

UNDERSTANDING KEY ELEMENTS OF ENERGY STORAGE

June 8, 2017
EUCI Offices
4601 DTC Blvd.
Denver, CO



EUCI is authorized
by IACET to offer
0.8 CEUs for the
course

OVERVIEW

This one-day course will introduce participants to concepts related to energy storage. We will discuss the growing need for energy storage, both grid-scale and behind the meter. We will examine the various storage technologies, their key attributes, and where they fit into today's energy marketplace. We will also examine regulatory issues, emerging business models, and a number of the companies active in the space. Finally, we will look at some of the growth and supply chain issues and examine analogs from the storage to the solar industry.

RECOMMENDED BACKGROUND

No experience is required. Some knowledge of utility grids and infrastructure, and power market operations will be helpful but not required.

LEARNING OUTCOMES

- Review the growing need for energy storage and the main drivers
- Comprehend the differences between grid storage products, energy storage, ancillary services, and frequency regulation
- Review the concept and related elements of storage 'value stacking'
- Discuss regulatory issues related to renewables and how they impact storage
- Evaluate different storage technologies, including pumped hydro, compressed air, elevated rail, flywheels, thermal, and chemical storage
- Review various chemical storage technologies and their attributes. These technologies include advanced lead acid, flow, and various lithium ion battery technologies
- Discuss the importance of cycle life for various products
- Evaluate the potential for grid storage of electric vehicles (EVs) and used EV batteries
- Discuss grid and on-site storage, and who controls the resource
- Identify the main competing players in the space and the various business models

WHO SHOULD ATTEND

This course is recommended for non-engineers who are seeking to develop a broader understanding of the technologies, regulatory policies, economic incentives and trends driving the rapid adoption of energy storage resources in today's electric grid.

AGENDA

THURSDAY, JUNE 8, 2017

7:45 – 8:15 am

Registration and Continental Breakfast

8:15 – 10:30 am

The Business Case For Energy Storage

- High Level: How Power Markets Work
- Understand the Business Case and Need for Storage
 - o Grid-level storage
 - Frequency regulation
 - Storage as a peaking resource
 - o On-Site, behind the meter
 - Utility demand charge management
 - System peak management (ICAP exposure)
 - Solar firming
 - Energy arbitrage
 - o The concept of value stacking
 - o Discuss the trade-offs between capacity and energy

10:30 am – 12:00 pm

Understanding the Key Storage Technologies

- Pumped Hydro
 - o Advantages of energy and dispatchability
 - o Disadvantages of location and externalities (open and closed loop)
 - o Future pumped hydro and ability to fine tune output
- Compressed Air
 - o Advantages of energy and dispatchability
 - o Disadvantages related to location/limited opportunities
- Elevated Rail
 - o Advantages
 - o Future challenges and economies of scale

1:00 – 2:30 pm

Additional Storage Technologies

- Thermal Storage
 - o Hot water
 - o Ice energy and its various applications
- Flow Batteries
 - o Various Technologies
 - o Advantages and drawbacks
 - o Bankruptcies and issues related to scale
 - o Companies and business models
- Advanced Lead Acid Batteries
 - o Advantages and drawbacks
 - o Companies and business models

AGENDA

THURSDAY, JUNE 8, 2017 (CONTINUED)

2:30 – 5:00 pm

Why Lithium Ion will Win the Lion's Share of the Market

- Lithium Ion – the World Leader
 - o Scale, history, and bankability - why lithium ion is winning
 - o Various lithium ion technologies, advantages and disadvantages
 - o Issues related to cycle lives
- Lithium Companies and Business Models
 - o Tesla and the giga-factory – a bet on vertical integration and economies of scale
 - o Alevio and its giga-factory
 - o Japan and Korean players, and Japan's approach to the market
 - o The emergence of Chinese actors and new giga-factories
- Supply Issues Related to Lithium
 - o Cobalt
 - o Lithium
 - How lithium is manufactured and why it matters: salars and spodium
- EVs and Their Potential Future Role as Grid Storage
 - o Existing projects and lessons learned to date
 - o Projects for spent EV batteries
 - o Re-deploy or recycle – the reason behind both philosophies
- Key Projects and Applications
 - o Southern California Edison – Aliso Canyon replacement
 - o NY – Brooklyn Queens
 - o NY – virtual power plants
 - o Chicago – Jake and Elwood
- Financing
 - o The analogies between batteries and solar
 - Where they are similar and where they differ
- The Future of Energy Storage
 - o Cost curves, customer education, markets, and deployments

COURSE INSTRUCTOR



Peter Kelly-Detwiler

Principal, NorthBridge Partners

Peter Kelly-Detwiler currently advises technology companies and customers concerning the integration of energy-consuming and producing assets into the power grid. He has 27 years of experience in the electric energy industry, with 15 years as an executive in competitive retail markets, since their inception in 1997. He served in various functions within the industry, including Director of Customer Care (East Coast) for NewEnergy Ventures. Prior to NorthBridge, he was Sr. Vice President of Constellation Energy's Load Response group. In this function, he created this unit and oversaw its growth to become a business with approximately \$80 mn in revenue, capable of dispatching 1700 MW of customer load.

