

Highlights 2019 Forbes Top 30 Under 30 – Energy | 2x TEDx Speaker
Carbontech co-founder & finalist (1 of 10 globally) of the \$20M Carbon XPRIZE
Youngest-ever director of the National Research Council of Canada
42 publications in high-impact journals with multiple in *Nature* and *Science*
Over 8 years of experience in strategic research and development of clean energy technologies

Education	2015 – 2018	University of Toronto	PhD Materials Science & Engineering
	2017	University of California, Berkeley	Visiting Scholar
	2013 – 2015	University of Ottawa	MSc Chemistry
	2009 – 2013	University of Windsor	BSc [H] Chemistry

Experience Program Director at National Research Council of Canada

Feb 2019 – Present

- Built and launched a 7-year mission-driven clean technology research program with a budget of \$57M focused on CO₂ conversion, hydrogen production, and artificial intelligence for materials discovery.
- Manages a team of 40 FTE in three thrusts – CO₂ recycling, H₂ technology, and AI for materials discovery across a portfolio of >25 collaborative research projects and with world-leading academics and startups in Canada, UK, Germany, and the US.
- Engages with oil & gas, energy, and chemical industry executives, high-ranking government officials, and technology innovators to align program for deepest impact.
- Contributes to national energy strategies around hydrogen and carbon capture, utilization, and storage.

Vice-Chairman of the Board of Directors at Carbon Management Canada (CMC) Research Institutes

Sep 2019 – Present

- Provides key strategic insight and direction to the firm's key value offerings in the carbontech ecosystem. Served on the HR & Governance committee and oversaw board renewal and hiring of the latest CEO.
- Supports the Chair of the Board of Directors in governance of the board and engagement with the management team.

Mentor at Creative Destruction Lab

May 2020 – Present

- Helping early stage founders change the world by building massive and scalable technology companies through technical assessments and entrepreneurial mentorship. Specialization in advanced materials and founding mentor of the Matter (Toronto) and Climate (Paris) streams.

Co-Founder & Finalist at Carbon XPRIZE

Sep 2016 – Mar 2019

- Co-founded a carbontech firm (CERT Systems) that raised >\$2M in non-dilutive funding to develop breakthrough technology to convert CO₂ to ethylene, a critical chemical feedstock with a global market of \$92B. 2019 Creative Destruction Lab – Energy cohort, a highly competitive startup accelerator.
- Brokered partnerships with engineering scale up providers, strategic oil & gas investment, and government funding programs. Led a team to scale up CO₂ conversion technology from bench to prototype.

Researcher at University of Toronto

Sep 2015 – Jan 2019

- Pioneering contributions to the fields of CO₂ recycling, artificial intelligence for materials discovery, artificial photosynthesis, and hydrogen technologies. Governor General Gold Medalist.
- Brokered funded research projects to oil and gas/ petrochemical corporations such as Total, Suncor, and Dow. More than \$5M in awarded funds and partnerships.
- Research has been featured by VICE, CBC, The Independent, Forbes, Popular Science, etc.

Research Scientist at Toyota Research Institute

Jun 2018 – Sep 2018

- Worked with researchers at Stanford University to use artificial intelligence to accelerate the discovery of new fuel cell and battery materials. Acceleration factors of >10x traditional experimental discovery was achieved.

Research Scientist at IBM TJ Watson Research Center

May 2016 – Sep 2016

- Developed large-scale simulations to understand biomolecule-material interfaces in the context of point-of-care biosensing applications.
- Published 4 research papers in high-impact journals over the course of a 4 month internship.

Volunteer Activities

Member, Advanced Materials Steering Committee at the OECD

May 2019 – Present

- Co-authored a policy report on collaborative research platforms with other international leaders from Japan, US, European Commission, Korea etc. Contributed Canadian case study and proposed policy recommendations.

Fellow, Action Canada at the Public Policy Forum

Jun 2020 – Present

- Participated in a Canadian public policy leadership accelerator program (1 of 13 fellows nationally).
- Co-authored a public policy task force report on the future of work in the agriculture sector from a place-based lens with a specific focus on recommendations to increase workforce diversity.

