist who was working for Exxon during the early 1970s oil crisis, began to look for new ways to store energy from renewable sources to power electric cars. He focused on lithium as the anode because it released electrons easily and was the lightest metal. He looked for materials that had a high energy density and captured lithium-ions in the cathode. He discovered that titanium disulfide had a molecular structure that let lithium-ions slot into small pockets. The result was the first lithium-ion battery. Lithium-ion stored about ten times as much energy as lead-acid or five times as much as nickel-cadmium, they were extremely lightweight and required little maintenance.

John Goodenough found that Whittingham's design was not quite good enough. His batteries tended to short-circuit after repeated charges and could cause an explosion. Goodenough suggested that the cathode be made from cobalt oxide instead of titanium disulfide. It was more tolerant of lithium being frequently pushed into and pulled out of it. It also made the battery about twice as powerful as Whittingham's, generating four volts. Akira Yoshino made the li-ion battery even more perfect. He discovered that carbon-based electrodes could house lithium-ions in between their layers as well. This made it possible to eliminate all pure lithium from the battery, and made the batteries safer. It was SONY CORPORATION in 1991 that developed the first commercial lithium-battery.

Lithium-ion batteries are not the best of all possible worlds

In spite of the Gottfried Leibniz-inspired belief that because TESLA has chosen lithium-ion batteries they must be the best choice, there may well be better choices.¹⁰ There is a limit to how many times they can be recharged and hold a charge. A slight manufacturing defect can turn the

battery into a tiny bomb. Remember the 2006 DELL COMPUTER recall of 4.1 million laptops, and the SAMSUNG ELECTRONICS fiasco with the Galaxy Note 7, its smartphone that it finally discontinued. Research continues to try to find ways of producing batteries that are safer, more powerful, last longer and perform under severe weather conditions. Solid-state batteries look like they may be a good replacement candidate for li-ions. Toyota has called the technology a “game changer”, and says it will introduce in on its electrified platform by 2025, when it is believed the technology will be ready for prime time.

A company named SOLID POWER, based in Denver, says it has come up with a solid state battery solution, and BMW and FORD are putting a \$130 million bet that it is has. The claim is that it solid state batteries can provide a high-capacity energy storage device that improves on lithium-ion batteries by replacing the liquid or gel-form electrolyte with a solid, conductive material. It would therefore offer more energy density and better safety due to the lack of flammable components. SOLID POWER says its battery will deliver 50% more energy density than current lithium-ion batteries.

Here is what Ford said about their investment:

“Solid-state battery technology is important to the future of electric vehicles, and that’s why we’re investing directly,” said Ted Miller, Ford’s manager of Electrification Subsystems and Power Supply Research. “By simplifying the design of solid-state versus lithium-ion batteries, we’ll be able to increase vehicle range, improve interior space and cargo volume, deliver lower costs and better value for customers and more efficiently integrate this kind of solid-state battery cell technology into existing lithium-ion cell production processes.”

...and BMW:

“Being a leader in advanced battery technology is of the utmost importance for the BMW Group. The development of all solid-state batteries is one of the most promising and important steps towards more efficient, sustainable, and safer electric vehicles. We now have taken our next step on this path with Solid Power,” said Frank Weber, Member of the Board of Management BMW AG, Development. “Together we have developed a 20 Ah all solid-state cell that is absolutely outstanding in this field. Over the past 10 years BMW has continuously increased the battery cell competence— important partners like Solid Power share our vision of a zero-emission mobility.”

Solid-state battery technology is currently more expensive than li-ion cells. It is claimed (by among others, Elon Musk) that they are



For solid-state batteries, the solid electrolyte does not require a diaphragm and an electrolyte. These two parts add up to nearly 40% of the volume and 25% of the mass in a conventional lithium-ion battery. Also, there is no leakage or corrosion. The battery case and the cooling system module can be simplified to further reduce the weight of the battery system. Further, the new positive and negative materials can make the electrochemical window reach 5V or more, which can fundamentally increase the energy density, and is expected to reach 500Wh/Kg. It is expected to increase the cruising range to 600-700km under the same battery capacity. For comparison, the energy density of the 21700 battery used in the Tesla Model3 is about 300Wh/Kg, and the cruising range is about 400 to 500 kilometers.