Mr. Kelly-Detwiler lectures frequently, has appeared on public television, and is also a frequent contributor on energy-related issues (over 240 posts) to Forbes.com. In this latter capacity, he has written on topics related to wind, storage, electric vehicles, shale gas, LEDs and numerous other issues. He has interviewed executives from dozens of companies and helped to provide context and meaning in the discussion of new technologies and market developments. As a consultant, he has provided strategic support to Fortune 100 companies such as Nike and GE, and advised leading companies and start-ups in the renewable energy space.

REQUIREMENTS FOR SUCCESSFUL COMPLETION OF PROGRAM

Participants must sign in/out each day and be in attendance for the entirety of the course to be eligible for continuing education credit.

INSTRUCTIONAL METHODS

PowerPoint presentations, classroom discussions, and ongoing Q&A will be used in this course.

IACET CREDITS



EUCI has been accredited as an Authorized Provider by the International Association for Continuing Education and Training (IACET). In obtaining this accreditation, EUCI has demonstrated that it complies with the ANSI/IACET Standard which is recognized internationally as a standard of good practice. As a result of their Authorized Provider status, EUCI is authorized to offer IACET CEUs for its programs that qualify under the ANSI/IACET Standard.

EUCI is authorized by IACET to offer 0.8 CEUs for the course.

EVENT LOCATION

EUCI Offices

4601 DTC Blvd.
Denver, CO 80237

NEARBY HOTELS

Hyatt Regency Denver Tech Center

7800 E. Tufts Ave
Denver, CO 80237
Phone: 303-779-1234
0.3 miles away

Hilton Garden Inn Denver Tech Center

7675 E. Union Ave
Denver, CO 80237
Phone: 303-770-4200
0.6 miles away

Denver Marriott Tech Center

4900 S. Syracuse St
Denver, CO 80237
Phone: 303-779-1100
0.7 miles away

Hyatt Place Denver Tech Center

8300 E. Crescent Parkway
Greenwood Village, CO 80111
Phone: 303-804-0700
0.9 miles away

REGISTRATION
to register [CLICK HERE](#) or

Call: 201 871 0474
fax: 253 663 7224
email: register@pmaconference.com
web: <http://pmaconference.com/>
Mail: POB 2303 Falls Church Va 22042

Please make checks payable to: "PMA"

EVENT LOCATION

EUCI Offices
 4601 DTC Blvd.
 Denver, CO 80237

See nearby hotels on page 5

PLEASE REGISTER

UNDERSTANDING KEY ELEMENTS OF ENERGY STORAGE COURSE:

June 8, 2017 | Denver, CO: US \$995,
 Early bird on or before May 19, 2017: US \$895

How did you hear about this event? (direct e-mail, colleague, speaker(s), etc.)

Print Name Job Title

Company

What name do you prefer on your name badge?

Address

City State/Province Zip/Postal Code Country

Phone Email

List any dietary or accessibility needs here

CREDIT CARD INFORMATION

Name on Card Billing Address

Account Number Billing City Billing State

Exp. Date Security Code (last 3 digits on the back of Visa and MC or 4 digits on front of AmEx) Billing Zip Code/Postal Code

OR Enclosed is a check for \$ _____ to cover _____ registrations.

Substitutions & Cancellations

Your registration may be transferred to a member of your organization up to 24 hours in advance of the event. Cancellations must be received on or before May 5, 2017 in order to be refunded and will be subject to a US \$195.00 processing fee per registrant. No refunds will be made after this date. Cancellations received after this date will create a credit of the tuition (less processing fee) good toward any other EUCI event. This credit will be good for six months from the cancellation date. In the event of non-attendance, all registration fees will be forfeited. In case of course cancellation, EUCI's liability is limited to refund of the event registration fee only. For more information regarding administrative policies, such as complaints and refunds, please contact our offices at (201) 871-0474.