



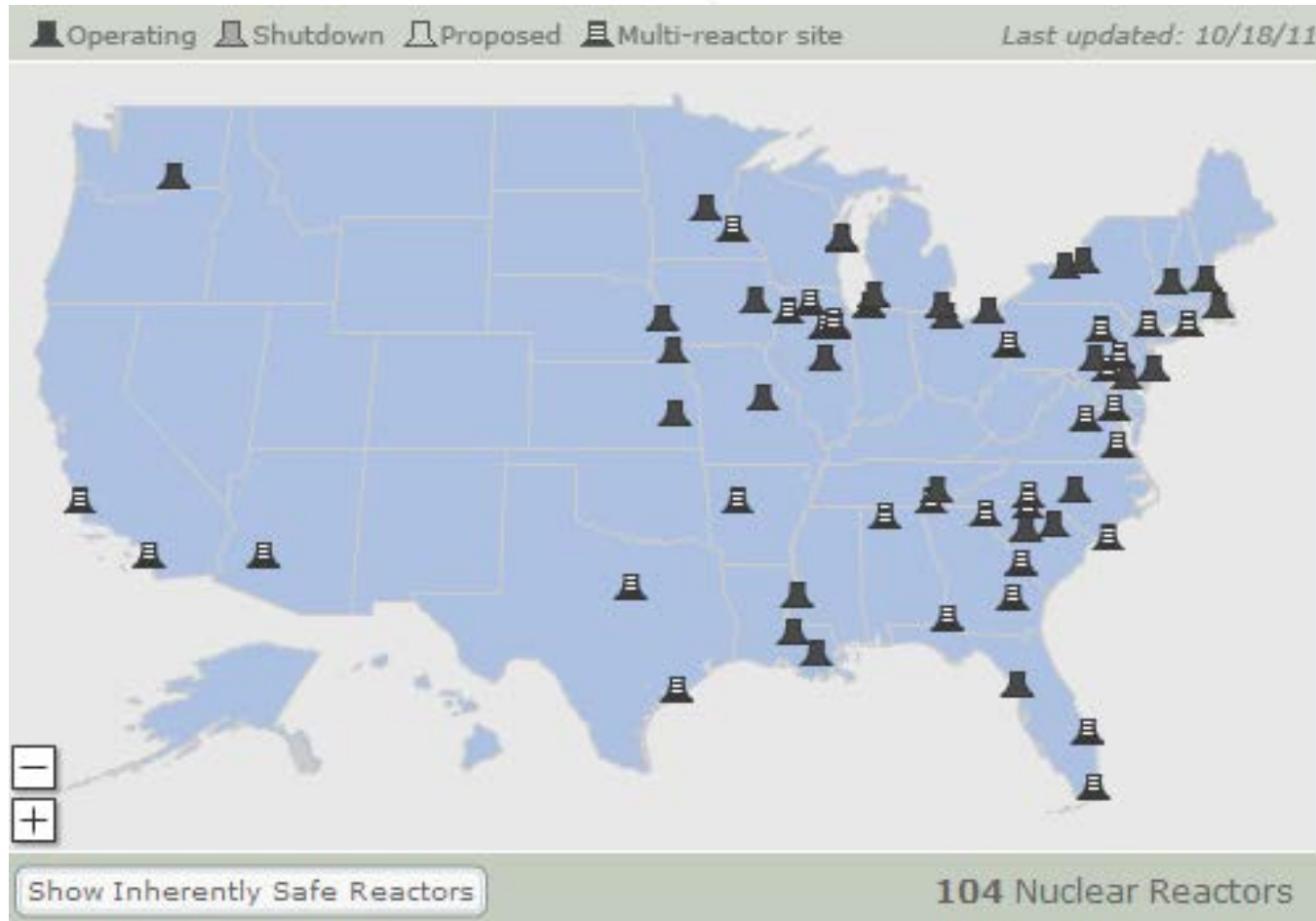
Synapse
Energy Economics, Inc.