VW finding it difficult to make money on its new ID4 BEV

"What they will discover with experience is that, as they lower the cost of the packaging and cooling around the cells themselves, the percentage of the battery's cost that is raw materials rises. Those raw materials are earth minerals, and the price of those rise with demand — the same as iron ore, gold, diamonds and crude oil. VW's top management has said that its global scale would help make EVs affordable by driving down purchasing costs. But scale does not work when demand is high and wide and supplies are constrained — just as automakers are discovering right now with microchips. When demand rises, prices rise, too. This is a tough lesson for carmakers used to lowering their costs with volume. These are not assembly costs; they are mineral costs, and mineral prices do not work that way."

Eric Noble, president of CarLab, a consulting firm in Orange, California reported in Automotive News Europe

hard to manufacture at a large scale. Finding the right mix of materials for the solid electrolyte is one of the main challenges.

A Burning Question

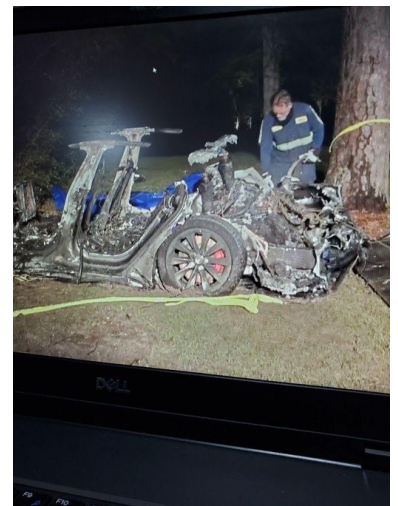
REPORTING OF THE recent crash of a TESLA in Texas has focused on whether the car, a 2019 Model S, was being driven by the owner or by the car's Autopilot system. The fact that the owner's charred remains were found in the back seat of the vehicle, behind the driver's seat, seemed to be a clear indication that it was the latter. However, evidence from surveillance cameras in the neighborhood where the owner lived show that he climbed into the driver's seat when he and his friend, who also died in the crash, began their ill-fated journey. Sorting out whether it is possible to jump into the back seat during a 550-foot (167 meter) trip in which the car was travelling at 85 miles per hour when it hit a drainage culvert and a raised manhole cover and then ploughed into a tree will take time, says the National Transportation Safety Board.

I believe NTSB should be more interested in finding out why the car looks like it was hit by an air-to-surface rocket. What I find remarkable about coverage of this and other TESLA crashes, like the one in Mountain View in 2018, is the lack of interest on the part of the reporters and the regulators on what happens after the crash. It was news back in 2013 when a TESLA ran over debris on the road. The battery pack was breached from below and the result can be seen in the photo in the sidebar. In another case, a TESLA ran over a tow hitch that had fallen off and was in the road. TESLA responded in March, 2014 by installing a triple underbody shield "to bring the risk of fire down to zero" in the words of Elon Musk. There were nine fires resulting from accidents during the next four years, including the one in which Walter Huang's Model X drove itself into a concrete barrier while in Autopilot mode. But it is as if TESLA's purported fix was enough to put a lid on the problem. Any more harping by reporters or regulators would be considered carping and would be met by a tweet: NCAP says our cars are the best.

