EEVC NEWSLETTER

Published by the Eastern Electric Vehicle Club

Peter Cleaveland, Editor **Vol 36 No 4**
Club Address: P.O. Box 134, Valley Forge, PA 19481-0134 **APRIL, 2016**
email: easternev@aol.com. Web site: www.eevc.info
President: Oliver Perry, 5 Old Stagecoach Turn
Shamong, NJ 08088, (609) 268-0944

Affiliated with EAA

FOOD, FUEL OR ELECTRICITY?
Pete Gruendeman

It's May and planting season will soon be upon us. The community solar garden at Westby, WI now occupies what was two years ago a few acres of crop land. These will probably never be planted again. Many are wondering how much crop land can be given over to solar gardens without causing grain shortages.

How much crop land can be lost to solar gardens without adversely affecting crop production? *photo: Pete Gruendeman*

How much corn can be grown on one acre? Data on www.usda.gov/nass/PUBS/TODAYRPT/crop0815.pdf suggests it's upwards of 200 bushels per acre in the most productive states, so I'll use 200 bushels in this analysis. And exactly what is a bushel of corn? On https://www.unc.edu/~rowlett/units/scales/bushels.html I found that one bushel of corn is 56 pounds of dried seeds. That means 11,200 pounds of corn per year per acre in the most productive states. My analysis assumes that every acre of farmland that will ever be home to a solar garden will result in 11,200 less pounds of corn produced each year.

What inputs does it take to fertilize, plant, apply herbicides, harvest and dry these 11,200 pounds of corn? This is a complicated question that could take pages to explore fully, which I won't spend the space to do. And these numbers are changing as farm equipment becomes more efficient, solar grain dryers might be invented, etc. Spoiler alert here, growing corn doesn't compare very well with using the land for a solar garden so it won't change the outcome very much for me to say that it takes Zero inputs to grow corn. Today's inputs are probably less than in the past, but

they'll never be less than zero. Zero inputs to grow 11,120 pounds of corn. That makes the analysis real simple.

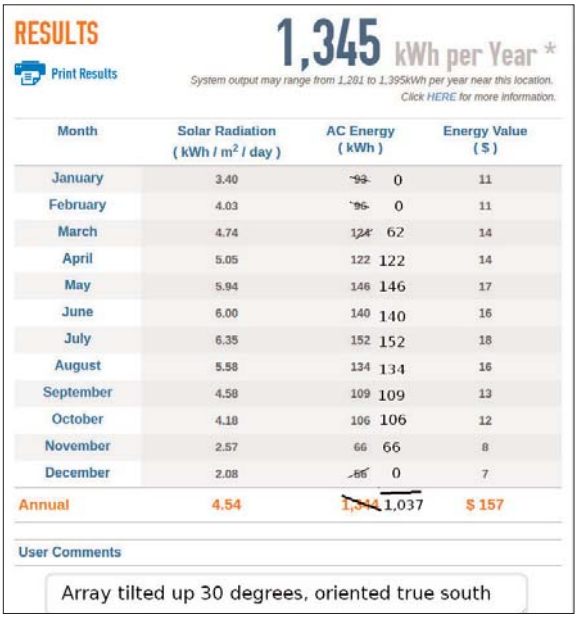
How many gallons of ethanol can be produced by a bushel of corn? On www.usda.gov/oce/reports/energy/EthanolSugarFeasibilityReport3.pdf I found that: "U.S. ethanol conversion rates utilizing corn as the feedstock are estimated at approximately 2.65 gallons of ethanol per bushel for a wet mill process and 2.75 gallons per bushel for a dry mill process."

After the fermenting process is complete, the leftover mash is dried and sold as animal feed. These are called distillers grains and they go back into the markets from which the corn was purchased. One could make the case that three bushels of corn were purchased, processed and two bushels of distillers grain returned to the animal feed market. With a bit of hand waving we could say that 56 pounds of corn produces 56 pounds of ethanol. How much energy does it take to accomplish this feat? Given the efficiencies of cascaded pot stills, diffusion gap distillers and thin film boilers, and that these are becoming more efficient each year, let's say that these are already 100% efficient and zero energy is required to power the stills. That's a stretch but technology, even old technologies, are improving and may one day get close to 100% efficient.