福島第一原発事故の アメリカ原子力発電産業への影響

2011年11月20日

高橋賢児

アメリカの既存の原発



Source: "Nuclear Power Information Tracker" Union of Concerned Scientists

原子力業界の対応、反応

- 原発施設オフィサーによるすべての装置と安全手続きや研修プログラムの検査
- 9・11以降、飛行機墜落による火事、爆発対策強化
- 地震、つなみなどへの対策プロトコルはすでに開発、実施されている（新規にたいして）
- 30年前に原発の全電源喪失を想定、規制に活用
- マーク I のデザインは改善されている（マーク I オーナーシップグループ）
- フクシマの教訓は学ぶ。特にシステムが耐えうる以上の災害に対策に関して、パッチワークや最善例ではなく、すべての施設が包括的な対策をとれるようにしていく
- 使用済み燃料貯蔵の問題があらわになった。

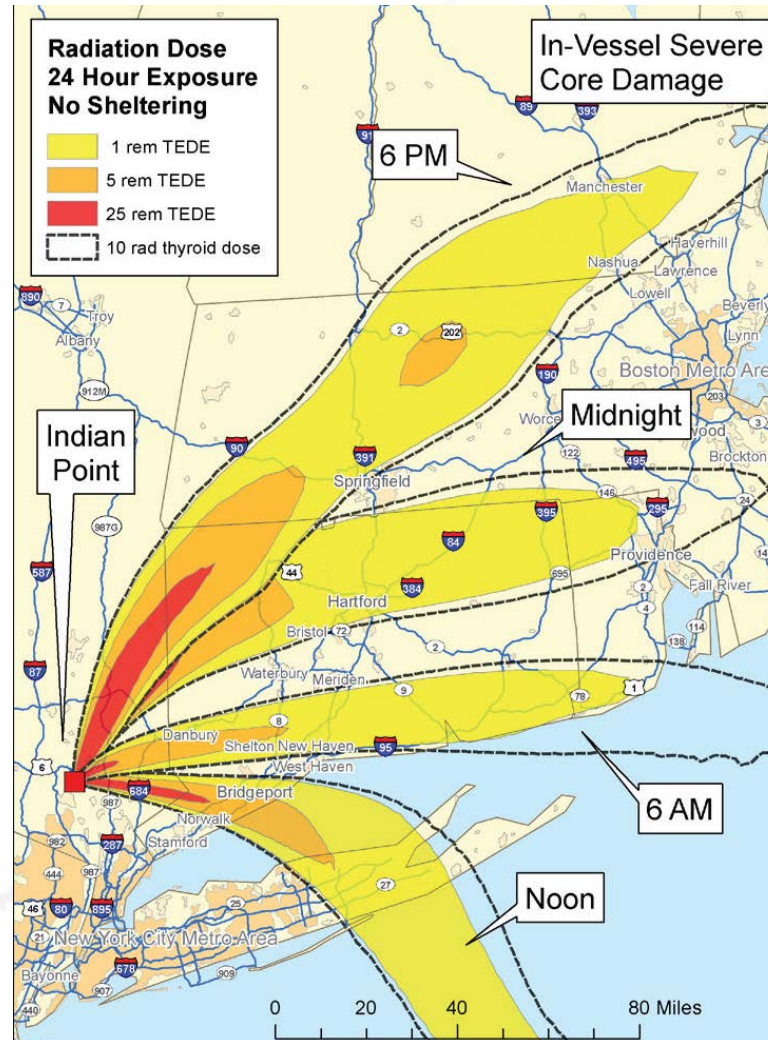
Source: “NEI’s Pletrangelo discusses progress on safety regulations post-Fukushima” OnPoint. November 9, 2011; “U.S. Nuclear Policy After Fukushima: Trust But Modify” Jack Spencer. May 18, 2011; “原発の全電源喪失、米は30年前に想定、安全規制に活用”、朝日新聞、2011年3月31日