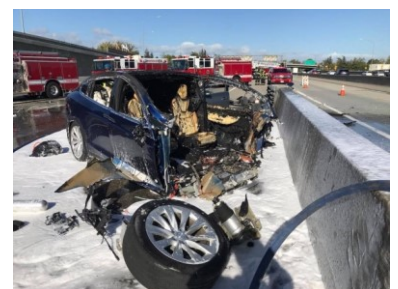
Rather than addressing the problem, the battery electric car industry, which includes those making the cars and batteries as well as the cadre of cheerleaders who make their livings writing about and investing in BEV technology, simply say that ICE vehicles catch fire too. They haul out the trope that ICE cars are eleven times more likely to catch fire in a crash. If there were one-half or one-quarter or one-eighth the number of BEV vehicles on the roads as



1 October 2013, a Tesla vehicle catches fire in Seattle after the car collided with debris on the road. The driver is not injured, but it's the first in a series of fires that prompt the company to add extra protection to the vehicle's chassis.



This is what the Tesla Model S looked like after crashing into a tree in Texas in April 2021.



Walter Huang, who died following a fiery Tesla crash in Mountain View in 2018. The severe damage to the Tesla breached the battery, causing it to catch fire shortly after the crash. Though bystanders were able to pull Huang from the vehicle just before it was engulfed in flames, he later died of his injuries.

there are ICE vehicles, it might be possible to make that comparison, but there aren't. If the BEV car manufacturers had been forced to remove their cars from the market when the fire problems were discovered in the early days of BEVs, being subjected to the same recall regimen as computer manufacturers like DELL and smartphone manufacturers like SAMSUNG, the problems would in all likelihood have been fixed by now. Regulators in the U.S., Europe and China seem to have been more interested in protecting their investments (subsidies, tax breaks, emissions credits and outright loans) than protecting the public.

The sky is falling!

CHICKEN LITTLE, known as Henny Penny outside the United States, is a European folk tale about a little chick who is certain the world is coming to a brutal end. Proof of this is that an acorn has fallen on his little head. There are many different interpretations of the moral of this fable, but one is that if you make a prediction many times and the prediction does not come about, eventually no one will believe you, including when the prediction is about to become fact. It's similar to the Aesop fable, *The Boy Who Cried Wolf*. That is how I feel about VOLVO CARS saying, once again, it will list itself on the stock market. The sky is falling; the wolf is coming.

Håkan Samuelsson, VOLVO CARS' longest-serving CEO in the last 30 years, said on the 12th of May: *"It could create an opportunity for global investors to participate in our journey to become a leader in the fast-growing premium and intelligent electric vehicle segment while continuing to deliver on what customers expect from the Volvo brand."* In other words, they pay and we play, which is what all IPOs are about. The difference here is that the money that comes in will be going into the pockets of the folks who financed the rescue following FORD's twelve years as guardians of the Viking legacy. Those pockets are in China, not in Göteborg.

Will the IPO happen this time? The fact that Samuelsson's contract has been extended for another year, until the end of 2022, is an indication that GEELY wants to see him fulfil two hoped-for results: reaching the 800,000 annual sales goal that was set for him when he took over as CEO in 2012; and, putting the 'other Volvo's' name on a stock market somewhere in the world. So my guess is that yes, Chicken Little will be proven correct and the sky will fall. I don't believe anyone knows what happens after that, but maybe it would be a good idea to wear a helmet, just in case.



THE ECONOMIST DECEMBER 19TH 1992



America's big three car firms, General Motors, Ford and Chrysler, are to collaborate on the development of **electric vehicles**. GM says it has now shelved plans to mass-produce its own electric car, the Impact, by the mid-1990s.

I was sorting through old papers the other day, filing those that were still relevant and throwing away those that were not. My wife believes I devote all too little time to the latter task; I think not, and here is a reason why I give filing precedence. I found a page from the THE ECONOMIST December 1992, the Business and Finance summary page. Among the clips about the world's biggest computer maker (IBM), the French franc, and VOLVO's hopes to merge with RENAULT, there was the clip that I circled about America's Big Three automakers, GM, FORD and CHRYSLER, collaborating to build an electric car. GM had plans to build its own EV, which would have been called 'Impact', but now favored a joint approach. Just imagine the conversations we would not now be having if they had followed through on that plan almost twenty-nine years ago. China produced a little over a million cars in 1992, fewer than Russia. Elon Musk was 21 and hadn't even started college. A lot can happen in 29 years, but sometimes it's what doesn't happen that can really make a difference.

