Response to

New York energy highway request for information

Applying Japanese technology to NY energy highway

- Remedial action schemes and energy storage system -

Hitachi America, Ltd.

1. Respondent information

1.1. Respondent

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1.3. Brief (no more than one page) summary of Respondent's background and relevant experience

Hitachi is a leading global electronics that provides products and services to support the advanced engineering needs of world's evolving infrastructure and information systems. Hitachi can provide innovative solutions to meet global power needs.

Hitachi has delivered the following computer systems and equipment for energy transmission network to utility companies in Japan.

- Remedial action schemes (Transient stability control system)
- Energy Management System
- Battery Energy Storage System
- STATCOM
- HVDC

Please refer to the following URL for more information.

http://www.hitachi.com/

2. Project description

2.1. Overview

In NY situation, Hitachi would like to consider the following possibilities.

- Remedial action schemes (RAS)
- Battery Energy Storage System

3. Remedial action schemes

3.1. Project description

Type of proposed project: Transmission

Size of proposed project: It depends on the situation. Hitachi needs to assess the expected impact.

Proposed project location: NYISO zone

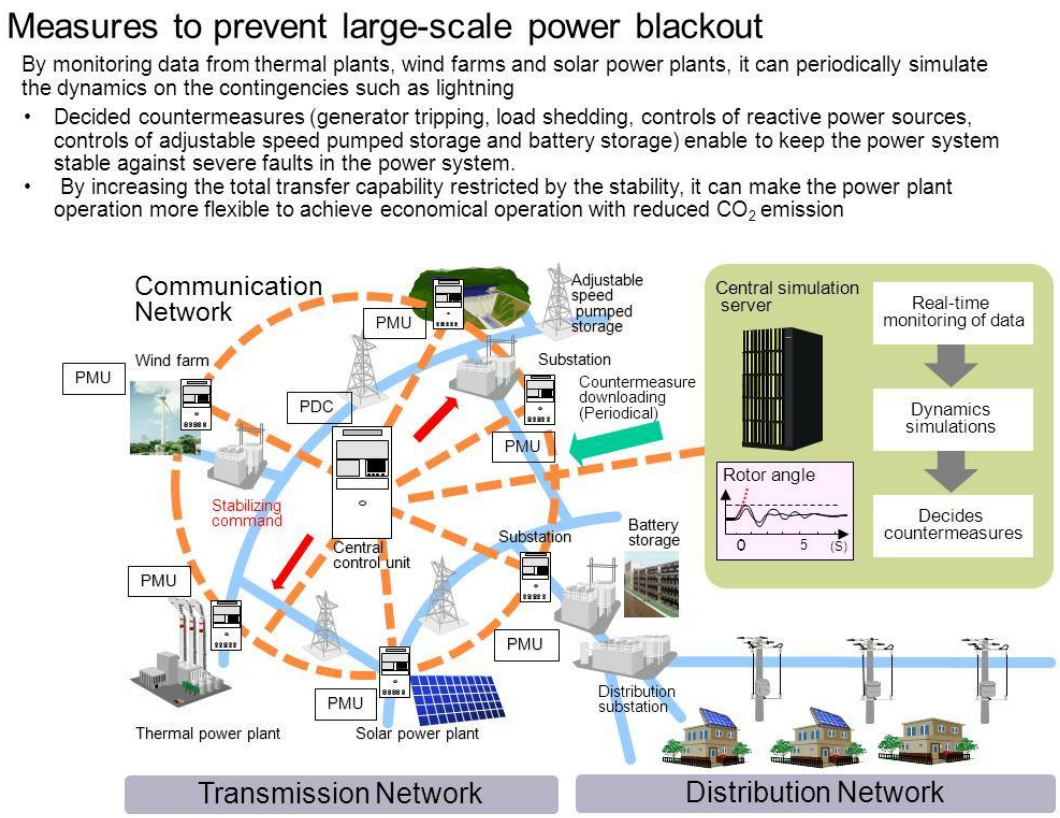
Fuel source and availability of fuel/infrastructure: Effective use of renewable energy resources

Earliest date project can be operational: April, 2014 (It depends on situation. Minimum term is one year and a half including assessment, development and on-site test.)