環境保護団体・産業団体などの反応

- UCS(Union of Concerned Scientists)の研究（3月17日発表）
 - 原子力規制委員会のこれまでの規制施行は、迅速ではなく、一貫性、効果がなかった。2010年で14ものニアミス事故があった。
 - 89から94年の間、300回以上規制をあえて適応しない場合があった。
- 45団体が新規発電提案プロジェクトの一時停止を求める
- NRDC(Natural Resource Defense Council)の研究（10月発表）
 - N Yにある、インディアンポイント原発における福島、チェルノブイリレベルの災害の人的、経済的被害を試算
 - 福島レベルで560万人避難の被害、1REM以上
 - チェルノブイリレベルで、NYCまで被害がおよぶ、25REM以上
 - NRCが地震による被害を過小評価していることを発見
 - インディアンポイント廃炉による代替エネルギーシナリオも研究

Source: “Democrats step up pressure on nuclear regulators over disaster preparedness” The Washington Post (March 18, 2011); “Nuclear Accident at Indian Point: Consequences and Costs” NRDC. October 2011

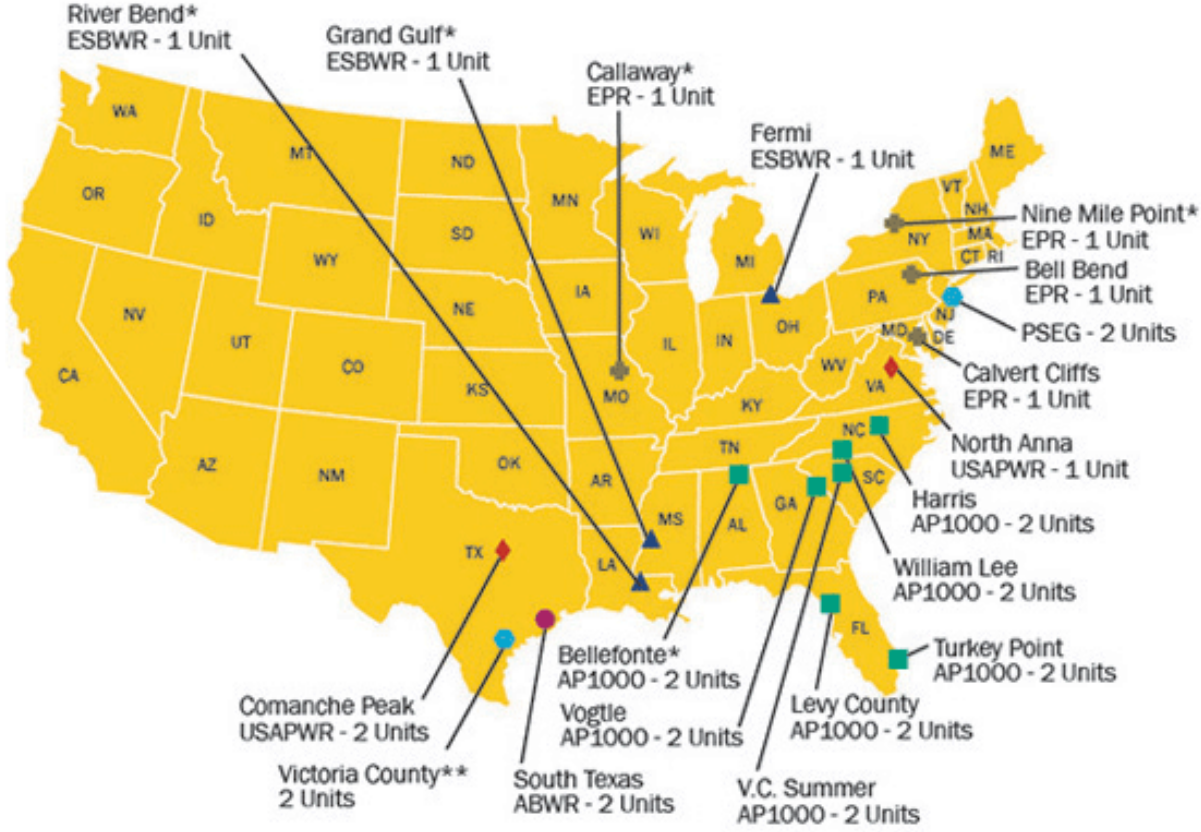
NRDCの研究結果例



- **政府の反応**
 - 福島タスクフォースを設立させ、その団体に福島事故の研究とそれからの教訓を学ぶことを指令
 - 原発は依然として “Important part of our energy future”
- **タスクフォース研究結果（7月）**
 - 現在のNRCの規制は原発の安全性には緊急の脅威をもたらさない
 - 電源喪失、洪水、地震、緊急対策を強化する新しい基準を推奨
- **NRC**
 - タスクフォースからの12の推奨対策のうち7つを選ぶ
 - 5年以内にすべての対策施行を想定

Source: “Nuke regulators toughen safety rules” THE HILL's Energy & Environment Blog, October 20, 2011

新規原発建設提案



◆ ABWR
 ■ AP1000
 + EPR
 ▲ ESBWR
 ◆ USAPWR
 ▽ Design/Units - TBA
 ● ESP

*Review Suspended by Applicant
 ** COL Application Amended by Applicant to ESP on 03/25/2010

- 新規建設費用見積もりの上昇：kWあたり\$1000から\$6000に上昇
- 連邦政府の新規に対するLoan保証（\$185億ドル）
- 新規原発建設提案
 - Calvert Cliff 3(メリーランド州) by Constellation Energy：連邦と交渉決裂、資金不足（2010年10月）
 - South Texas (3 & 4) by NRG:予想を超えた建設費用の上昇、福島の影響(2011年4月)
 - Levy (1 & 2) by Progress energy(フロリダ州)：建設費用上昇
 - Vogtle (3 & 4) by Georgia Power(フロリダ州)：連邦補助金を受け取る
