Electronic Supplementary Material (ESI) for Energy & Environmental Science.

Supplementary information: Energetic productivity dynamics of global super-giant oilfields

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This supplementary information document contains table of references (Table S1) corresponding to input parameters to Oil field Production Greenhouse Gas Emissions Estimator (OPGEE). The dynamic input data of each oil field is presented in "Input Data" Excel file. The time-series net energy ratio (NER) and external energy ratio (EER) results can be also found in "NERs & EERs Data" Excel file.

This document also presents all energy sources consumed for different OPGEE process stages in Table S2. The oil fields data quality assessment and the time-series NER_{oil} and EER_{oil} results are shown in Figs. S1-S3, respectively.

Finally, selecting 100 bins, the probability distribution histograms of dynamic oil fields NER_{total} and EER_{total} Monte Carlo simulations (1000 realization per year) are presented for years 5, 10, 15, 20, and 25 (Figs. S4 and S5).

Table S1. Abbreviated data sources (AG: Agbami, BR: Brent, CA: Cantarell, CO: Coalinga, EH: Elk Hills, EK: Ekofisk, FO: Forties, GU: Gullfaks, HB: Huntington Beach, HI: Hibernia, KF: Kingfish, KR: Kern River, MS: Midway Sunset, NI: Ninian, OS: Oseberg, PB: Prudhc Bay, PI: Piper, SB: South Belridge, SN: Snorre, SP: Spraberry Trend, ST: Statfjord, TN: Terra Nova, VE: Ventura, VH: Valha, WI: Wilmington

Variables	**AG**	**BR**	**CA**	**CO**	**EH**	**EK**	**FO**	**GU**	**HB**	**HI**
API gravity	[1]	[4]	[11]	[13]	[13]	[19]	[25]	[14]	[13]	[33]
WOR	NA	[3, 5, 7-10]	[12]	[13]	[13]	[14, 16, 21, 22, 23]	[3]	[14]	[13]	[29, 30]
SOR	NA	NA	NA	[13]	[13]	NA	NA	NA	[13]	NA
FOR	[2]	[2]	[2]	[2]	[2]	[15]	[2]	[15]	[2]	[31]
Field depth	[1]	[4]	[12]	[13]	[13]	[14, 19]	[3]	[14]	[13]	[33, 34]
Production rate	[1]	[3, 5, 7-10]	[12]	[13]	[13]	[14, 16, 18, 21, 22]	[3]	[14, 28]	[13]	[29, 30]
Number of producing wells	[1]	[3]	[12]	[13]	[13]	[14]	[3]	[14]	[13]	[29, 30]
Productivity index	-	-	-	-	-	-	-	-	-	[32]
Number of water injection wells	[1]	[3]	NA	[13]	[13]	[14]	[3]	[14]	[13]	[32]
Reservoir pressure	[1]	[6, 10]	[12]	[13]	[24]	[16, 20, 22, 23]	[26]	[27]	[13]	[34]
Reservoir temperature	-	[4]	[12]	[13]	[13]	[19]	[69]	[27]	[13]	[33, 34]
GOR	[1]	[3, 5, 7-10]	[12]	[13]	[13]	[14, 16, 19, 22, 23]	[3]	[14]	[13]	[29, 30]
Processing practices	[1]	[3]	-	-	-	[17]	-	-	-	-
Associated gas processing path	-	-	-	-	-	-	-	-	-	-
Water injection ratio	-	[3, 10]	NA	[13]	[13]	[14, 15, 17, 19, 20, 22]	[3]	[14, 15]	[13]	[31]
Fraction of remaining gas reinjected	[1]	[3]	[12]	[13]	[13]	[14, 15]	NA	[14, 15]	[13]	[31]

Variables	KF	KR	MS	NI	OS	PB	PI	SB	SN	SP
API gravity	[36]	[13]	[39]	[44]	[14]	[49]	[47, 48]	[13]	[14]	[59, 60]
WOR	[35]	[13]	[40]	[3]	[14, 45]	[52]	[3]	[13]	[14, 62]	[56]
SOR	NA	[13, 37, 38]	[40]	NA	NA	NA	NA	[13]	NA	NA
FOR	[2]	[2]	[2]	[2]	[15]	[50]	[2]	[2]	[15]	[2]
Field depth	[35]	[13]	[40]	[44]	[14]	[70]	[47, 48]	[13]	[14]	[57]
Production rate	[35]	[13]	[40]	[3]	[14, 45]	[52]	[3]	[13]	[14]	[56, 58, 60]
Number of producing wells	[36]	[13]	[40]	[3]	[14]	[52]	[3]	[13]	[14]	[56, 58, 60]
Productivity index	-	-	-	-	-	-	-	-	-	[59]
Number of water injection wells	-	[13]	[40]	[3]	[14]	[71]	[3]	[13]	[14]	-
Reservoir pressure	[35]	[13]	[41-43]	[44]	[46]	[53]	[47]	-	[62]	[59, 61]
Reservoir temperature	-	[13]	-	[3]	[45]	[72]	[47, 48]	[13]	[63]	[59]
GOR	[36]	[13]	[40]	[3]	[14, 45]	[52]	[3]	[13]	[14]	[56]
Processing practices	-	-	-	[3]	-	[50]	[3]	-	-	-
Associated gas processing path	-	-	-	-	-	[50]	-	-	-	-
Water injection ratio	-	[13]	[40]	[3]	[14, 15]	[51, 52]	[3]	[13]	[14, 15]	-
Fraction of remaining gas reinjected	-	[13]	[40]	[3]	[14, 15]	[51, 52]	[3]	[13]	[14]	-