Ethanol has a density of 789 kilograms per cubic meter, which when converted to Imperial units comes out to 6.5846 pounds per gallon. So 11,120 pounds of ethanol at 6.5846 pounds per gallon equals 1,690 gallons. If we were to use this ethanol in a modest sedan, one that gets 30 mpg on ethanol, we would be able to drive 50,700 miles. At 12,000 miles per year, that's enough fuel for slightly more than four modest sedans. That's not too bad. Some might challenge the statement that a modest sedan could only get 30 mpg on ethanol. The chemical formula of ethanol is $CH_3–CH_2–OH$ and its molecular weight is 46. The OH group on the end of the molecule, which defines it as an alcohol, is dead weight as far as combustion energy. The OH group is a hydrogen atom that has already been oxidized. The molecular weight of the OH group is 17. So 17/46 or 37% of the total molecular weight of ethanol is dead weight. The energy bearing part of the ethanol molecule is the 29/46 or 63% of the total weight. The energy isn't there for ethanol to deliver the same mpg as gasoline.

The alternative: Solar Gardens

Another use for our one acre is a solar garden or photovoltaic array. How much power can be produced on a PV array that occupies one acre? A friend in the solar business told me that the watts per acre varies somewhat from one site to another, depending on the slope of the ground and shading, but that a good starting point is 4 acres of land are needed for 1 megawatt (nameplate) PV array. Our one acre can reasonably be expected to provide a home for a 250 kW array.



RESULTS

Print Results

1,345 kWh per Year *

System output may range from 1,201 to 1,395kWh per year near this location. Click HERE for more information.

Month	Solar Radiation (kWh / m² / day)	AC Energy (kWh)	Energy Value ($)
January	3.40	~~93~~ 0	11
February	4.03	~~96~~ 0	11
March	4.74	~~124~~ 62	14
April	5.05	122 122	14
May	5.94	146 146	17
June	6.00	140 140	16
July	6.35	152 152	18
August	5.58	134 134	16
September	4.58	109 109	13
October	4.18	106 106	12
November	2.57	66 66	8
December	2.08	~~86~~ 0	7
Annual	4.54	~~1,345~~ 1,037	$ 157

User Comments

Array tilted up 30 degrees, oriented true south

Predicting the energy production of our proposed 250 kW array is best done with the National Renewable Energy Laboratory product called Pvwatts. See it at http://pvwatts.nrel.gov/. I entered this data:

- Site: La Crosse, Wisconsin, USA
- Module type: premium (single crystal Silicon)
- Array tilt: 30 degrees up from horizontal
- Array orientation: true south or 180º

Thirty years of weather data from my chosen site of the La Crosse municipal airport (KLSE) were then combed through to produce these predictions. The units are AC kilowatt hours for the month in question. It includes inverter losses and minor losses due

to wiring and dust but does not take into account any shading or snow on the panels.

We have not budgeted for snow removal so we will assume for this exercise that electricity production in December, January, February and the first half of March will be zero. Notice my modifications to the Pvwatts prediction shown in the table. This simplifies performance prediction because we don't have to speculate on whether or not the array melted out of the snow though they typically do, especially when tilted up 30 degrees as in this case. Writing off the winter months' production allows us to tilt the array closer to horizontal to better optimize summer output when the grid is most heavily loaded. The remaining 8-1/2 months of production is 1,037 kWh per kW of nameplate array size. One year's production is estimated to be 1,037 x 250 kW nameplate rating of this array or 251,800 kWh per year.

How far can one drive a modest EV sedan on 251,800 kWh? The kWh/mile energy use of EVs varies just as the mpg on cars varies. A commonly cited figure is 300 Wh/ mile. That works out to 840,000 miles. Inverter losses are included in the Pvwatts calculation but distribution around the area is not. Ignoring distribution losses is about as correct as ignoring the losses of transporting ethanol in tanker trucks to its destination. 840,000 miles possible with the PV-to-EV route versus 50,700 miles for the ethanol-to-ICE route is a substantial improvement over business as usual. That's 16.5 times as many miles traveled with the energy output from the same 1-acre site. If we were to believe that tractor fuel, fertilizer, herbicides, more tractor fuel and energy to dry the corn plus energy for fermentation and distillation was actually needed, then the comparison is even poorer for corn.