- 市民と産業界が一致団結して反対

Levyの建設費用見積もり上昇

Year	Month	Event	Completion Date	Cost Estimate	Note
2006	Aug.	Early site permit application filed with NRC	2016 Unit 3 2017 Unit 4	\$14 billion	1
2007	Aug.	Limited work authorization application filed with NRC			2
2008	March	Construction and operating license application filed with NRC			3
2008	March	Georgia Power files certification request with Georgia Public Service Commission			4
2008	April	Contract signed with Westinghouse for reactor design			5
2008	Aug.	Environmental Impact Statement filed			6
2009	March	Georgia PSC approves new Vogtle units. Total cost of project estimated at \$14 billion. Georgia Power's share will be \$6.4 billion			7
2009	Aug.	NRC grants Early Site Permit			8
2010	Feb.	Georgia PSC approves cost of new units. Stipulation lowers cost from \$6.4 to \$6.1 billion			9
2010	Feb.	Federal loan guarantees granted. Total guaranteed borrowings would not exceed 70 percent of the company's eligible projected costs, or approximately \$3.4 billion, and are expected to be funded by the Federal Financing Bank. Any guaranteed borrowings would be full recourse to Georgia Power and secured by a first priority lien on the company's 45.7 percent ownership interest in the project.			10, 11
2010	Sept.	NRC's draft Supplemental Environmental Impact Statement states that it has not found an environmental reason to deny a COL			12
2011	Jan.	Beginning of early cost recovery plan upon ratepayers			13
2012		Anticipated approval of construction and operating license application			14

Notes:

- <http://www.nrc.gov/reactors/new-reactors/esp/vogtle.html>
- <http://www.nrc.gov/reactors/new-reactors/esp/vogtle.html>
- <http://www.nrc.gov/reactors/new-reactors/col/vogtle/documents/nrc-2008.html>
- http://www.world-nuclear-news.org/NN-Georgia_PSC_approves_new_Vogtle_units-1803094.html
- http://www.world-nuclear-news.org/IT-EPC_contract_signed_for_new_Vogtle_units_090408.html
- <http://www.nrc.gov/reactors/new-reactors/esp/vogtle.html>
- http://www.world-nuclear-news.org/NN-Georgia_PSC_approves_new_Vogtle_units-1803094.html
- <http://www.nrc.gov/reactors/new-reactors/esp/vogtle.html>
- <http://www.walb.com/global/Story.asp?s=12045857>
- http://www.world-nuclear-news.org/NN-Georgia_Power_accepts_Vogtle_loan_guarantee-2106107.html
- <http://southerncompany.mediaroom.com/index.php?s=43&item=2044>
- http://www.world-nuclear-news.org/NN-NRC_gives_planned_Vogtle_units_environmental_OK-0809104.html
- http://www.world-nuclear-news.org/NN-NRC_gives_planned_Vogtle_units_environmental_OK-0809104.html
- http://www.powermag.com/nuclear/Plant-Vogtle-Leads-the-Next-Nuclear-Generation_2247.html

Year	Month	Event	Completion Date	Cost Estimate	Note
2006	Dec.	Progress selects Levy site for single unit	2016 Unit 1	\$2.5 to \$3.5 billion	1
2008	March	Progress triples cost estimates for Levy Units 1 and 2 to \$17 billion	2016 Unit 1 2018 Unit 2	\$17 billion	2
2008	July	Florida PSC approves need for two units			3
2008	Aug.	Construction and operating license filed with NRC			4, 5
2008	Aug.	Approval given to project from governor and his cabinet			6
2009	Jan.	Progress signs contract for reactor design			7
2009	May	Progress files 2010 cost recovery plan to PSC			8
2009	May	Progress announces at least a 20-month delay on planned reactors			9
2010	Jan.	Progress announces unspecified delays to Levy project based on Florida PSC decision that denied \$500 million rate hike request			10
2010	Feb.	Progress extends delay on Levy project to at least 36 months			11
2010	May	Cost estimate for project increases from \$17.2 billion to \$22.5 billion			2019 Unit 1 2021 Unit 2
2010	May	The timeline for the Levy project is delayed to 2021 for Unit 1 and 2023 for Unit 2	2021 Unit 1 2023 Unit 2		13

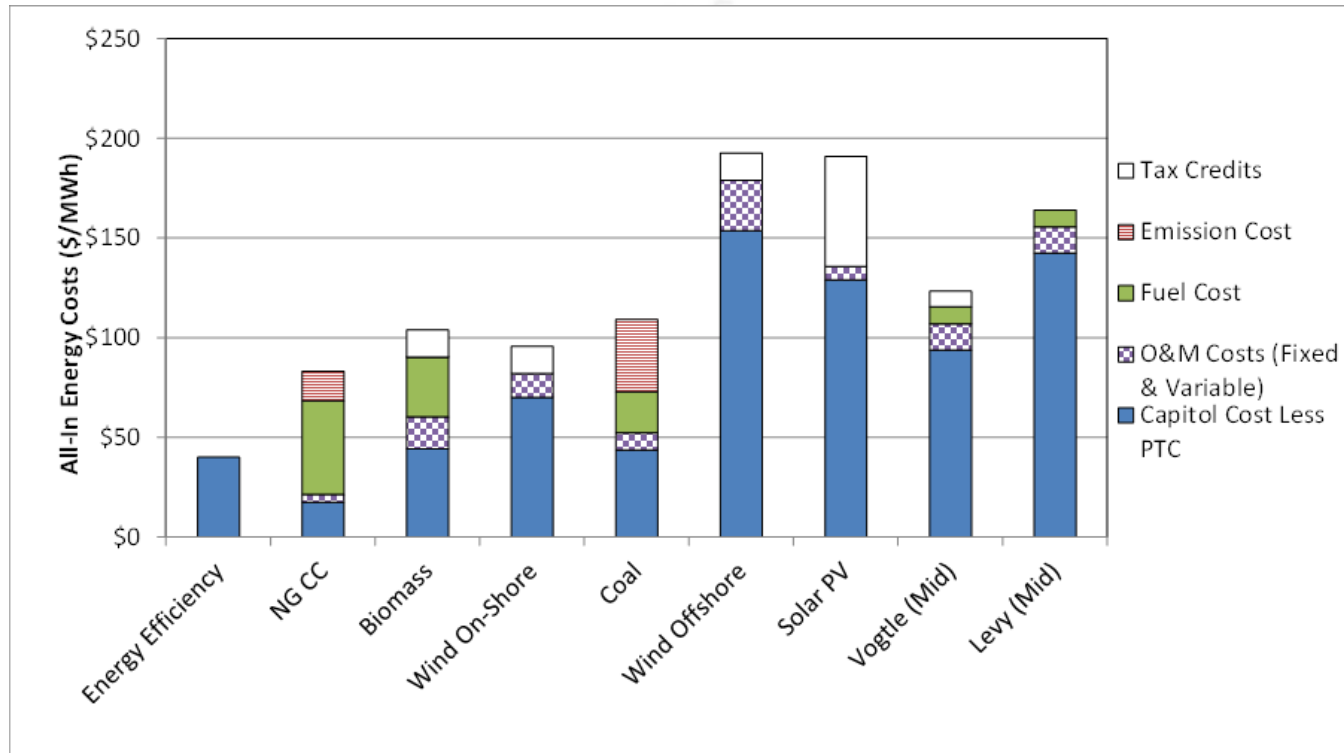
Notes:

- <http://news.google.com/newspapers?id=jrQpAAAIBAJ&sjid=U-wDAAAIBAJ&pg=2316,2730406&dq=progress-energy+levy+hl=en>
- http://www.sptimes.com/2008/03/11/Business/Price_triples_for_Pro.shtml
- <http://www.psc.state.fl.us/home/news/index.aspx?id=418>
- <http://www.nrc.gov/reactors/new-reactors/col/levy.html>
- <http://www.reuters.com/article/idUSN0147884920080801>
- http://www.world-nuclear-news.org/NN-Florida_cabinet_approves_Levy_plant-1208094.html
- <https://www.progress-energy.com/company/media-room/news-archive/press-release.page?title=Progress+Energy+Florida+signs+contract+for+new%2C+advanced-design+nuclear+plant&pubdate=01-05-2009>
- <https://www.progress-energy.com/company/media-room/news-archive/press-release.page?title=Progress+Energy+shifts+Levy+nuclear+project+schedule+&pubdate=05-01-2009>
- <http://uk.reuters.com/article/2009/05/01/utilities-nuclear-progress-idUKN0134187020090501>
- http://articles.orlandosentinel.com/2010-01-14/business/os-progress-energy-nuclear-power-20100114_1_nuclear-power-rate-hike-plant
- <http://www.istockanalyst.com/article/view/StockNews/articleid/3880743>
- <http://www.businessweek.com/ap/financialnews/D9HQ2TN80.htm>
- http://www.cleaneenergy.org/index.php?/Press-Update.html?form_id=8&item_id=184
- <http://flaglerlive.com/25200/progress-energy-nuclear-costs>

Differences Between Proposed Projects

- Federal Loan Guarantee
 - \$8.33 billion DOE loan guarantee announced February 2010
 - Allows Georgia Power to borrow at below market rates
 - Allows Georgia Power to increase debt fraction (Synapse increases debt fraction to 75%)
- Production Tax Credit
 - 1.8 cents per kWh for first 1,000 MW
 - Cap at \$125 million per year for first eight years of operation
 - PTC extends through December 31, 2020
 - In analysis, Synapse assumed Vogtle 3 & 4 would receive PTC, Levy 1 & 2 would not

發電價格比較



Source: "Big Risks, Better Alternative: An Examination of Two Nuclear Energy Projects in the U.S." Synapse Energy Economics, prepared for UCS, October 2011.