Variables	ST	TN	VE	VH	WI
API gravity	[54]	[64]	[13]	[14]	[67]
WOR	[14]	[29, 30]	[13]	[14]	[13]
SOR	NA	NA	[13]	NA	[13]
FOR	[15]	[31]	[2]	[15]	
Field depth	[14]	[64]	[13]	[14, 65]	
Production rate	[14]	[29, 30]	[13]	[14]	[13]
Number of producing wells	[14, 54]	[29, 30]	[13]	[14]	[13]
Productivity index	-	[32]	-	-	-
Number of water injection wells	[14]	[32]	[13]	[14]	[13]
Reservoir pressure	[55]	[64]	[13]	[65, 66]	[68]
Reservoir temperature	[54]	[64]	[13]	[65]	
GOR	[14]	[29, 30]	[13]	[14]	[13]
Processing practices	-	-	-	-	-
Associated gas processing path	-	-	-	-	-
Water injection ratio	[14, 15, 55]	[31]	[13]	[14, 15]	[13]
Fraction of remaining gas reinjected	[14, 15, 55]	[31]	[13]	[14, 15]	NA

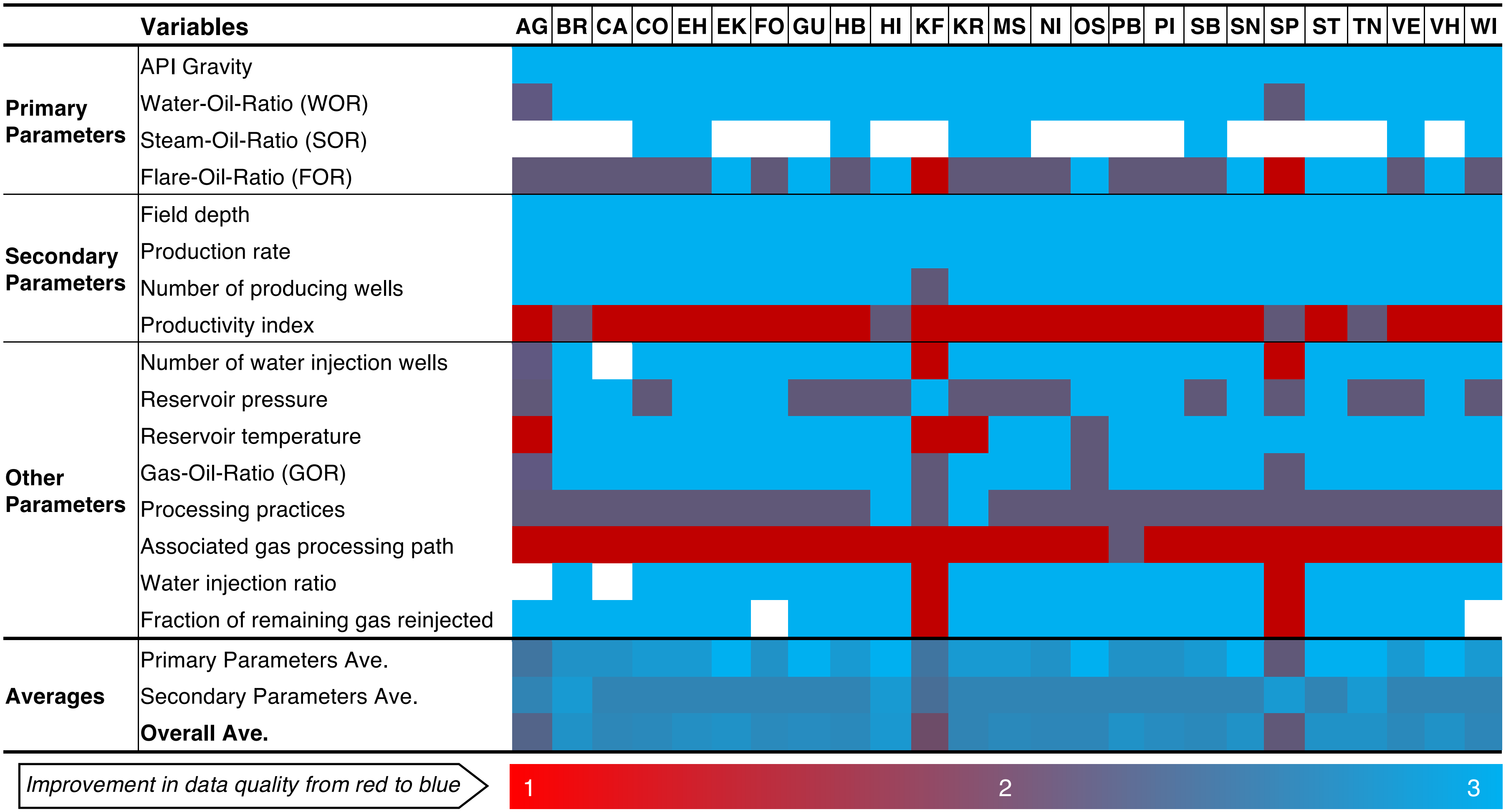

Figure S1. Oil fields data quality assessment (AG: Agbami, BR: Brent, CA: Cantarell, CO: Coalinga, EH: Elk Hills, EK: Ekofisk, FO: Fortie GU: Gullfaks, HB: Huntington Beach, HI: Hibernia, KF: Kingfish, KR: Kern River, MS: Midway Sunset, NI: Ninian, OS: Oseberg, PB: Prudhoe Bay, PI: Piper, SB: South Belridge, SN: Snorre, SP: Spraberry Trend, ST: Statfjord, TN: Terra Nova, VE: Ventura, VH: Valha, WI: Wilmington). White color squares mean not applicable (N/A - no number) when a parameter is irrelevant for the corresponding field.

Table S2. Energy sources consumed for different OPGEE process stages. Adapted from Brandt (2015) and Tripathy and Brandt (2017).

Energy source	Energy type	Process stage	Fuel spec/ reference
Diesel	External, Fuel cycle	Drilling & Development (drilling), Transportation (barges, railroads, tankers), Embodied Energy	LHV≈128450 Btu/gal – GREET 2014 (Fuel_Specs worksheet)
Electricity	External, Internal (only for offshore fields)	Drilling & Development (N_2 air separation unit), Production & Extraction (amine treater pumps and air coolers, glycol dehydrator pump, water treatment), Transportation (pipeline), Embodied Energy	GREET 2014 (Fuel_Specs and Electric worksheets)
Natural Gas	External, Internal, Fuel cycle	Production & Extraction (steam generation, downhole/water re-injection/water flooding injection pumps, NG re-injection/gas lifting/gas flooding injection compressors), Embodied Energy	LHV≈983 Btu/ft^3 – GREET 2014 (Fuel_Specs worksheet)
Oil	External, Internal, Fuel cycle	Transportation (barges, railroads, tankers), Production & Extraction (steam generation)	LHV≈129670 Btu/gal* – GREET 2014 (Fuel_Specs worksheet)