Some annual production was missed because no money was allocated for snow removal. Was any money allocated for cutting the grass and controlling weeds? No, because the site will also be used for grazing sheep. https://commons.wikimedia.org/wiki/File:04_Solarpark_Unterm%C3%B6ckenlohe.jpg. Apparently the sheep love these sites because many pastures don't provide shade and solar gardens do.

Sheep grazing at a solar garden. Do not try this with goats as they are climbers!

Conclusion

16.5 acres of corn provides the energy for as many vehicle miles as a one acre solar garden when powering EVs. If we really value our farmland, we would cease corn production for ethanol and convert those farm fields to solar gardens as quickly as possible.

U.S. SOLAR COMPANY SUNEDISON FILES FOR CHAPTER 11 BANKRUPTCY PROTECTION

James Natale

This article resulted from a rabble rousing Instigator's earlier email. I was struck by the irony that a week apart two companies on the opposite sides of the energy spectrum filed for bankruptcy and were granted first day motions.

For that rabble rousing Instigator: Sometimes asking the right questions is more important than having the right answers.

A casual observer might conclude this is the inevitable outcome for a highly leveraged startup. The story is longer and more interesting than that.

The entity known as SunEdison started out as a division of Monsanto pioneering silicon wafer manufacturing in 1960. In 1986 they were the first non-Japanese wafer maker with manufacturing and research facilities in Japan. The 1980s were "Made in Japan" and they could make everything smaller, better and cheaper. They were behind the real estate boom buying up iconic properties like Rockefeller Center.

Pricing pressure led to losses that encouraged Monsanto to get out of the chip business selling, to the Germans in 1989. VEBA com-

bined them with their Dynamite Nobel Silicon to form MEMC Electronic Materials. In 1995 they were spun off in an IPO (Initial Public Offering) raising some $400 million.

Y2K and the DotCom bubble hit MEMC hard and they were consolidated into E.ON whose core business was electric utilities. The company was shopped around but couldn't a buyer. Private equity came to the rescue for "the usual amount — $1" and a $150 million line of credit.

CEO Nabeel Gareeb turned the company around. Sales topped $1 billion in 2004. Texas Pacific Group (the VC) sold their shares through secondary offerings through 2007.

MEMC entered the burgeoning solar wafer market by supplying China's Suntech Power and Taiwan's Gintech Energy with solar grade silicon wafers. Conergy was added to the list in 2007 and Tainergy tech in 2008. MEMC had 14% of the solar wafer market.

SunEdison LLC was purchased in 2009. SunEdison was North America's largest solar energy provider, pioneering solar-as-a-service with the power purchase agreement for no-money-down customer financing. The company became a developer of solar power projects and an energy services provider.

Over the next few years, during the Great Recession, they went on a buying & building spree. The new plant in South Korea went on line in 2014 with a new process enabling sizeable cost reductions.

The name was changed to SunEdison, Inc. in 2013 and in 2014 the electronics-wafer business was spun off as SunEdison Semiconductor, Ltd leaving the solar wafer and solar energy business. Wind power was added in 2014 with the acquisition of First Wind.

This summary is based on https://en.wikipedia.org/wiki/SunEdison.

So why did they end up in court? Does this mean that solar energy, aside for small contributions, is not ready to compete with fossil fuel energy to provide energy for the grid at the present time?

Opponents of solar and wind have claimed that there is no way that we can produce significant amounts of green energy unless we spend far more than an equivalent cost of fossil fuels. Does the collapse of SunEdison verify that claim?

The semiconductor industry is tough; just ask AMD and Intel. It takes a lot of money to make money. The company expanded from just making wafers and chips into cells, panels, and then selling and managing solar systems. They became a vertically integrated energy company like ExxonMobil. The advantage of staying integrated is that the upstream and the downstream take care of each other. The refiner's profits support the exploration and production when the price of oil falls. The higher price of oil supports the refinery when margins are thin. I believe if SunEdison had stayed integrated they would have been better off. How well have the Marathons and ConocoPhillips and Phillips done since the refineries were split off?

Merger & Acquisition is best done in a declining market. Why buy assets or companies at the high? Should they have held out for lower prices? Did they overpay?

To some extent they are a victim of their own success. When your new process makes your old one too inefficient and your product too expensive the write-downs of your plant and inventory are going to be massive. If the increases in the profit margin and the sales aren't big enough there's going to be a real problem.