Musings of a Dispatcher: Our Own Legacies

Legacy Noun

A gift by will, especially money; a bequest.

Something transmitted by or received from an ancestor or predecessor from the past.

A candidate for membership in an organization given special status because of a familial relationship to a member.

Adjective

Previous or outdated, as in a 'legacy system'.

Carried over from a previous time.

*From the Latin **Legare**, to bequeath*

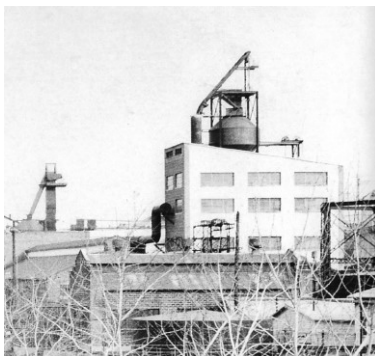
Definition by Merriam-Webster



Scranton Gas Works circa 1936



The main gas storage tank



The retort house with the coal cart track leading up to the funnel where coal was dumped in and the flames shot out

At some point we have all burned coal

Whether the high schoolers in Sweden want to admit it or not—even if they knew it, which they probably don't—Swedes once burned coal to heat their homes, make gas for their stoves and ovens and to produce electricity. The last coal-fired electricity-generating plant closed only one year ago on the 22nd of April 2020 (although it was brought back into service briefly during an emergency). If a country made it through the Industrial Revolution before the middle of the 20th Century, it didn't do it without coal. If it didn't start to enter its Industrial Revolution before the middle of the 20th Century, it is probably burning a lot of coal to catch up. What is important as we try to reverse the damage that a few centuries of greenhouse gas emissions has caused, much of it due to the burning of coal, is that we do not deny our own legacies while at the same time denying those who are late to industrialization the right to claim theirs.

THE SCRANTON GAS WORKS was a constant presence during the first thirteen years of my life. We lived on South Seventh Avenue, only a ten-minute walk to the center of the city. At the time, Scranton had a population of around 125,000. There was a steep bank behind the houses on the eastern side of the street. At the bottom of the bank were the CENTRAL RAILROAD OF NEW JERSEY tracks. Another bank led down to the heavily polluted Lackawanna River, and on the other side of the river was the SCRANTON GAS WORKS. Behind the Gas Works were the DELAWARE & HUDSON RAILROAD tracks, another steep bank and then the plateau where LACKAWANNA RAILROAD yards formed the edge of downtown Scranton.

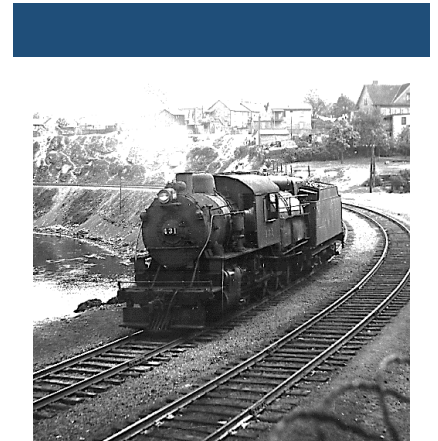
My grandparents' house where my father grew up, with my grandfather's shoemaker shop on the ground floor facing the street, was on the eastern side of the street side closest to the WORKS. From his bedroom, my father had a front row seat on the entire production line extending from the retort house at one end, where coal was dumped in and the flames shot out, all the way to the gas storage tank that rose and fell behind the latticework grid of supports at the other end (see photos in sidebar). It was a kinetic work of industrial art in shades of black and grey, except for the periodic yellow, red and blue flames from the retort, accompanied by the pungent smell of gas.