原発施設建設費用の上昇の歴史

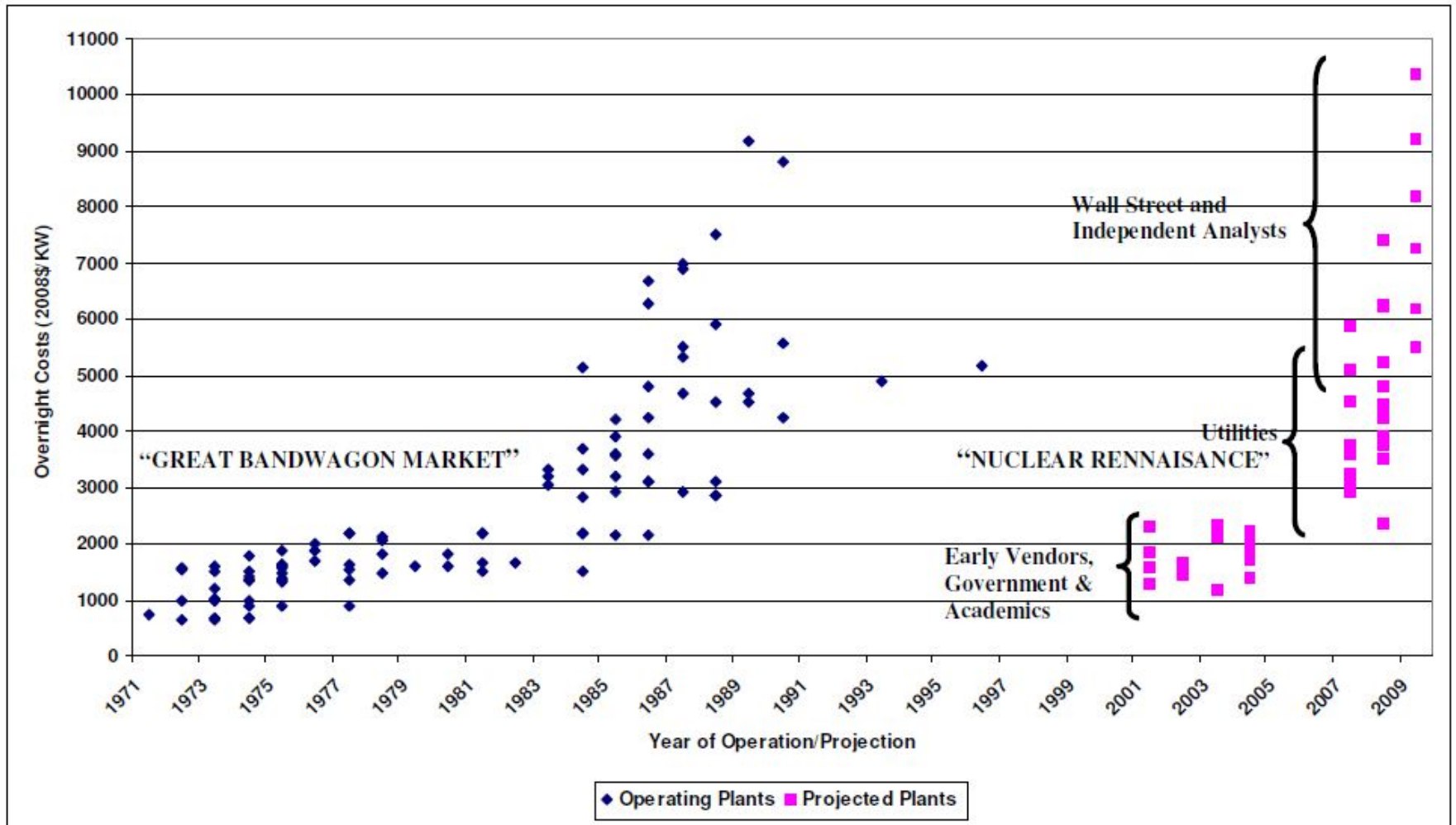


Figure from Cooper (2009). *Economics of Nuclear Reactors: Renaissance or Relapse*