Who in their right mind is recommending and approving dividend payments? I understand shareholders want and expect to be paid. Better usages of cash that is in short supply should be paying down debt or covering interest.

SunEdison isn't going to vaporize. Their solar and wind projects will continue to generate electricity for their customers and revenue payments to the company. What is going to vaporize is the money their shareholders paid for their equity, the money that was lent on unsecured bonds, and the money owed to all the other unsecured creditors. Those holding the first mortgage bonds will be holding all the new equity.

I can't debate the economics of solar or wind power at any given location because there are too many factors. The question presupposes that there is an efficient and inexpensive source of power already in place. In many places across the world that is not the case. How many Indians would be able to

afford their use of fossil fuels without the government subsidies? How much and how long does it take to build a new coal fired power plant? Natural gas? Nuclear?

Peabody Energy

Now let's turn the question around. So why did Peabody Energy end up in court? Does this mean that coal is not ready to compete with wind and solar to provide energy for the grid at the present time?

Opponents of coal have claimed that there is no way that we can produce significant amounts of energy unless we spend far more than an equivalent cost of wind and solar. Does the collapse of Peabody Energy verify that claim?

Here's the context:

Business Summary

Peabody Energy Corporation is a coal company. The company has five segments: Western United States Mining, Midwestern United States Mining, Australian Mining, Trading and Brokerage, and Corporate and Other. Western United States Mining and Midwestern United States segments are engaged in the mining, preparation and sale of thermal coal, which is typically supplied to United States electricity generators and industrial customers for power generation, with a portion sold into seaborne export markets. Australian Mining segment consists of the Company's mines in Queensland and New South Wales, Australia. Trading and Brokerage segment is engaged in the direct and brokered trading of coal and freight-related contracts. Corporate and Other segment includes selling and administrative items, associated with its joint ventures, resource management activity, past mining obligations and other energy-related commercial activities.

The company was founded in 1883 and from Wikipedia, "The coal produced by Peabody Energy fuels approximately 10% of the electricity generated in the United States and 2% of electricity generated throughout the world. In 2014, Peabody Energy recorded sales of 249.8 million tons of coal."

Peabody Energy announces court approval of first-day motions allowing business operations to proceed in ordinary course

2:42 AM ET, 04/15/2016 — Briefing.com

Peabody Energy announced that first-day motions to help facilitate continued operations in the ordinary course of business while the company operates under Chapter 11 protection were approved by Judge Barry S. Schermer of the U.S. Bankruptcy Court for the Eastern District of Missouri.

As part of the court's approval of first-day motions, Peabody received authorization from the court to:

- Pay employees in the usual manner and to continue their healthcare and other benefits programs without disruption
- Pay certain prepetition wages and reimbursable U.S. employee expenses
- Continue to use existing cash management systems and maintain existing bank accounts.

The Court's approvals also affirmed on an interim basis the $800 million in Debtor-in-Possession financing facilities by a lender group led by Citigroup that includes participation of a number of the company's secured lenders and unsecured noteholders. Those facilities include a $500 million term loan, of which $200 million is now available to the company, a $200 million bonding accommodation facility and a cash-collateralized $100 million letter of credit facility.

SUNEDISON Receives Court Approval Of First Day Motions

MARYLAND HEIGHTS, Mo., April 22, 2016 /PRNewswire/ — SunEdison, Inc. today announced that the U.S. Bankruptcy Court for the Southern District of New York has granted the relief requested by the Company in key first day motions related to ordinary course business activities. This includes the continuation of employee wages and benefits, work on ongoing projects, and certain vendor payments. Some of these motions were granted on an interim basis and the Bankruptcy Court has scheduled a final hearing for May 10, 2016.

The Court also granted interim approval for the Company to access up to $300 million in debtor-in-possession (DIP) financing from a consortium of first and second lien lenders in support of continuing business operations.

The motions were filed yesterday in conjunction with voluntary petitions for reorganization filed by SunEdison and certain of its domestic and international subsidiaries under Chapter 11 of the U.S. Bankruptcy Code.

Additional information on the restructuring can be found at www.restructuringupdates .com or by calling the Company's toll-free restructuring information line at (855) 388-4575 (or, if you are calling from outside the U.S. or Canada, at +1 (646) 795-6966). Information about the claims process will also be available athttps://cases.primeclerk .com/sun edison.