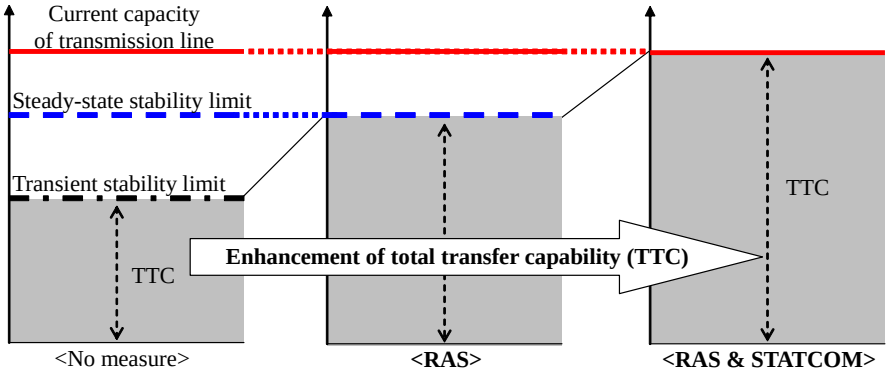
Experience, market availability and suitability of project technology:

Hitachi has already delivered this kind of software to a Japanese utility. First project began in 1970s.

3.2. Project justification



Due to dynamic transient stability control, it can enhance total transfer capability of transmission line. It allows more power transmission from north NY power generation area to south NY consumption area



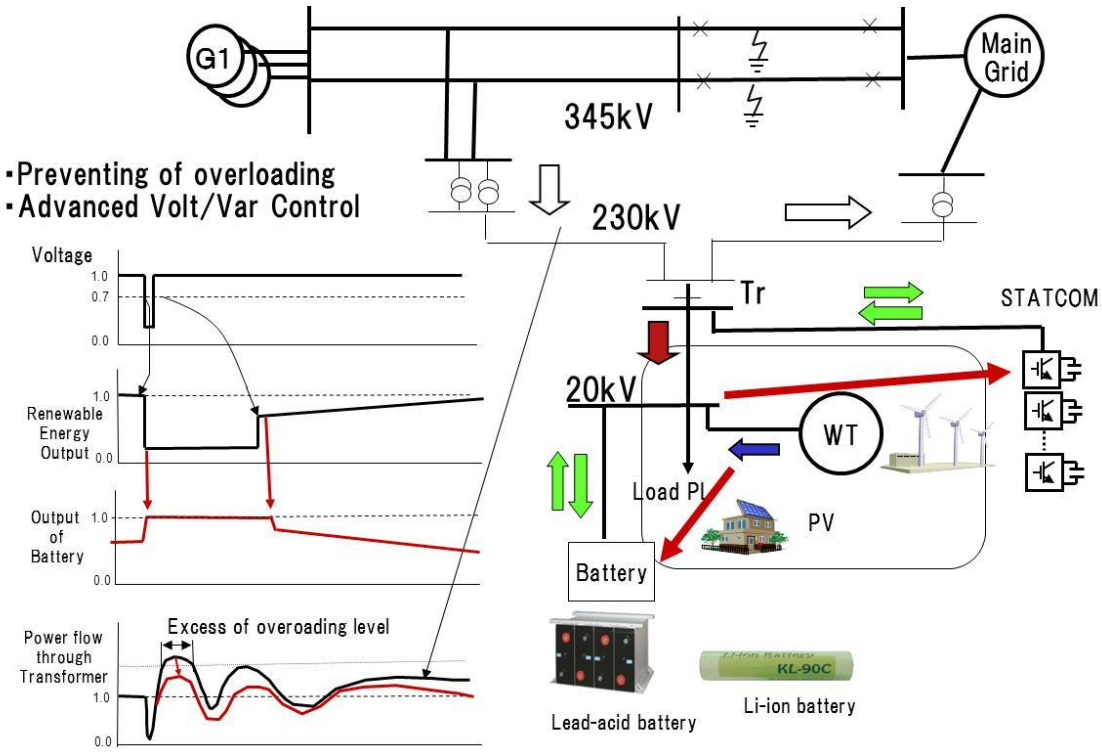
Reference 1: K. Anzai, H. Ito, M. Yatsu, Y. Hara, H. Horii, "Development of New SPS with Online DSA Function and Its Verification Technique Using RTDS ", PSCC, August, 2011

A Japanese utility has benefit of over $800k per day by adopting on-line transient simulation based RAS to ease the limit of TTC(total transfer capability) of transmission line.