Member, Forbes Under 30 Advisory Board at Polestar

Sep 2020 – Present

- Provides guidance on strategies and generated suggested impact projects to increase the uptake of electric vehicles in the mass consumer market.

Member, Sustainable AI Ethics Working Group at the Canadian Commission for UNESCO

Oct 2020 – Present

- Works with the UNESCO secretariat to develop proposals for applying artificial intelligence technology to advance the realization of Canadian UN Sustainable Development Goals.

Alumni Fellow at Massey College

August 2016 – January 2019

- Participated in a number of committees as an active member in the Massey College Community, an exclusive graduate community focused on multi-disciplinary research excellence at the University of Toronto.
- Served as Co-Chair Junior Fellow Lecture Series, Co-Chair Quarter Century Fund, Lionel Massey Fund Committee Member, Junior Fellow/Senior Fellow Liaison Committee Member, Science at Massey Committee Member, House Committee Member and the Massey Tutors Program High School Tutor

Graduate Fellow, Canadian Institute for Advanced Research (CIFAR)

September 2015 – January 2019

- Participated as a founding graduate fellow of the Bio-Inspired Solar Energy Program – a collaborative research program bringing the best minds in the world together around new clean energy technologies.
- Served as meeting co-organizer and meeting recorder.

Awards

- 2020** Action Canada Fellow, Public Policy Forum
Mission Innovation Champion – Canada, Mission Innovation
- 2019** Forbes Best of Canada Top 30 Innovators, Forbes
Forbes Top 30 Under 30 – Energy, Forbes
Governor General's Gold Medal, Governor General of Canada
GreenBiz Top 30 Under 30, GreenBiz Magazine
- 2017** Massey College Catherall Award, Massey College
- 2016** Michael Smith Foreign Study Supplement, NSERC
Alexander Graham Bell Canada Graduate Scholarship (CGS-D), NSERC
- 2015** Atsumi Ohno Scholarship, University of Toronto
Dr. Yu Graduate Scholarship, University of Ottawa
- 2014** uOttawa Teaching Assistant Excellence Award, University of Ottawa
Top Poster Prize Award, Carbon Management Canada (CMC) Annual Conference
- 2013** Tito Scaiano Graduate Scholarship, University of Ottawa
Department of Chemistry Undergraduate Excellence Award, University of Windsor
- 2012** Top Undergraduate Poster Award at the 25th Canadian Symposium for Theoretical and Computational Chemistry (CSTCC), University of Guelph

Featured Media

VICE Mini-Documentary, *Empowered Episode 2*
Toronto Star Opinion Editorial, “*If you want a diverse workforce, you need diverse leadership*”
Podcast Interviews, *Pipelines & Turbines* and *Forward – How Stories Drive Change*
TEDxUofT Speaker, “*The future of discovery will be self-driven*”