* *See Schmidt (1985)* [73] *for API dependent oil heating values.*

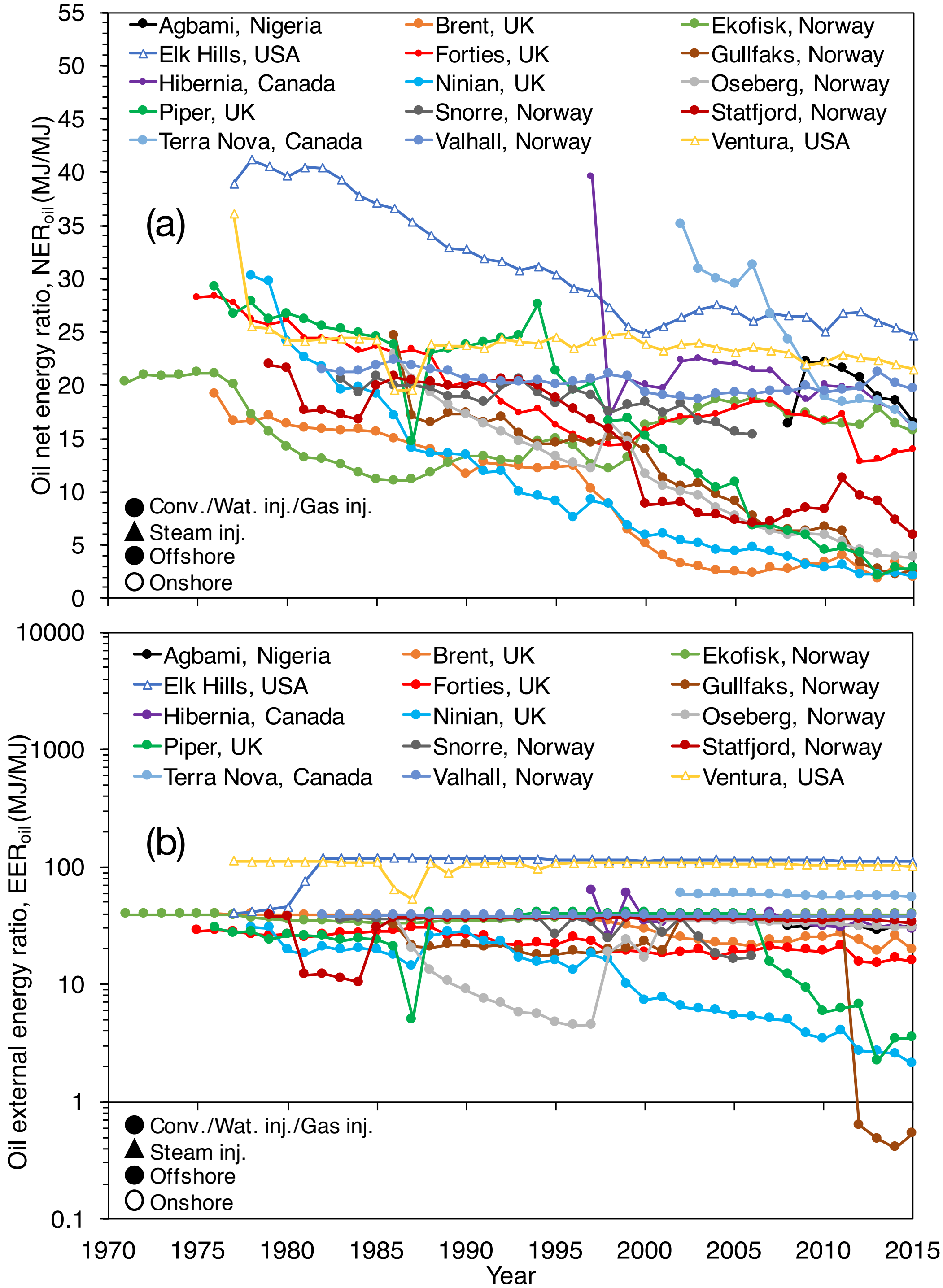

Fig. S2. Light (API > 30°) crudes historic trends in total: (a) net energy ratio (NER_{oil}); (b) external energy ratio (EER_{oil}).