After my father returned from the War, my parents moved into a house his parents bought for him and my mother. It was on the opposite side of the street from their own home. I arrived about eighteen months later. From my bedroom on the second floor I saw only the top of the gas storage tank and the top of the retort. At night, before I climbed into bed, I always had to see at least one coal car climb up the tracks to the top of the retort, drop its load and watch the first step in the process that eventually produced the heat on our stove and in the oven that cooked our food.

Waste from the GAS WORKS, along with leftovers from the slaughterhouses that lined up along the river bank, chemicals from the hide and tallow processing company and the silk mill just up the street from our house, the sulfur pumped out of the coal mines all along the river and, of course, the raw sewage that we could see flowing in through pipes poking out from the banks, was what had turned the Lackawanna River into black, stinking goop. You didn't fall into the river and live to tell about it.

My maternal grandfather was a coal miner, as were his sisters' husbands and his wife's brothers. They lived 'down the line' in communities between Scranton and Wilkes-Barre, which was the heart of the anthracite coal mining region. The coal that went down the GAS WORKS retort to start the gas-making process could have been carved out of a coal seam with one of their picks or blasted out with dynamite one of them had set. The coal they mined went directly into most of the furnaces that heated the homes and many of the businesses in Scranton and into the steam trains' fireboxes. The same coal was used to produce electricity to power everything from my paternal grandfather's shoemaking and repair machines, to the sewing machines in the dress factories where my mother worked from the time she was thirteen, and to the SCRANTON LACE COMPANY looms where my father was a designer of lace patterns. It was electricity that gave the city its nickname: *The Electric City*.

Why is Scranton called *The Electric City*? Difficult as it may be to believe, Scranton is credited with having the first trolley system to run exclusively on electric power. E.B. Sturges introduced his electric street cars in 1886. The street car line eventually ran north to Carbondale and south to connect with lines in Luzerne County. Hence the term, 'up the line' and 'down the line' referring to north for up and down for south. Another reason Scranton earned its *Electric City* moniker is that it was among the first places in Amer-



A JERSEY CENTRAL steam train heading north along the Lackawanna River across from the Scranton Gas Works



The Electric City Sign sits above the Board of Trade building, built in 1896 and at the time it was the tallest building in Scranton. The original sign was placed on top of the building in 1923. The building was later renamed the Electric Building after it was purchased by the Scranton Electric Company.



The Scranton Lace Company was where my father worked from 1932 until 1959, with a three-year leave of absence for active duty during WWII. Established in 1890, abandoned since 2002, its clock tower will be restored, but the rest will be demolished for apartments and retail space.

ica where electric lights were installed in workplaces. In December 1880, only eleven months after Thomas Edison received his patent for the electric light bulb, DICKSON LOCOMOTIVE WORKS had lights installed. The Scranton family, after whom the city is named, lit up their steel mill in the city in February 1891.

Both of my sets of grandparents arrived in Scranton between 1890 and 1915, during the first three decades of the city's heydays that lasted until the end of World War II. My parents, both born in America, experienced the vibrancy of a growing city with street cars providing easy accessibility up and down the Lackawanna and Susquehanna River valleys, and multiple train lines linking them to every city and town across the country. Those of us in my generation caught the tail end of Northeastern Pennsylvania's salad days. We were handed the legacy of a city in full bloom, like a flower before the first frost damages its petals and the hard winter brings it down to the ground.

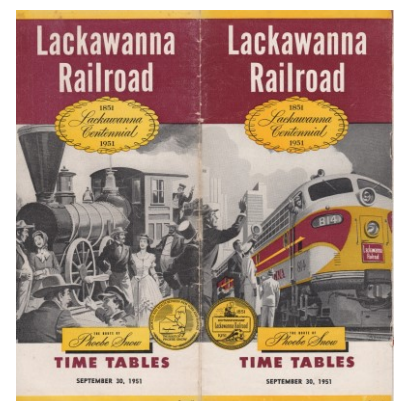
As coal goes, so goes Scranton

During the decade following the end of the War, electric street cars were replaced by gasoline driven buses, steam trains were withdrawn from service in favor of diesels, and coal mines closed down as natural gas from far off gas fields took over more of the tasks that coal had performed. With the closing of the mines, the main draw to the city disappeared and the city's growth went into reverse. This was about the time, in 1953, that Joe Biden, Sr. moved his family to Delaware where he had found work cleaning boilers at a heating and cooling company. President Joe Biden, Jr. was ten years old at the time. Many other families left the city in search of work.

