

From: [Arn Welles](#)
To: [Pruitt, Jacalyn](#)
Cc: [Alban, Margarita](#); [DeLuca, Katie](#); [LaRow, Patrick](#)
Subject: Arnold Foods/ Backup Generators for Industrial Uses
Date: Wednesday, April 27, 2022 5:56:15 PM
Attachments: [48701F408B1A43A499D8465AA9C48251.png](#)
[8CB11E9E6F8A406EBC8BB8D8F9F7BBCD.png](#)
[10FEEC80D3A9418F93742FE24C21E781.png](#)
[7AFD89E476E5408FBAD1F246CC2E985A.png](#)
[7AFD89E476E5408FBAD1F246CC2E985A.png](#)

[EXTERNAL]

Hi Jackie,

Could you please place the attached email chain into the public file on the Arnold Foods Company?

Many Thanks,

Arn

Sent from my iPad

Begin forwarded message:

From: "Welles, Arn" <Arn.Welles@greenwichct.org>
Date: April 14, 2022 at 5:51:53 PM EDT
To: Arn Welles <arnwelles@aol.com>
Subject: Fwd: Backup Generators for Industrial Uses

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From: Thompson, Amy <amy.2.thompson@uconn.edu>
Sent: Monday, January 24, 2022 4:05:16 PM
To: Welles, Arn <Arn.Welles@greenwichct.org>
Cc: DiBonaventura, Laura <Laura.DiBonaventura@greenwichct.org>; Alban, Margarita <Margarita.Alban@greenwichct.org>; Schweinfurth, Peter <Peter.Schweinfurth@greenwichct.org>
Subject: RE: Backup Generators for Industrial Uses

[EXTERNAL]

Arn,

Yes, and also when you size renewables for the majority of regular, normal loads, you get the benefit of its use during outages, but you are absorbing the large cost not just with justification of what happens during the outage period, but the cost is justified by

the benefits during regular use as well. Need to look in totality of annual usage.

Amy

Amy E. Thompson, Ph.D.

Associate Professor-In-Residence, Systems Engineering
Associate Director, UTC Institute for Advanced Systems Engineering (UTC-IASE)
Director, SmartBuildings CT and Operations Director, DOE Industrial Assessment Center
University of Connecticut
Email: amy.2.thompson@uconn.edu
Cell: (203)747-1254 | Web: <https://utc-iase.uconn.edu/education/>

From: Welles, Arn <Arn.Welles@greenwichct.org>
Sent: Saturday, January 22, 2022 9:42:16 AM
To: Thompson, Amy <amy.2.thompson@uconn.edu>
Cc: DiBonaventura, Laura <Laura.DiBonaventura@greenwichct.org>; Alban, Margarita <Margarita.Alban@greenwichct.org>; Schweinfurth, Peter <Peter.Schweinfurth@greenwichct.org>
Subject: Re: Backup Generators for Industrial Uses

Message sent from a system outside of UConn.

Thank you, Amy, for your rationale for using natural gas generators as back up power at industrial facilities. Additionally, understand and agree with your approach to have renewables provide energy in support of normal, ongoing operations. As you point out, a more efficient energy system will require a smaller fossil back up. Think this approach will work for other types of large facilities such as hospitals that require significant electric power in their daily operations and during outages. Thank you again for helping us navigate this. Arn

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From: Thompson, Amy <amy.2.thompson@uconn.edu>
Sent: Friday, January 21, 2022 4:29 PM
To: Welles, Arn
Cc: DiBonaventura, Laura; Alban, Margarita; Schweinfurth, Peter
Subject: RE: Backup Generators for Industrial Uses

[EXTERNAL]

Arn,

I think there is a lot of benefit of using natural gas to produce electricity during electric grid outage at industrial facilities in that it can be done relatively inexpensively

compared to a lot of the renewable alternatives that don't have the capacity and reliability for something like a 7-day period, if you are only using the resource during grid outage.

The short period of energy usage and total energy consumption during grid outage has a significantly lower impact on climate than energy consumption levels during normal operating use throughout the year. Generally, I like to target renewables and renewable systems installations for normal operating conditions as this is the biggest bang for the buck for climate impact. Then you may also pick up the benefit that these can cover a % of load during outage as well. Then size the backup to the overall renewable system + fossil capability.

Amy

Amy E. Thompson, Ph.D.