Reference 2: A. Takeuchi, Y. Niwa, M. Nakane, T. Miura, "Performance Evaluation of the On-line Transient Stability Control System (On-line TSC System) ", IEEE, 2006

In the future power system, large penetration of renewable energy resources (RERs) and electric vehicles (EVs) are expected to influence dynamics of power system, especially in disturbance. Uncertainty of RER operation and EV charging during a power system disturbance may affect conventional operation of RAS.

Feasible RAS using synchrophasors, on-line contingency analysis and battery energy storage might be studied in advance.



3.3. Financial

Hitachi has no idea at this point.

3.4. Permit / Approval process

Hitachi has no idea at this point.

3.5. Other considerations, if applicable

In order to enhance the assessment result, Hitachi needs the following data provided by NYPA or NYISO. Such data should be shared with Hitachi, Ltd. based in Japan.

- 1. On-line SV & TM data (P, Q, V, Tap, f)
  - 1-1. Just before a fault
  - 1-2. TM trend data at a fault, phasor data from PMU
- 2. Facility data of transmission network
  - 2-1. Facility data (Line, Transformer, Generator configuration)
  - 2-2. Impedance for each facility
  - 2-3. Controllable block and parameter such as generators
  - 2-4. FACTS equipment specification and location such as STATCOM, if any
  - 2-5. Load characteristic
  - 2-6. Renewable power generation characteristic such as PV, Wind
- 3. Actual fault case, scenario such as excessive RAS generation drop
  - 3-1. Actual fault scenario in past
  - 3-2. Actual control method at the fault

However, Hitachi would like to discuss it with NYPA or NYISO and might use the reduced order model instead.

4. Battery Energy Storage System

4.1. Project description

Type of proposed project: Transmission

Size of proposed project: It depends on the situation. Size is flexible.

Proposed project location: NYISO zone

Fuel source and availability of fuel/infrastructure: Effective use of renewable energy resources

Earliest date project can be operational: October, 2013 (It depends on situation and size.)

Experience, market availability and suitability of project technology:

Hitachi has already delivered this kind of systems to some projects. In US, Hitachi has delivered it to NEDO New Mexico pilot site.

NEDO: New Energy and Industrial Technology Development Organization

http://www.nedo.go.jp/english

4.2. Project justification

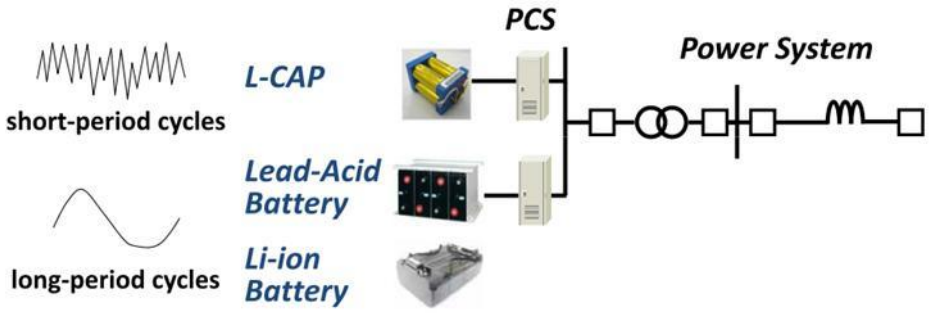
Due to reliable and safe energy storage system, it can support frequency and voltage of transmission lines. It will bring more stable power quality to south NY power consumption area.

Since Hitachi has long-life lead-acid battery, li-ion battery and li-ion capacitor technology, Hitachi can propose right technology for the right place. Hitachi has also bi-directional power conditioning system (inverters).

Reference 3: Long-life Battery for Energy Storage

Those technologies have a trade-off between power and energy density. Hitachi is trying to find a solution in order to reduce total battery cost by combination of those technologies to meet requirement both of power application (e.g. frequency regulation) and energy application (e.g. peak shifting).

Example of hybrid use:



Technical Challenges

- Optimum selection of storage devices (size, cost)
- Power distribution algorithm

4.3. Financial

Hitachi has no idea at this point.

4.4. Permit / Approval process

Hitachi has no idea at this point.

4.5. Other considerations, if applicable

None.