At the end of the '50s, during the first recession in America following WWII, the pace of business closings in Scranton accelerated. The dress factory sewing machines and the SCRANTON LACE COMPANY looms were packed up and moved south where cheap labor was more plentiful. My father found a new job as a draftsman at the CHRYSLER TANK DIVISION which, for reasons still unknown to me, had located in a suburb of Scranton. One result of this was that two-thirds of my undergraduate college education costs were paid for by a scholarship funded by CHRYSLER CORPORATION. Soon after I left for college, the passenger trains that had connected Scranton to cities in all directions, including to New York City via the Hoboken terminal, stopped running.



This postcard image, dated 1905, shows both the newer electric trolleys and the older horse-drawn trolleys. The Electric City sign had not yet been placed on the Board of Trade building in the background.



LACKAWANNA RAILROAD Timetable from the 50th Anniversary on September 30, 1951.

When I and many of my friends and family of my age were ready to start working after college, the jobs we wanted were not in Scranton or neighboring communities that had been built around the coal industry. They were in the growing financial and service centers, like New York, Boston, Atlanta and Houston. San Francisco was still a backwater. I went to London for a year. The air in London, filled with coal smoke and diesel fumes from the buses and taxis, was more polluted than anything I had experienced in Scranton, so in addition to all the personal and professional benefits I received from that year, part of its legacy for me was a chronic sinus problem. Returning to the U.S., I settled in Cambridge, Massachusetts just as the minicomputer boom was getting started there. Scranton's population was sinking like a stone and the once-bustling central city became a mix of fast food joints, drive-through banks and empty stores. Buildings were being torn down and their land converted to parking lots, which were mostly empty. A large shopping mall built on the outskirts of the city sealed the fate of the city's two department stores. It was the same up and down 'the line', and it continued well into the 1990s.

Not everyone left Scranton. My parents lived out their long lives there. My sister, a teacher, and her husband, a fireman, built their house on one-half of my parent's property and raised their two sons there. Many of my cousins, grade school and high school friends remained. Doctors, lawyers, college professors, teachers, nurses, engineers and architects, business owners, laborers. They did what they could to preserve the legacy of the city they had inherited, to stop the erosion and then to build it back up again.

Those who stayed and helped rebuild had good role models among the city's founding families.¹¹ William Warren "Bill" Scranton, grandson of the man who gave the city its name, was one of them. He became the 38th Governor of the Commonwealth and the U.S. Ambassador to the United Nations. His wife, Mary Chamberlin Scranton, was the daughter of Scranton industrialist. After her husband's terms as Governor and U.N. Ambassador, they returned to Scranton. In 1970, she began a project that would eventually result in the restoration of the Lackawanna River. When her work was completed, it was possible to catch trout on a dry fly along the bank where the GAS WORKS once stood, where twenty years earlier nothing living could even touch the water and survive. The Casey family owned the largest hotel in the city. One member of the family, Robert P. Casey went on to become the 42nd Governor of the Commonwealth and later U.S. Senator. His

Steamtown



STEAMTOWN NATIONAL HISTORIC SITE (NHS) is a railroad museum and heritage railroad located on 62.48 acres (25.3 ha) in downtown Scranton, Pennsylvania, at the site of the former Scranton yards of the DELAWARE, LACKAWANNA AND WESTERN RAILROAD (DL&W). The museum is built around a working turntable and a roundhouse that are largely replications of the original DL&W facilities. The roundhouse, for example, was reconstructed from remnants of a 1932 structure. The site also features several original outbuildings dated between 1899 and 1902. All the buildings on the site are listed with the National Register of Historic Places as part of the DELAWARE, LACKAWANNA AND WESTERN RAILROAD Yard-Dickson Manufacturing Co. Site.