Publications * denotes equal contribution

1. Zhong, M.,* Tran, K.,* Min, Y.,* Wang, C.,* Wang, Z., Dinh, C. T., **De Luna, P.**, Yu, Z., Rasouli, A. S., Brodersen, P., Sun, S., Voznyy, O., Tan, C. S., Askerka, M., Che, F., Liu, M., Seifitokaldani, A., Pang, Y., Lo, S. C., Ip, A., Ulissi, Z., & Sargent, E. H. Accelerated discovery of CO₂ electrocatalysts using active machine learning. *Nature*, 2020, 581, 178-183
2. Nam, D. H.,* **De Luna, P.**,* Rosas-Hernandez, A., Thevenon, A., Li, F., Agapie, T., Peters, J. C., Shekhah, O., Eddaoudi, M., & Sargent, E. H. Molecular enhancement of heterogeneous CO₂ reduction. *Nature Materials*, 2020, 19, 226-276
3. Coskun, H., Aljabour, A., **De Luna, P.**, Sun, H., Nishiumi, N., Yoshida, T., Koller, G., Ramsey, M. G., Greunz, T., Stifter, D., Strobel, M., Hild, S., Hassel, A. W., Sariciftci, N. S., Sargent E. H., & Stadler, P. Metal-Free Hydrogen-Bonded Polymers Mimic Noble Metal Electrocatalysts. *Advanced Materials*, 2020, 32(25)
4. Hui, S., Shaigan, N., Neburchilov, V., Zhang, L., Malek, K., Eikerling, M., & De Luna, P. Three-Dimensional Cathodes for Electrochemical Reduction of CO₂: From Macro- to Nano-Engineering. *Nanomaterials*, 2020, 10(9), 1884
5. **De Luna, P.**, Hahn, C., Higgins, D., Jaffer, S. A., Jaramillo, T. F., & Sargent, E. H. What would it take for renewably powered electrosynthesis to displace petrochemical processes? *Science*, 2019, 364, 6438
6. Ross, M. B., **De Luna, P.**, Li, Y., Dinh, C. T., Kim, D., Yang, P., & Sargent E. H. Designing materials for electrochemical carbon dioxide recycling. *Nature Catalysis*, 2019, 2, 648-658
7. Liu, M., Liu, M., Wang, X., Kozlov, S. M., Cao, Z., **De Luna, P.**, Li, H., Qui, X., Liu, K., Hu, J., Jia, C., Wang, P., Zhou, H., He, J., Zhong, M., Lan, X., Zhou, Y., Wang, Z., Li, J., Seifitokaldani, A., Dinh, C. T., Liang, H., Zou, C., Zhang, D., Yang, Y., Chan, T. S., Han, Y., Cavallo, L., Sham, T. K., Hwang, B. J., & Sargent, E. H. Quantum-Dot-Derived Catalysts for CO₂ Reduction Reaction. *Joule*, 2019, 3, 1-16
8. Duan, G., Chen, L., Jing, Z., **De Luna, P.**, Wen, L., Zhang, L., Zhao, L., Xu, J., Li, Z., Yang, Z., & Ruhong, Z. Robust Antibacterial Activity of Tungsten Oxide (WO_{3-x}) Nanodots. *Chemical Research in Toxicology*, 2019, 32(7), 1357-1366
9. Nandi, S., **De Luna, P.**, Maity, R., Chakraborty, D., Daff, T. D., Burns, T. D., Woo, T. K., Ramanathan, V. Imparting Gas Selective and Pressure Dependent Porosity into a Non-Porous Solid via Coordination Flexibility. *Materials Horizons*, 2019, 6, 1883-1891
10. Pang, Y., Li, J., Wang, Z., Tan, C. S., Hsieh, P. L., Zhuang, T. T., Liang, Z. Q., Zou, C., Wang, X., **De Luna, P.**, Edwards, J. P., Xu, Y., Li, F., Dinh, C. T., Zhong, M., Lou, Y., Wu, D., Chen, L. J., Sargent, E. H., & Sinton, D. Efficient electrocatalytic conversion of carbon monoxide to propanol using fragmented copper. *Nature Catalysis*, 2018, 2, 251-258
11. Dinh, C. T.,* Jain, A.,* de Arquer, F. P. G.,* **De Luna, P.**, Wang, N., Zheng, X., Cai, J., Gregory, B. Z., Voznyy O., Zhang, B., Liu, M., Sinton, D., Crumlin, E. J., & Sargent, E. H. Multi-Site Catalysts Destabilize Water Molecules and Achieve High-Activity Neutral Hydrogen Evolution. *Nature Energy*. 2018, 4, 107-114
12. Li, J.,* Che, F.,* Pang, Y.,* Zou, C.,* Howe, J. Y., Burdynyn, T., Edwards, J. P., Wang, Y., Li, F., **De Luna, P.**, Dinh, C. T., Zhuang, T. T., Saidaminov, M. I., Cheng, S., Wu, T., Finprock, Y. Z., Ma, L., Hsieh, S. H., Liu, Y., Botton, G., Pong, W. F., Du, X., Guo, J., Sham, T. K., Sargent, E. H., & Sinton, D. Copper adparticle enabled selective electrosynthesis of n-propanol. *Nature Communications*. 2018, 9, 4614
13. Zhuang, T. T.,* Pang, Y.,* Liang, Z. Q., Li, Y., Tan, C. S., Li, J., Din, C. T., **De Luna, P.**, Hsieh, P. L., Burdynyn, T., Li, H. H., Liu, M., Wang, Y., Li, F., Proppe, A., Johnston, A., Wu, Z. Y., Zheng, Y. R., Ip, A. H., Tan, H., Chen, L. J., Yu, S. H., Kelly, S. O., Sinton, D., & Sargent, E. H. Copper nanocavities confine intermediates for efficient electrosynthesis of C₃ alcohol fuels from carbon monoxide. *Nature Catalysis*. 2018, 1, 945-951
14. Ross, M. B., Li, Yi., **De Luna, P.**, Kim, D., Sargent, E. H., & Yang, P. Electrocatalytic Rate Alignment Enhances Syngas Generation. *Joule*. 2018, 3 (1), 257-264
15. Kibria, M. G., Dinh, C. T., Seifitokaldani, A., **De Luna, P.**, Burdynyn, T., Quintero-Bermudez, R., Ross, M. B., Bushuyev, O. S., de Arquer, F. P. G., Yang, P., Sinton, D., & Sargent, E. H. A Surface Reconstruction Route to High Productivity and Selectivity in CO₂ Electroreduction Toward C₂₊ Hydrocarbons. *Advanced Materials*. 2018, 30 (49), 1804867