About SunEdison

SunEdison develops, finances, installs, owns and operates renewable power plants, delivering predictably priced electricity to its residential, commercial, government and utility customers. The company is one of the leading renewable energy asset managers and provides customers with asset management, operations and maintenance, monitoring and reporting services. Corporate headquarters are in the United States with additional offices around the world.

Bankrupt SunEdison sticks to India growth plans - Asia head

By Krishna N. Das

MUMBAI, April 22 (Reuters) — U.S. renewable energy company SunEdison Inc, which filed for bankruptcy Thursday, aims to secure partners for about 1.7 gigawatts of planned projects in India within two months, the head of its Asia business said on Friday.

Pashupathy Gopalan, president of SunEdison Asia Pacific, told Reuters the company had excluded India — its largest market outside the United States — from its bankruptcy process. As a result, it planned to keep growing in the country.

"Nothing really has changed other than that we will look for equity partners in our India projects and India business," he said by telephone from the United States.

Sources familiar with the matter told Reuters last week that the company is in talks to sell stakes in the planned projects with India's Adani Group and Finland's Fortum. None of the parties have commented.

Gopalan did not comment on why India, which accounts for a fifth of SunEdison's total business, was excluded from the bankruptcy. Officials at the U.S. parent did not immediately comment.

SunEdison was, at its peak, the United States' fastest growing renewable energy group — expanding capacity through acquisitions and aggressive bidding, including in India, where last year it won a solar project in Andhra Pradesh state by offering to sell power at record low prices.

SunEdison currently has around 700 megawatts of projects financed and nearly constructed in India, with another 1.7 gigawatts of capacity to be completed in two years, Gopalan said.

Around 80 percent of the planned projects are solar and the rest are wind energy.

Gopalan said he was confident of striking partnership deals soon and would bid for new projects after that, a growth strategy questioned by industry analysts and consultants.

"SunEdison should try to complete existing projects so that it does not lose bank guarantees submitted during bids," said Jasmeet Khurana, at solar consultancy Bridge To India.

A person familiar with SunEdison's stake sale process said the company's complex structure, where its units run some of its main assets, along with restrictions preventing companies from exiting Indian solar projects, would also keep suitors at bay.

(Reporting by Krishna N. Das; Editing by Clarence Fernandez and Christian Schmollinger)

NEWS UPDATE

200 kW Wireless Charger

Inside EVs reported on April 19 that Momentum Dynamics (Malvern, PA), of which EEVC member Andrew Daga is president, has announced the release of a 200 kW wireless charging system. Like the company's other systems, this one uses resonant magnetic coupling, but its output is an order of magnitude greater than the 25 kW systems it advocates for passenger EVs. It is aimed, says *Inside EVs*, at applications like en-route charging of electric buses, and reports that "The first two systems are to be delivered to

municipal agencies this year in Maryland and Washington state."

More form the wireless charging front

Oak Ridge National Laboratory (ORNL) has been experimenting with wireless EV charging, and recently demonstrated a 20 kW system that it says achieves 90 percent efficiency. They're currently working n a 50 kW system. The ORNL press release claims that this is the first such system. Since Momentum Dynamics reportedly has already delivered 25 kW and 50 kW units, Andy Daga might want to look into it.

Electric plane makes it to California

The Solar Impulse 2 finished the Hawaii-to-California leg of its round-the-world trip in the wee hours of April 24 after a 62-hour flight. The spindly-looking plane landed at Moffett Field in Mountain View at about 3:00 a.m., after circling San Francisco Bay for a couple of hours, and having set records for the longest endurance flight by a solo pilot in any kind of plane and the first solar flight across the Pacific Ocean.

The plane is powered by 17,248 solar cells built into the wings, which, at 236 feet are wider than those of a Boeing 747, although it flies more slowly: between 28 and 50 mph.

France offers Tesla Motors shuttered nuclear plant as production facility

April 6 (MT Newswires) — Tesla Motors has been offered a soon-to-be shuttered nuclear power plant as a possible production facility by the French government, according to media reports, including Automotive News Europe. French President Francois Hollande has said he would like to close the Fessenheim facility in Alsace, but has been met with strong opposition from unions and local politicians as the plant currently employs 850 people and 250 contractors.

Tesla CEO Elon Musk has recently said he would like to build a Tesla factory in Europe, mentioning Alsace as a possibility given its location near the German border with France.