Associate Professor-In-Residence, Systems Engineering
Associate Director, UTC Institute for Advanced Systems Engineering (UTC-IASE)
Director, SmartBuildings CT and Operations Director, DOE Industrial Assessment Center
University of Connecticut
Email: amy.2.thompson@uconn.edu
Cell: (203)747-1254 | Web: <https://utc-iase.uconn.edu/education/>

From: [Welles, Arn](#)

Sent: Friday, January 21, 2022 3:40 PM

To: [Thompson, Amy](#)

Cc: [DiBonaventura, Laura](#); [Alban, Margarita](#); [Schweinfurth, Peter](#)

Subject: Re: Backup Generators for Industrial Uses

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Thank you, Amy, this is extremely helpful. Had not considered an overall approach to this plant's energy needs. Probably a lot more cost effective to use this overall energy approach when you are building a new factory rather than retrofitting an existing one.

But who knows maybe they have older HVAC that could be replaced/ supplemented with some or all renewable HVAC. They must be spending significant sums for their generator that will sit idle most of the year. Also solar for this plant seems like a good bet since they have a huge flat roof. Arn

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From: Thompson, Amy <amy.2.thompson@uconn.edu>

Sent: Friday, January 21, 2022 2:57:53 PM

To: Welles, Arn <Arn.Welles@greenwichct.org>; Schweinfurth, Peter <Peter.Schweinfurth@greenwichct.org>

Cc: DiBonaventura, Laura <Laura.DiBonaventura@greenwichct.org>; Alban, Margarita <Margarita.Alban@greenwichct.org>

Subject: RE: Backup Generators for Industrial Uses

[EXTERNAL]

All,

Very good conversations about this.

I agree that battery storage and backup on its own is probably not feasible for cost reasons for this particular application. I use this tool to play with battery backup sizing and cost: <https://www.tesla.com/megapack/design>. For instance, 4 megapacks = 3.1 MW and 12.3 MWh, which means only about 4 hours of energy. There may be some companies who could do this for a little less, but scale doesn't work for this industrial application on its own.

At this scale of facility and operation, it is generally not a good approach to plan energy systems for the facility for only the condition of loss of power from grid or utilities due to the expense of the systems. It's best to plan for total power and renewable power throughout the year and all conditions, include loss of grid power, and total cost so that the cost of the backup power systems can be absorbed by other general energy uses throughout the year. You need to consider the load curve daily, weekly, monthly to plan optimal use of investment in energy systems and backup systems. There are several configurations of renewables you could consider from use of battery backup systems, wind, solar, biofuels, and even geothermal, but at this expense and size, needs to be carefully planned and take into account site characteristics.

My two cents...Amy

Amy E. Thompson, Ph.D.

Associate Professor-In-Residence, Systems Engineering

Associate Director, UTC Institute for Advanced Systems Engineering (UTC-IASE)

Director, SmartBuildings CT and Operations Director, DOE Industrial Assessment Center

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From: [Welles, Arn](#)

Sent: Friday, January 21, 2022 11:43 AM

To: [Schweinfurth, Peter](#)

Cc: [Thompson, Amy](#); [DiBonaventura, Laura](#); [Alban, Margarita](#)

Subject: Re: Backup Generators for Industrial Uses

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Peter,

Thanks for providing the link to what Mass General is doing to reduce their carbon footprint. Fascinating reading and an excellent model for what CT hospitals should be

thinking about.

Back to your and Laura's questions: This is not a new factory building. It's built and operating as a bakery. The owner wants to have back up on site electric power capable of producing 2.7 MWs in case of a power outage. The back up power will need to be sufficient to run the entire factory - heating, lighting, industrial equipment etc - for an extended power outage, with a week being a good estimate.

Preliminary thoughts on alternatives:

1. Agree fuel cells might not be a great solution. As you say, they are expensive and some take a while to warm up and produce power.
2. Would large storage batteries combined with a roof top solar array be a solution? The solar power would reduce the need for grid and back up electricity and could top up the batteries. Probably not feasible because the 2.7 MWs needed is going to drain the batteries pretty quickly and it will take too long for solar to top them up.
3. Not convinced CHP works in this situation since most of the time the generator will be sitting idle except for short weekly maintenance runs. If it were running continuously, then agree it would be worth building the infrastructure to use the heat.
4. From the Mass General material you sent, looks like they have 10 large high efficiency gas generators in their system ready to provide electric power in case of an extended outage. Am not seeing in their presentation that Mass General uses fuel cells or renewables for back up power.
5. Unless there is some terrific renewables alternative, looks like a gas generator may be the way to go.

Amy, would welcome your thoughts on the fleshed out version of the question we started with.

Thanks to All,

Arn

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From: Schweinfurth, Peter <Peter.Schweinfurth@greenwichct.org>

Sent: Thursday, January 20, 2022 8:53 PM

To: Welles, Arn

Cc: Amy Thompson

Subject: Re: Backup Generators for Industrial Uses

Hi Arn -

I'm reattaching the presentation by the Mass General hospital system; you'll see around page 9 a slide entitled Onsite Generation & Fuel Switching, where they combine CHP and fuel cell technologies. I think fuel cells as a backup to a bakery might be

overkill (in addition to probably being cost prohibitive) but a CHP unit would make a lot of sense; they would run it continuously for hot water and electricity and would remain on during a electric outage. This is for a new building, yes? By the way, Act 21-29 does mention CHP specifically under the "require or promote" paragraph.