THE MARKETPLACE AT STEAMTOWN (formerly The Mall at Steamtown) is a small shopping mall in Scranton, Pennsylvania. It was conceived in the mid-1980s as the keystone of downtown revitalization, though the project was not completed until 1993. Its opening in 1993 was nationally televised on CNN and attended by then-Pennsylvania Governor Robert P. Casey, Sr., who was instrumental in securing funding for and initiating development of the mall. The mall is built on approximately half of the former DELAWARE, LACKAWANNA AND WESTERN RAILROAD yard that was abandoned by Conrail in the late 1970s.

11. A cynic (one who believes that human conduct is motivated wholly by self-interest) might say that those who founded Scranton, who owned the mines and railroads and factories, became rich because they exploited both the natural resources and the people who worked for them. My point is that they, or their heirs, have also given back, both financially and through service.

son, Robert P. Casey, Jr. is one of the two current U.S. Senators from Pennsylvania. The Casey family was instrumental in establishing STEAMTOWN NATIONAL HISTORIC SITE commemorating the debt we have to the age of steam trains (see previous sidebar).

Make the best of the gifts you received

When did the word 'legacy' begin to be used predominantly as an adjective instead of as a noun? At some point, I can't recall exactly when, it began to be used pejoratively to refer to something that has been carried over from a previous time that is now outdated, rather than as something that has been bequeathed or that would be bequeathed to a lucky child or grandchild or niece or nephew. When the coal ran out in Scranton or Wilkes-Barre, or when the steel furnaces were no longer stoked in Bethlehem because they could not compete with foreign steel, or when Detroit's automobile businesses could no longer support the city that had grown to be one of the country's largest, these places were referred to as 'legacy cities', outdated and unneeded and better left to whither.

Scientists, inventors and entrepreneurs who came before us bequeathed to us the results of their labors. They gave us the legacy of electricity to light the way, engines to pull our loads, stoves, refrigerators and washing machines to help us with our daily chores, and then nuclear power plants to create energy without the need to pump oil or gas or dig for coal. What is our work today compared to what it was before these bequests? What did the children, the adults and the elderly on the farms and in the cities do before the Industrial Revolution changed everything? How were the loads pulled, the homes warmed and the spaces lighted before coal was dug out of the ground by men like my grandfather? It seems like no one wants to ask this question. It seems like there is an entire generation that would not know the answer to the question if someone did dare to ask one of them. They are very sure they have the answers to the problem of climate change. It is simply to stop using any form of transport that is not driven by electricity. All we need to do is listen to them and the problem is solved. The universe began the day each of them was born, and we must all now sacrifice everything so that they may have a future. Otherwise, they will be very, very cross.

The fact is that without coal there would have been no Industrial Revolution and no iPhones and Instagram accounts to organize the climate strikes. There was no other power source in abundance that could fuel the machines, produce the gas and generate

the electricity that made industrialization possible. You can ask—and many in my generation have—was it worth it? Some of us might be here today if the Industrial Revolution had not happened, but most of us would not. My grandparents would not have come from different parts of Italy to Scranton where their children met and married. There would not have been the great migrations on the steamships. There would not have been the railroads, the mines, the shipping ports, the steel mills and the textile factories to encourage people to leave their homelands, the cities and villages where their families had lived for many generations, for a better chance in life, not just to America but to many places around the world. The majority of people would still be living short lives in abject poverty, but the climate that sustains human life on Planet Earth would not have been modified. There might be protests and riots for other reasons, but not to stop climate change. There is no answer to whether it was good or bad to discover coal and burn it. We would not be here to ask.