GETTING RID OF THE EVIDENCE
By California Pete

Members of the San Francisco Board of Supervisors have recently begun using a new app that offers them the ultimate in secrecy: it's called Telegram, and it provides both end-to-end encryption and, more importantly to politicians, self-destructing messages that are, according to the *San Francisco Chronicle*, "impractical and sometimes impossible for law enforcement or other third parties to decode."

Telegram isn't the only app to do this (Snapchat, Wickr and Frankly come to mind), but it seems to be the current favorite among the supervisors in SF.

Texting has replaced email as the preferred method of communication among supervisors, for the obvious reason: "Former Mayor Willie Brown, now a San Francisco Chronicle columnist, reportedly said the 'e' in email stands for 'evidence.'"

Homeless? What homeless?

Speaking of the ex-mayor, Willie Brown's column in the *Chronicle* for April 15 pointed out that, compared to Los Angeles, San Francisco's homeless population is tiny. SF has about 6600 living on the street. The official number for Los Angeles, Brown reports, is 12,500, but the real number is more than twice that.

Solar panels to be required by law

The San Francisco Board of Supervisors

has passed a rule that will require that all new buildings of less than ten stories be fitted with solar panels, as part of "an effort to help the city reach its goal of 100 percent renewable energy by 2020," according to an article by Kasey Panetta of *ECN*. "The rule, unanimously approved, builds on an existing state law that requires all new buildings to have 15 percent of the roof be 'solar ready.' Essentially, the roof must be designed in a way that it is exposed to the sun for potential future solar panel installation with no obtrusions to create shade in that area. The new rule requires that any commercial or residential buildings in the city of San Francisco — the law is statewide — take the next step and install either solar photovoltaic or solar water panels."

FOR SALE

ELECTRIC CAR CONVERSION. MOST OF THE WORK IS COMPLETE.

Everything is new and never been connected to any system. Available at a very reasonable price.

The car I chose to use: 1998 Jeep Grand Cherokee in good condition. All gas equipment has been removed, the rear floor has been cut out and a welded steel cage has been installed for a battery box.

The motor is an Advanced DC, current up to 144 volts, with 30 hp continuous power for long periods. matched with a five speed transmission with clutchless shifting.

The vehicle uses minimal power once it is up to speed but if you want to get more power to accelerate; this motor will surge up to 100 hp and 275 ft lb of torque.

The controller is a Curtis 500 amp, 144 V.

Both the motor and controller are high quality units, used throughout the industry in electric vehicles.

Motor is dual shaft on which you can run other things like a/c, alternator, etc. The four wheel drive is still active in the vehicle.

ALSO Albright contactors, Westberg volt and amp gauges, fuses, collision shut off switch, Anderson contactors and ceramic heater with aluminum heat sinks and more.

This carefully selected package is everything you need except battery pack and a few minor items. Asking $4200. for everything. Contact me for more info

Glad to answer any questions.

Bill Miley
610-917-9650
mileyandmiley@yahoo.com

COMING EVENTS

WAVE TROPHY 2016
June 11-16, from the North Sea to the Alps. www.wavetrophy.com/en/

2016 American Solar Challenge
July 22 - Aug 6, traveling through seven states from Brecksville, OH to Hot Springs, SD. http://americansolarchallenge.org/the-competition/ascfsgp-2016/

SAE 1016 Convergence; Theme: Personal Mobility – Creating a Smart and Autonomous Journey
Sept 19-22. Detroit. https://www.sae.org/events/convergence/

NOTICE ON DUES

Annual EEVC dues are $20 with electronic delivery of the Newsletter, or $25 for a printed copy. Mail checks payable to EEVC to James Natale, 3307 Concord Dr, Cinnaminson NJ 08077, or pay via PayPal to jnatalemicro@comcast.net.

MEETING SCHEDULE

Meetings are held in Room 49, Plymouth-Whitemarsh High School, 201 East Germantown Pike in Plymouth Meeting, PA, and begin at 7:00 p.m.

The June, July and August meetings will be at Cugini's Pizzeria on Clemens Bridge Rd in Deptford, NJ. There is no chargng available there, but there are two free J1772 stations a mile away at Ken Barbour's charging oasis.

May 11

June 8

July 13

August 10

September 14

October 12