Amy, sorry I didn't cc you below, sounds like they want backup power to continue operations, which for a bakery will require a significant continuous output, not just standby.

Peter

PETER SCHWEINFURTH
CHAIR, ENERGY MANAGEMENT ADVISORY COMMITTEE
M: +1 (203) 550-1997

"Sustainability is not just one thing, it's both a practice and a philosophy".

On Jan 20, 2022, at 8:13 PM, Welles, Arn <Arn.Welles@greenwichct.org> wrote:

Hi Peter,

Yes, this would be a very large generator which would need to power the industrial equipment in addition to heat and lighting in the event of an outage. This is related to an application so don't want provide more details without running afoul of P&Z guidelines. Agree natural gas is an alternative. Asking Amy if there are renewable energy alternatives.

Arn

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From: Schweinfurth, Peter <Peter.Schweinfurth@greenwichct.org>

Sent: Thursday, January 20, 2022 4:31:35 PM

To: Welles, Arn <Arn.Welles@greenwichct.org>

Subject: Re: Backup Generators for Industrial Uses

Hi Arn -

If peak demand is actually 3-5MW then a generator would also have to be able to produce up to 5MW of standby power, which would be a very large generator.

Does the application say what the generator is (e.g. make and product name or simply the kW or KVA output number)? Is this simply emergency power (heat and lighting) or do they intend to power the ovens during a power outage, which would take a much larger scale of generator? I'm guessing you won't know but it's worth asking.

Caterpillar and Kohler make industrial scale gas gen sets in addition to diesel gen sets so there is no reason not to default to natural gas.

Best, Peter

PETER SCHWEINFURTH
CHAIR, ENERGY MANAGEMENT ADVISORY COMMITTEE
M: +1 (203) 550-1997

"Sustainability is not just one thing, it's both a practice and a philosophy".

On Jan 20, 2022, at 2:38 PM, Welles, Arn
<Arn.Welles@greenwichct.org> wrote:

Amy,

Thanks so much for your quick response. Yes, am sizing this off a large factory (400,000 sf) that has a peak demand of 3-5 MW. Their back up generator would need to produce this amount of electricity continuously for lets say a week. Am thinking of a Sandy situation where we might be out of power for a week.

Thanks,

Arn

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From: Thompson, Amy <amy.2.thompson@uconn.edu>

Sent: Thursday, January 20, 2022 12:29 PM

To: Welles, Arn

Cc: DiBonaventura, Laura; Schweinfurth, Peter; Alban, Margarita

Subject: RE: Backup Generators for Industrial Uses

[EXTERNAL]

Arn,

I can respond to your question, but I want to make sure I understand the size you are specifying. Do you mean you want to be able to produce enough energy to cover a peak demand rate of 3-5MW or do you mean you want the system to be able to produce between 3 and 5MWh over the 7 day period? 3 to 5MWh over a 7 day period would be more like a 30 kW load, which is very different from a 5MW load.

Amy

Amy E. Thompson, Ph.D.

Associate Professor-In-Residence, Systems Engineering
Associate Director, UTC Institute for Advanced Systems Engineering (UTC-IASE)
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From: Welles, Arn <Arn.Welles@greenwichct.org>

Sent: Thursday, January 20, 2022 11:13:06 AM

To: Thompson, Amy <amy.2.thompson@uconn.edu>

Cc: DiBonaventura, Laura

<Laura.DiBonaventura@greenwichct.org>; Schweinfurth,

Peter <Peter.Schweinfurth@greenwichct.org>; Alban,

Margarita <Margarita.Alban@greenwichct.org>

Subject: Backup Generators for Industrial Uses

Message sent from a system outside of UConn.

Dr. Thompson,

We very much appreciated your speaking with Greenwich's Energy Management and Planning Subcommittee on Nov 8th. Had a question regarding fuel sources for back up electric power generators for both industrial and large commercial buildings. We are seeing factories and commercial buildings default to diesel even when natural gas is available. The question is are there reliable renewable energy alternatives that could produce say 3,000 - 5,000 KW's of electricity for short periods of time (up to a week) at a total cost comparable to diesel or gas generators? Have seen online discussion of hydrogen fuel cells and large solar

powered batteries but unclear of their application in CT for large industrial and commercial applications. Am wondering if any factories in CT have solved their need for back up power in a climate friendly way. Any insights you could provide would be very much appreciated.

Many Thanks,

Arn Welles
Member, Energy Management Advisory and Planning &
Zoning Subcommittee
Town of Greenwich
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