After my widowed mother finally had to enter a nursing home at the age of ninety-five, the family that bought my parent's second house (one they moved to after the house on South Seventh Avenue was bought by the Scranton Redevelopment Authority following a mine subsidence) had come from Brazil. Their son was the same age as I was when we moved into the house. They paid a third of what the house would have sold for a few years earlier or a few years later, but when my parents bought the house in 1959, they paid a third of the price that the builder's wife had hoped it would fetch.

The Brazilian family is one of many who have found Scranton to be a place where they can live and work. Some of these families are filling the pews in the church that my paternal grandfather helped to build a hundred years ago, pews that had become empty as parishioners died or left. Others, like those who bought our house, are Evangelicals who are taking over churches that have long been abandoned. The father has a pickup truck and manages a crew of workers, also Brazilians, who do all types of jobs that need to get done. The mother cleans houses and has a car to get herself from one place to another. The son is now a sophomore at the University of Scranton after graduating from the same high school I attended. He has a car to drive to classes and home again, to all of the church activities, and to visit his cousins 'down the line'. They are making the best of what Scranton has to offer them and creating a new legacy for their children.

'Tis the gift to come down where I ought to be

Scranton's population declined from its height of 143,400 in 1930 to 76,400 in 2000. Since then it has been stable. The air no longer smells of sulfur and coal gas, and coal dust no longer fills the lungs of its residents. The Lackawanna River flows clean. Housing is affordable, schools are decent, people are generally friendly, and neighbors are helpful. The families who settled there from Brazil are being joined by people leaving the cities that have become too expensive for them to continue to live in them. All of them are making Scranton and other cities built on the inventions of the Industrial Revolution theirs, creating their own legacies. But places like Scranton would not have been there for them if it they not gone through all their previous phases, if the people who made them what they were had not done the hard, dirty work that could not have been done in any other way at the time.

It took sixty years for Scranton to make the transition away from its dependence on coal, yet it is hardly a picture of health today. The best that can be said is that it is stable. The next phase will be to begin to generate wealth and perhaps to begin to grow again. Maybe there are people who are hoping to find a rare earth mineral that can create the boom caused by coal, but that is likely to be a curse, something that would eventually bust. It would be better to build on the universities and the new teaching hospital that are there, to attract more people who want to live in a livable, small city that is still only a few hours away from New York and Philadelphia.

There are many places in the world that have not come as far as Scranton, where coal is still the fuel of growth, where the air is foul and the rivers polluted. It is not just in China and India where this is true. Russia, Poland, Indonesia, Australia, Germany and other regions of the United States all burn significant amounts of coal for heat and for producing electricity. For the good of the Planet, they need to stop mining and burning coal. Coal regions in these countries must be encouraged and given assistance to take the necessary steps to transition away from coal, but the towns and the people who live in them must be treated with the respect they deserve. They have borne the burden to bring about the first stages of a post-subsistence economy; they should not be punished for their service. They are not legacy people or legacy cities. They have created the foundation for a legacy that is a gift for those who will inherit it and those who will find it.



*'Tis the gift to be simple, 'tis the gift
to be free,
'Tis the gift to come down where I
ought to be;
And when we find ourselves in the
place just right,
'Twill be in the valley of love and
delight.*

*SIMPLE GIFTS by Joseph Brackett, Jr.
(1797-1882)*

About Michael L. Sena

Michael Sena, through his writing, speaking and client work, attempts to bring clarity to an often opaque world of highly automated and connected vehicles. He has not just studied the technologies and analyzed the services. He has developed and implemented them. He has shaped visions and followed through to delivering them. What drives him—why he does what he does—is his desire to move the industry forward: to see accident statistics fall because of safety improvements related to advanced driver assistance systems; to see congestion on all roads reduced because of better traffic information and improved route selection; to see global emissions from transport eliminated because of designing the most fuel efficient vehicles.

This newsletter touches on the principal themes of the industry, highlighting what, how and why developments are occurring so that you can develop your own strategies for the future.



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