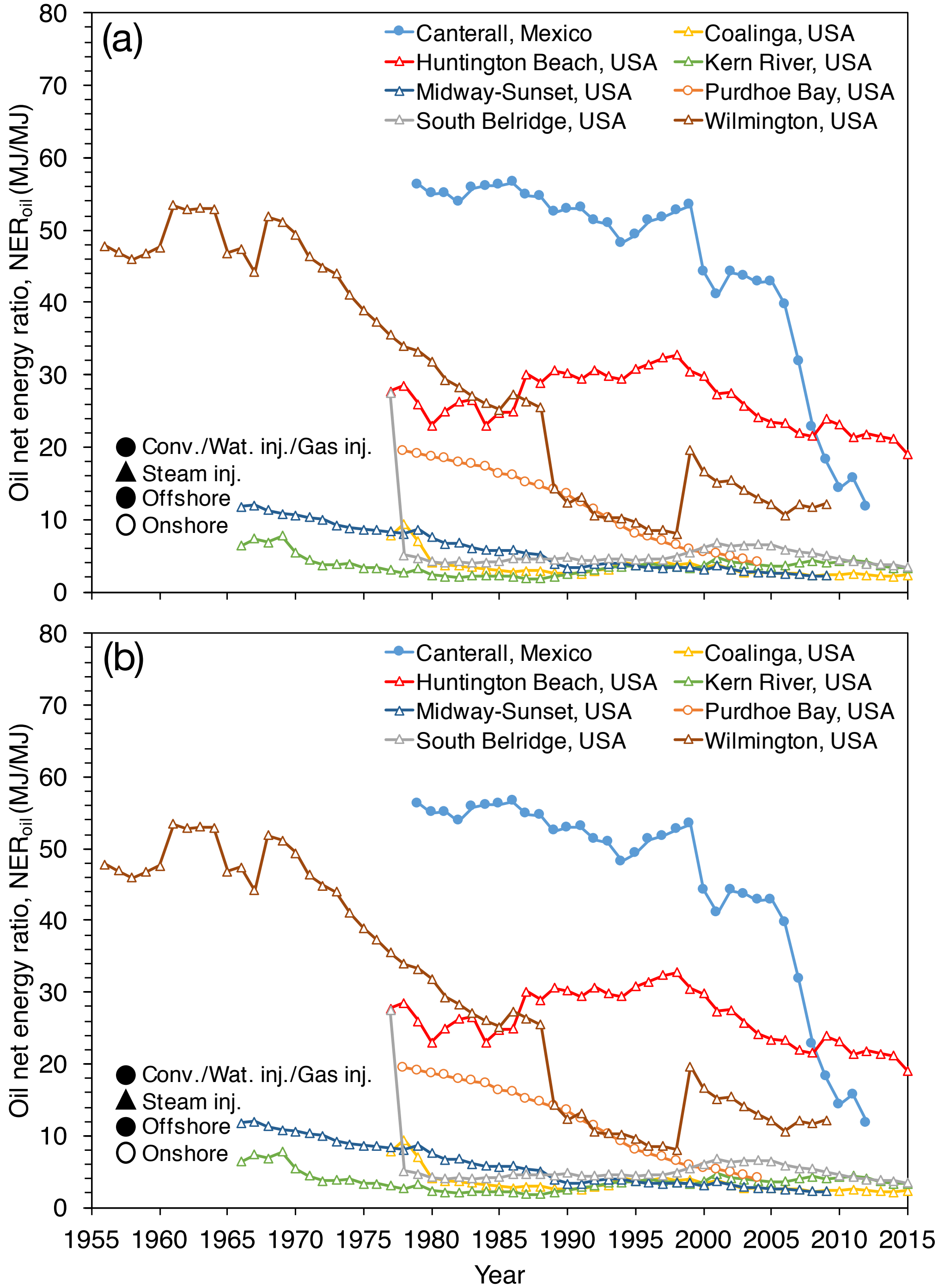

Fig. S3. Medium (20° < API ≤ 30°) and Heavy (API gravity ≤ 20°) crudes historic trends in total: (a) net energy ratio (NER_{oil}); (b) external energy ratio (EER_{oil}).