16. Liang, Z.,* Zhuang, T.,* Seifitokaldani, A., Tan C. S., Li, Y., **De Luna, P.**, Huang, C. W., Hsieh, P. L., Dinh, C. T., Wang, Y., Quintero-Bermudez, R., Zhou, Y., Li, J., Chen, P., Pang, Y., Lo, S. C., Chen, L. J., Tan, H., Xu, Z., Zhao, S., & Sargent, E. H. Copper-on-nitride enhances the stable electrosynthesis of multi-carbon products from CO₂. *Nature Communications*. 2018, 9, 3828
17. **De Luna, P.**, Liang, W., Mallick, A., Shekhah, O., Garcia de Arquer, F. P., Proppe, A., Todorovic, P., Kelley, S. O., Sargent, E. H., & Eddaoudi, M. Metal-Organic Framework Thin Films on High-Curvature Nanostructures Towards Tandem Electrocatalysis. *ACS Applied Materials Interfaces*. 2018, 10 (37), 31225–31232
18. Nam, D. H., Bushuyev, O. S., Li, J., **De Luna, P.**, Seifitokaldani, A., Dinh, C. T., Garcia de Arquer, F. P., Wang, Y., Liang, Z., Proppe, A. H., Tan, C. S., Todorovic, P., Shekhah, O., Gabardo, C. M., Jo, J. W., Choi, J., Choi, M. J., Baek, S. W., Kim, J., Sinton, D., Kelley, S. O., Eddaoudi, M., & Sargent, E. H. Metal-Organic Frameworks Mediate Cu Coordination for Selective CO₂ Electroreduction. *Journal of the American Chemical Society*. 2018, 140 (36), 11378–1138
19. Garcia de Arquer, F. P.,* Bushuyev, O. S.,* **De Luna, P.**,* Dinh, C. T., Seifitokaldani, A., Saidaminov, M. I., Quan, L. N., Proppe, A., Kibria, M. G., Kelley, S., Sinton, D., & Sargent, E. H. 2D Metal Oxyhalide-Derived Catalysts for Efficient CO₂ Electroreduction. *Advanced Materials*. 2018, 1802858
20. Zhou, Y.,* Che, F.,* Liu, M.,* Zou, C., Liang, Z.Q., **De Luna, P.**, Yuan, H., Li, J., Wang, Z., Chen, P., Bladt, E., Quintero-Bermudez, R., Sham, T. K., Bals, S., Hofkens, J., Sinton, D., Chen, G., & Sargent, E. H. Dopant-induced electron localization drives CO₂ reduction to C₂ hydrocarbons. *Nature Chemistry*. 2018, 10, 974–980
21. Zhuang, T.,* Liang, Z.Q.,* Seifitokaldani, A.,* Li, Y., **De Luna, P.**, Burdyny, T., Meng, F., Quintero-Bermudez, R., Dinh, C.T., Zhong, M., Che, F.L., Zhang, B., Li, J., Chen, P.N., Zheng, X.L., Liang, H.Y., Ge, W.N., Ye, B.J., Sinton, D., Yu, S.H., & Sargent, E.H. Steering post-C-C coupling selectivity enables high efficiency electroreduction of carbon dioxide to multi-carbon alcohols. *Nature Catalysis*. 2018, 1, 421–428