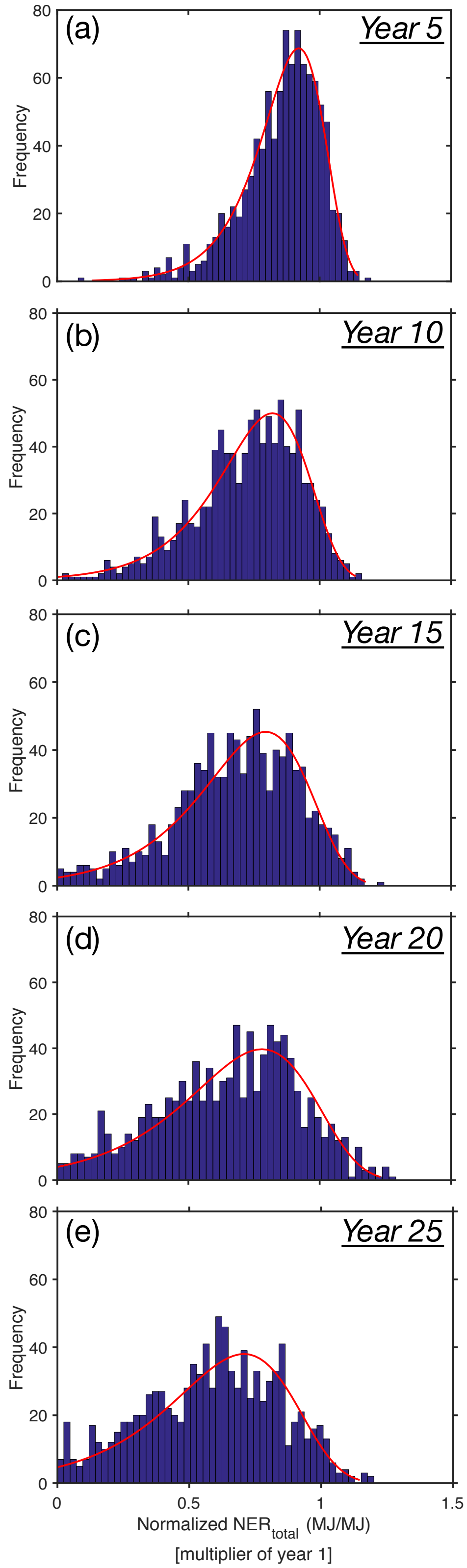

Figure S4. Selected twenty oil fields NER$_{total}$ extreme value probability distribution histograms of (a) year 5 (b) year 10 (c) year 15 (d) year 20 (e) year 25.

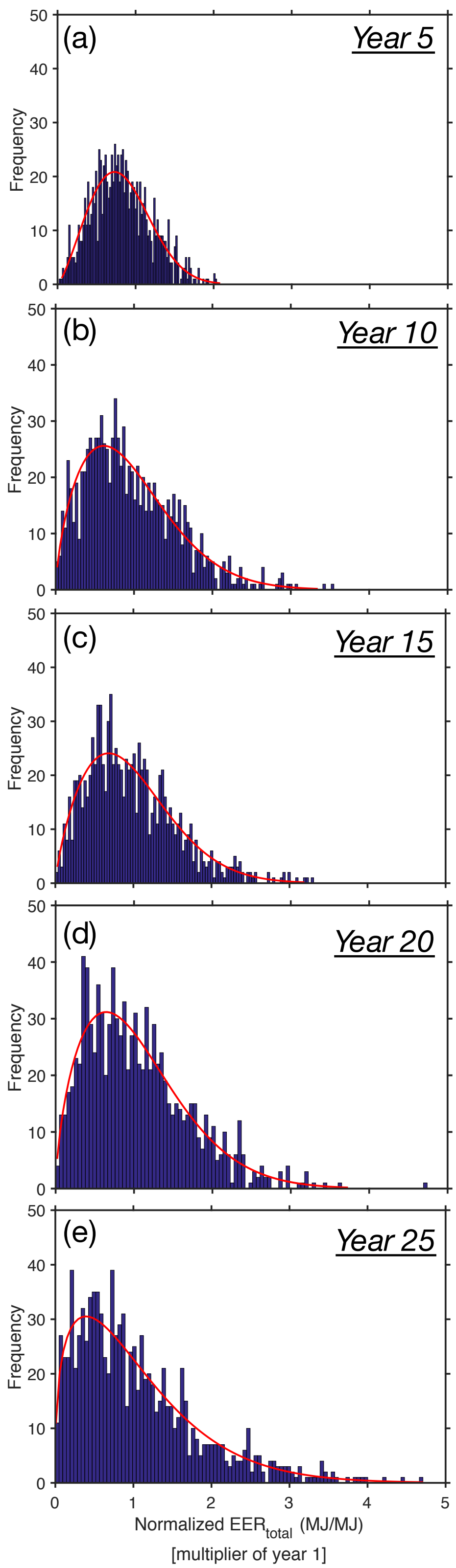

Figure S5. Selected twenty oil fields EER$_{total}$ Weibull probability distribution histograms of (a) year 5 (b) year 10 (c) year 15 (d) year 20 (e) year 25.

References

[1] Nnpcgroup, Oil and gas statistics, http://www.nnpcgroup.com/PublicRelations/OilandGasStatistics.aspx, Accessed July 2016.

[2] Elvidge, C.D., Zhizhin, M., Baugh, K., Hsu, F.C. and Ghosh, T., 2015. Methods for Global Survey of Natural Gas Flaring from Visible Infrared Imaging Radiometer Suite Data. *Energies*, *9*(1), p.14.

[3] UK Government, Oil and gas: field data, https://www.gov.uk/guidance/oil-and-gas-uk-field-data, Access July 2016.

[4] Livera, S.E., Gdula, J.E., 1990. Brent oil field. 21-63. In: Structural Traps II: Traps Associated with Tectonic Faulting.

[5] Bath, P.G., Fowler, W.N. and Russell, M.P., 1980, January. The Brent Field, A Reservoir Engineering Review. In *European Offshore Technology Conference and Exhibition*. Society of Petroleum Engineers.

[6] Tollas, J.M. and McKinney, A., 1991. Brent field 3D reservoir simulation. *Journal of Petroleum Technology*, *43*(05), pp.589-595.

[7] Braithwaite, C.I.M. and Schulte, W.M., 1992, January. Transforming the Future of the Brent Field: Depressurisation--The Next Development Phase. In *European Petroleum Conference*. Society of Petroleum Engineers.

[8] Schulte, W.M. and van de Vijver, W., 1994. Current challenges in the Brent Field. *Journal of Petroleum Technology*, *46*(12), pp.1-073.

[9] Braithwaite, C.I.M., 1994, January. A Review of IOR/EOR Opportunities for the Brent Field: Depressurisation, the Way Forward. In *SPE/DOE Improved Oil Recovery Symposium*. Society of Petroleum Engineers.

[10] Gallagher, J.J., Kemshell, D.M., Taylor, S.R. and Mitro, R.J., 1999, January. Brent field depressurization management. In *Offshore Europe Oil and Gas Exhibition and Conference*. Society of Petroleum Engineers.

[11] Sanchez Bujanos, J.L., Abundes, A., Valeriano, A., Morales, J. and Rodriguez Torres, A., 2005, January. Nitrogen injection in the Cantarell complex: results after four years of operation. In SPE Latin American and Caribbean Petroleum Engineering Conference. Society of Petroleum Engineers.

[12] Lozada, M., Torres, M., Gonzalez, M., Garcia, B., Cortes, M., Milne, A., Miquilena, E. and Perez, J.M., 2014, February. Selectively Shutting Off Gas in Naturally Fractured Carbonate Reservoirs. In SPE International Symposium and Exhibition on Formation Damage Control. Society of Petroleum Engineers.

[13] Annual Reports of the State Oil & Gas Supervisor, The Division of Oil, Gas & Geothermal Resources (DOGGR), Department of Conversation, http://www.conservation.ca.gov/dog/pubs_stats/annual_reports/Pages/annual_reports.aspx, Accessed July 2016.

[14] Norwegian Petroleum Directorate, http://factpages.npd.no/factpages/default.aspx?culture=en&nav1=field&nav2=PageView|All&nav3=43513 and http://www.norskpetroleum.no/en/, Accessed July 2016.

[15] Personal communication with Egil Dragsund, Norsk olje og gass, August 2016.

[16] Sorensen, S., SPE Stavanger, Sept. 14th 2011. Ekofisk 40 years of history and preparing for 40 more. ConocoPhillips.

[17] Concophillips, UTSLIPPSRAPPORT 2015 for Ekofisk feltet, 2015.

[18] Gavenas, E., Rosendahl, K.E. and Skjerpen, T., 2015. CO 2-emissions from Norwegian oil and gas extraction. *Energy*, *90*, pp.1956-1966.

[19] Thomas, L.K., Dixon, T.N., Evans, C.E. and Vienot, M.E., 1987. Ekofisk waterflood pilot. *Journal of petroleum technology*, *39*(02), pp.221-232.

[20] Christian, T.M., Currie, J.C., Lantz, T.G., Rismyhr, O. and Snow, S.E., 1993, January. Reservoir management at ekofisk field. In *SPE Annual Technical Conference and Exhibition*. Society of Petroleum Engineers.

[21] Hermansen, H., Thomas, L.K., Sylte, J.E. and Aasboe, B.T., 1997, January. Twenty five years of Ekofisk reservoir management. In *SPE Annual Technical Conference and Exhibition*. Society of Petroleum Engineers.

[22] Sylte, J.E., Thomas, L.K., Rhett, D.W., Bruning, D.D. and Nagel, N.B., 1999, January. Water induced compaction in the Ekofisk field. In *SPE Annual Technical Conference and Exhibition*. Society of Petroleum Engineers.

[23] Agarwal, B., Hermansen, H., Sylte, J.E. and Thomas, L.K., 2000. Reservoir characterization of Ekofisk field: a giant, fractured chalk reservoir in the Norwegian North sea—history match. *SPE Reservoir Evaluation & Engineering*, *3*(06), pp.534-543.

[24] Echols, D.P. and Ezakwe, N., 1998, January. A Reservoir Management Model for 26R Reservoir, Elk Hills Oil Field, California. In *SPE Western Regional Meeting*. Society of Petroleum Engineers.

[25] Thomas, M. Forties at 40. E&P, 2015. http://www.epmag.com/forties-40-829626#p=full. Accessed April 17, 2016.