22. Dinh, C. T.,* Burdyny, T.,* Kibria, M.,* Seifitokaldani, A.,* Gabardo, C., de Arquer, F. P. G., Kiani, A., Edwards, J., **De Luna, P.**, Bushuyev, O., Zou, C., Quintero-Bermudez, R., Pang, Y., Sinton, D., & Sargent E. H. Sustained high-selectivity CO₂electroreduction to ethylene via hydroxide-mediated catalysis at an abrupt reaction interface. *Science*. 2018, 360 (6390), 783-787
23. He, S., Zhang, Y., Qiu, L., Zhang, L., Zhang B., Xie, Y., Pan, J., Chen, P., Song, H., Hu, Y., Wang, B., Dinh, C. T., **De Luna, P.**, Banis, M. N., Wang, Z., Sham, T. K., Gong, X., Peng, H., Sargent, E. H. Chemical-to-Electricity Carbon: Water Device. *Advanced Materials*. 2018, 1707635
24. Bushuyev, O.S.* **De Luna, P.***, Dinh, C.T., Tao, L., Saur, G., van de Lagemaat, J., Kelley, S. O., Sargent, E.H. What should we make with CO₂ and how can we make it? *Joule*. 2018, 2 (5), 825-832
25. **De Luna, P.***, Quintero-Bermudez, R.*, Dinh, C. T., Ross, M. B., Bushuyev, O., Todorovic, P., Regier, T., Yang, P., & Sargent, E. H. Electro-redeposited catalysts control morphology and oxidation state for selective carbon dioxide reduction. *Nature Catalysis*. 2018, 1 (2), 103-110
26. **De Luna, P.**, Wei, J. N., Bengio, Y., Aspuru-Guzik, A., & Sargent, E. H. Use machine learning to find energy materials. *Nature*. 2017, 552 (7683), 23-25
27. Zheng, X.*, Zhang, B.*, **De Luna, P.***, Liang, Y., Comin, R., Voznyy, O., Garcia de Arquer, F. P., Liu M., Dinh, C.T., Dynes, J., Regier, T., Xin, H. L., Prendergast, D., Du, X., & Sargent, E. H. Theory-driven design of high-valence metal sites for water oxidation confirmed using *in-situ* soft X-ray absorption. *Nature Chemistry*. 2017, 10 (2), 149-154
28. Zheng, X.*, **De Luna, P.***, Garcia de Arquer, F. P., Zhang, B., Becknell, N., Ross, M., Liu, M., Banis, M. N., Voznyy, O., Dinh, C.T., Zhuang, T., Du, X., Yang, P., & Sargent, E. H. Sulfur-modulated tin sites enable efficient electrochemical reduction of CO₂ to formate. *Joule*. 2017, 1 (4), 794-805
29. Coskun, H., Aljabour A., **De Luna, P.**, Farka D., Greunz, T., Stifter, D., Kus, M., Zheng, X., Liu, M., Sariciftci, N. S., Sargent, E. H., & Stadler, P. Biofunctionalized conductive polymers enable efficient CO₂ electroreduction. *Science Advances*. 2017, 3 (8), e1700686
30. Ross, M. B., Dinh, C. T., Li, Yi., Kim, D., **De Luna, P.**, Sargent, E. H., & Yang, P. Cu-Enrichment of Nanostructured Catalysts Enables Designer Syngas Electrosynthesis from CO₂. *Journal of American Chemical Society*. 2017, 139 (27), 9359–9363