[26] Chesterman, A., Vaughan, O. and Plahn, S., 2009, January. Forties: Creating a Long Range Development Plan for a Large, Mature, Complex North Sea Oil Field. In Offshore Europe. Society of Petroleum Engineers.

[27] Hesjedal, A. and Eltvik-Statoil, P., Introduction to the Gullfaks Area.

[28] Rolfsvag, T.A., Jakobsen, S.R., Lund, T.A.T. and Stromsvik, G., 1996, January. Thin gel treatment of an oil producer at the Gullfaks Field: Results and evaluation. In *European Production Operations Conference and Exhibition*. Society of Petroleum Engineers.

[29] Natural Resources Canada (NRC), Geological Survey of Canada, Geoscience Data Repository, BASIN Database, http://basin.gdr.nrcan.gc.ca/wells/index_e.php?query_type=field, Accessed July 2016.

[30] CNLOPB, Production data, http://www.cnlopb.ca/offshore/production.php, Accessed July 2016.

[31] Personal communication with Shania Barry, CNLOPB, August 2016.

[32] CNLOPB Resource Information, http://www.cnlopb.ca/resource/information.php, Accessed Aug 2016.

[33] Hurley, T.J., Kreisa, R.D., Taylor, G.G. and Yates, W.R.L., 1990. The reservoir geology and geophysics of the Hibernia field, offshore Newfoundland. *AAPG Bulletin (American Association of Petroleum Geologists);(USA)*, *74*(CONF-9010204--).

[34] Handyside, D.D. and Chipman, W.I., 1983. A preliminary study of the Hibernia field. *Journal of Canadian Petroleum Technology*, *22*(04).

[35] Cinar Y, 2005. Numerical Simulation of CO_2 Injectivity in Kingfish Field, Gippsland Basin, SE Australia. The University of New South Wales. CO2CRC Report No. RPT05-0107.

[36] Ozimic, S., Nicholas, E., Pain, L. and Vuckovic, V., 1987. Australian Petroleum Accumulations Report 3 Gippsland Basin, Victoria. *Department of Primary Industries and Energy Bureau of Mineral Resources, Geology and Geophysics, Australian Government Publishing Service, Canberra*.

[37] Johnson, R.S., Chu, C., Mims, D.S. and Haney, K.L., 1989, January. History matching of high-and low-quality steamfloods in Kern River field, California. In *SPE California Regional Meeting*. Society of Petroleum Engineers.

[38] Bursell, C.G., 1970. Steam Displacement Kern River Field. *Journal of Petroleum Technology*, *22*(10), pp.1-225.

[39] MCON Inputs Spreadsheet for 2010 Baseline Crudes. http://www.arb.ca.gov/fuels/lcfs/crude-oil/2010 baseline mcon inputs opgee v1.1 april 3

2015.xlsx‹ California Air Resources Board. Accessed April 14, 2016.

[40] Annual Reports of the State Oil & Gas Supervisor 1966-2009. http://www.conservation.ca.gov/dog/pubs stats/annual reports/Pages/annual reports.aspx , California Department of Conservation, Division of Oil, Gas & Geothermal Resources. Accessed April 22, 2016.

[41] Alford, W.O., 1977. The 200 sand steamflood demonstration project. InEnhanced Oil, Gas Recovery and Improved Drilling Methods (Vol. 1). ERDA Tulsa, Okla.

[42] Carpenter, D.E. and Dazet, S.C., 1992, January. Horizontal wells in a steamdrive in the Midway Sunset Field. In SPE/DOE Enhanced Oil Recovery Symposium. Society of Petroleum Engineers.

[43] Webb, M.G., 1978. Monarch Sandstone: Reservoir Description In Support Of A Steam Flood Section 26C, Midway-Sunset Field, California. Journal of Canadian Petroleum Technology, 17(04).

[44] Omoregie, Z.S., King, G.R., Strang, C., Hodgson, P. and Pressney, R.A., 1995, January. Reservoir Management in the Ninian Field-A Case History. In *Offshore Europe*. Society of Petroleum Engineers.

[45] Aasheim, I., 2000, January. Oseberg: Increased recoverable resources by optimal reservoir management and use of new technology. In *SPE European Petroleum Conference*. Society of Petroleum Engineers.

[46] Lin, X.Q., Meisingset, K.K., Nybo, R. and Espelid, O., 2014, April. When BlackOil Approximates Compositional Simulation on Dry Gas Injection-A Case Study in Oseberg Vestflanken Field, Norway. In *SPE Bergen One Day Seminar*. Society of Petroleum Engineers.

[47] Slater, J., Bamford, M. Piper Field, Past, Present & Future. Presentation to Institute of Materials, Minerals & Mining. BP Aberdeen 11th March 2009.

[48] Maher, C.E., Schmitt, H.R.H. and Green, S.C., 1992. Piper Field--UK Outer Moray Firth Basin, North Sea. In: Structural Traps VI. pp85-111.

[49] AOGCC Pool Statistics Prudhoe Bay Unit, Prudhoe Oil Pool. Alaska Oil and Gas Conservation Commission. http://doa.alaska.gov/ogc/annual/current/18 Oil Pools/Prudhoe%20Bay%20-%20Oil/Prudhoe%20Bay,%20Prudhoe%20Bay/1Oil 1.htm . Accessed April 16, 2016.

[50] Sun, Y., Bharadwaj, A., Brandt, A.R., Operating data for CEIP Oil Carbon Index. http://oci.carnegieendowment.org/data/OPGEE OCI 30 _elds.xlsx, February 2015. Accessed April 22, 2016.

[51] Injection History for Prudhoe Bay, Prudhoe Oil Pool May 1977 Through December 2004.

Alaska Oil and Gas Conservation Commission. http://doa.alaska.gov/ogc/annual/2004/oil pools/prudoe%20bay%20-%20oil/prudhoe%20bay,%20prudhoe%20bay/data injector.txt., Accessed April 16, 2016.

[52] Production History for Prudhoe Bay, Prudhoe Oil Pool January 1965 Through December 2004. Alaska Oil and Gas Conservation Commission. http://doa.alaska.gov/ogc/annual/2004/oil pools/prudoe%20bay%20-%20oil/prudhoe%20bay,%20prudhoe%20bay/Data Prod.txt., Accessed April 16, 2016.

[53] White, B. Prudhoe gas sales in 2020s could be timed well for aging oil field. Office of the Federal Coordinator for Alaska Natural Gas Transportation Projects. http://www.arcticgas.gov/prudhoe-gas-sales-2020s-could-be-timed-well-aging-oil-field , February 2015, Accessed April 12, 2016.

[54] Haugen, S.A., Lund, O. and Hoyland, L.A., 1988. Statfjord field: development strategy and reservoir management. *Journal of petroleum technology*, *40*(07), pp.863-873.

[55] Yerkinkyzy, G., 2012. Late life field material balance analysis–Statfjord Fm. Master Thesis, University of Stavanger, Norway.

[56] Permian Investor PresentationMarch 2012, Pioneer Natural Resources.

[57] Permian Investor Presentation October 2012, Pioneer Natural Resources.

[58] Hart Energy 2013 DUG Conference Horizontal Spraberry/Wolfcamp Acceleration, Pioneer Natural Resources, April 3, 2013.

[59] Christie, R.S. and Blackwood, J.C., 1952, January. Characteristic and Production Performance of the Spraberry. In *Drilling and Production Practice*. American Petroleum Institute.

[60] Spraberry Investor Presentation September 2008, Pioneer Natural Resources.

[61] Elkins, L.F., 1953. Reservoir performance and well spacing, Spraberry trend area field of west Texas. *Journal of Petroleum Technology*, *5*(07), pp.177-196.

[62] Byberg, A., 2009. Importance of fault communication for predicted Snorre performance.

[63] Skrettingland, K., Dale, E.I., Stenerud, V.R., Lambertsen, A.M., Nordaas Kulkarni, K., Fevang, O. and Stavland, A., 2014, March. Snorre In-depth Water Diversion Using Sodium Silicate-Large Scale Interwell Field Pilot. InSPE EOR Conference at Oil and Gas West Asia. Society of Petroleum Engineers.

[64] Skaug, M., Kerwin, K. and Katay, J., 2001, January. Reservoir Development Plan for the Terra Nova Field. In *Offshore Technology Conference*. Offshore Technology Conference.

[65] Barkved, O., Heavey, P., Kjelstadli, R., Kleppan, T. and Kristiansen, T.G., 2003, January. Valhall field-Still on plateau after 20 years of production. In *Offshore Europe*. Society of Petroleum Engineers.

[66] Doornhof, D., Kristiansen, T.G., Nagel, N.B., Pattillo, P.D. and Sayers, C., 2006. Compaction and subsidence. *Oilfield Review*, *18*(3), pp.50-68.

[67] Vafi, K. and Brandt, A.R., 2014. Uncertainty of Oil Field GHG Emissions Resulting from Information Gaps: A Monte Carlo Approach. Environmental science & technology, 48(17), pp.10511-10518.

[68] Huey, W.F., 1964. Subsidence and repressuring in Wilmington oil field. Calif. Div. Oil and Gas, Summary of Operations—California Oil Fields, 50(2), pp.5-25.

[69] Hillier, G.R., Cobb, R.M. and Dimmock, P.A., 1978, January. Reservoir development planning for the Forties Field. In *SPE European Petroleum Conference*. Society of Petroleum Engineers.

[70] Alaska's Department of Administration, Prudhoe Bay, Prudhoe Oil Pool, 2011 http://doa.alaska.gov/ogc/annual/current/18_Oil_Pools/Prudhoe%20Bay%20%20Oil/Prudhoe%20Bay,%20Prudhoe%20Bay/Text_Summary.pdf

[71] Alaska's Department of Administration, EOR Injection Prudhoe Bay, Prudhoe oil, http://doa.alaska.gov/ogc/annual/current/18_Oil_Pools/Prudhoe%20Bay%20%20Oil/Prudhoe%20Bay,%20Prudhoe%20Bay/Cht_Inj_EOR.pdf

[72] Sharpe, T.A., 1971, January. Production Modules-Prudhoe Bay Field. In *SPE Southwest Alaska Section Regional Meeting*. Society of Petroleum Engineers.

[73] Schmidt PF. Fuel oil manual. Industrial Press Inc.; 1985.