31. Klinkova, A., **De Luna, P.**, Sargent, E. H., Kumacheva, E., & Cherepanov, P. V. Enhanced electrocatalytic performance of palladium nanoparticles with high energy surfaces in formic acid oxidation. *Journal of Materials Chemistry A*. 2017, 5, 11582-11585
32. **De Luna, P.**, Mahshid, S., Das, J., Luan, B., Sargent, E. H., Kelley, S. O., Zhou, R. High-Curvature Nanostructuring Enhances Probe Display for Biomolecular Detection. *Nano Letters*. 2017, 17 (2), 1289–1295
33. Zhang, W., Ye, C., **De Luna, P.**, Zhou, R. Snatching the Ligand or Destroying the Structure: Disruption of WW Domain by Phosphorene. *The Journal of Physical Chemistry C*. 2017, 121 (2), 1362–1370
34. Gu, Z., **De Luna, P.**, Yang, Z., Zhou, R. (2017). Structural Influence of Proteins Upon Adsorption to MoS₂ Nanomaterials: Comparison of MoS₂ Force Field Parameters. *Physical Chemistry Chemical Physics*. 19, 3039-3045
35. Klinkova, A.*, **De Luna, P.***, Dinh, C.T., Voznyy, O., Larin, E.M., Kumacheva, E., Sargent, E.H. Rational Design of Efficient Palladium Catalysts for Electroreduction of Carbon Dioxide to Formate. *ACS Catalysis*. 2016, 6 (12), 8115-8120
36. Liu, M.*, Pang Y.*, Zhang, B.*, **De Luna, P.***, Voznyy, O., Xu, J., Zheng, X., Dinh, C.T., Fan, F., Cao, C., García de Arquer, F. P., Safaei, T. S., Mephram, A., Klinkova, A., Kumacheva, E., Filleter, T., Sinton, D., Kelley S. O., & Sargent, E. H. Enhanced Electrocatalytic CO₂ Reduction via Field-Induced Reagent Concentration. *Nature*. 2016, 537 (7620), 383-386
37. Briard, J.G*, Fernandez, M.*, **De Luna, P.**, Woo, T.K., Ben, R.N. QSAR Accelerated Discovery of Potent Ice Recrystallization Inhibitors. *Scientific Reports*. 2016, (6), 26403
38. Zhang, B., Zheng, X., Voznyy, O., Comin, R., Bajdich, M., García-Melchor, M., Xu, J., Liu, M., García de Arquer, F. P., Dinh, C.T., Fan, F., Yuan, M., Yassitepe, E., Janmohamed, A., Chen, N., Reiger, T., Han, L., Liu, P., Li, Y., **De Luna, P.**, Xin, H.L., Zheng, L., Vojvodic, A., & Sargent, E.H. Homogeneously-Dispersed Multi-Metal Oxygen-Evolving Catalysts. *Science*. 2016, 352 (6283), 333-337
39. Nandi, S., **De Luna, P.**, Daff T.D., Liu, M., Buchanan, W., Hawari, A.I., Woo, T.K., Vaidhyanathan, R. A Single Ligand Ultra-Microporous MOF with Exceptional CO₂ Capacity and Selectivity. *Science Advances*. 2015, 1 (11), e1500421
40. **De Luna, P.**, Bushnell, E. A., & Gauld, J. W. A Molecular Dynamics Examination on Mutation Induced Catalase Activity in Coral Allene Oxide Synthase. *The Journal of Physical Chemistry B*. 2013, 117 (47), 14635–14641
41. **De Luna, P.**, Bushnell, E. A., & Gauld, J. W. A Density Functional Theory Investigation into the Binding of the Antioxidants Ergothioneine and Ovothiol to Copper. *The Journal of Physical Chemistry A*. 2013, 117 (19), 4057–4065
42. Ion, B. F., Bushnell, E. A., **De Luna, P.**, & Gauld, J. W. A Molecular Dynamics (MD) and Quantum Mechanics/Molecular Mechanics (QM/MM) Study on Ornithine Cyclodeaminase (OCD): A Tale of Two Iminiums. *International Journal of Molecular Sciences*. 2012, 13(10), 12994-13011.

Conferences

Over 60 conference and public presentations over the last 5 years highlights include:

- Clean Energy Ministerial, Mission Innovation Panelist | 2020
- GLOBE, Moderator on CCUS Panel | 2020
- Energy Future Forum, Panelist on hydrogen technologies | 2020
- Chemical Institute of Canada, Virtual Talk | 2020
- Canadian Undergraduate Technology Conference, Keynote Speaker | 2020
- International Carbon Utilization Conference, Keynote Speaker | 2019
- Royal Society of Canada, Panelist at Annual Symposium | 2019