

MARKETS AND PROFITABILITY

Market Insights: Green Solvents

Global

December 2022



This Report was prepared by NexantECA, the Energy and Chemicals Advisory company ("NexantECA"). Except where specifically stated in this Report, the information contained herein is prepared on the basis of information that is publicly available, and contains no confidential third party technical information to the best knowledge and belief of NexantECA. The information has not been independently verified or otherwise examined to determine its accuracy, completeness or financial feasibility. Neither NexantECA, Subscriber nor any person acting on behalf of either shall have any liabilities for any loss or damage arising from or connected to the use of any information contained in this Report. NexantECA does not represent or warrant that any assumed conditions will come to pass.

The Report is for Subscriber's internal use only and shall be kept strictly confidential. The Report should not be otherwise reproduced, distributed or used without first obtaining prior written consent by NexantECA. Each Subscriber agrees to use reasonable effort to protect the confidential nature of the Report.

Copyright © by NexantECA (BV) Ltd. 2022. All rights reserved.



Contents

1	Executive Summary	1
1.1	Market Outlook	1
1.2	NexantECA Solvent Market Attractiveness Index (NESMAI)	4
2	Introduction	9
2.1	Study Objective	9
2.2	Overview	9
2.3	Market Influencing Factors	10
2.3.1	Regulatory Environment.....	10
2.3.1.1	Solvent Hazards.....	11
2.3.2	Personal and Health Care	11
2.3.3	Covid-19 Pandemic	12
2.3.4	Renewable Feedstock.....	12
2.3.5	Consumer Awareness	13
2.4	Ways to Reduce Environmental Impact	13
2.4.1	Solvent Recycling	13
2.4.2	Use of Green Solvents	15
2.4.3	Disposal of Solvents and Solvent Contaminated Wastes	15
2.4.4	Process Emission Reduction	16
2.4.5	Substitution Technologies	16
3	Regulatory Framework	17
3.1	Global	17
3.1.1	World Health Organization	17
3.1.2	International Council for Harmonization of Technical Requirements for Registration of Pharmaceuticals for Human Use (ICH)	17
3.1.3	UN Global Harmonized System of Classification and Labelling of Chemicals (GHS)	18
3.1.4	UN Sub-Committee of Experts (SCE) on the Transport of Dangerous Goods (TDG).....	18
3.1.5	World Coatings Council.....	19
3.1.5.1	International Maritime Organization (IMO).....	19
3.1.5.2	ISO Standards.....	19
3.1.5.3	International Council for Harmonisation of Technical Requirements for Pharmaceuticals for Human Use (ICH).....	19
3.1.5.4	Persistent Organic Pollutants (POPs).....	20
3.2	North America	21
3.2.1	United States.....	21
3.2.1.1	Health and Safety: Toxic Substances Control Act (TSCA)	22
3.2.1.2	Health and Safety: Permissible Exposure Limit (PEL): Occupational Safety and Health Association.....	25
	Standards 26	
	Occupational Health Guidelines for Chemical Hazards	27
	OSHA Occupational Chemical Database	27



3.2.1.3	Health and Safety: Emergency Planning and Community Right-to-Know Act (EPCRA)	27
3.2.1.4	Health and Safety: Toxic Release Inventory (TRI)	28
3.2.1.5	Air Quality: Clean Air Act	28
3.2.1.6	Air Quality: The Significant New Alternative Policy (SNAP)	29
	Cleaning Solvents: Defining Non-Aerosol Solvent Cleaning	29
	Substitutes in Aerosols.....	30
3.2.1.7	Air Quality: National Emission Standards for Hazardous Air Pollutants (NEHAPS)	31
	Halogenated Solvent Cleaning.....	31
3.2.1.8	Air Quality: Options for Complying with VOC and HAP Regulations	33
3.2.1.9	LVP (Low Vapor Pressure) -VOC Exemption	33
	Volatile Organic Compounds and Reactivity Based Exemptions	34
3.2.1.10	Air Quality: Emissions Control – NSPS and RACT/BACT/LAER Clearinghouse	35
3.2.1.11	Water Quality: Clean Water Act (CWA): National Pollutant Discharge Elimination System	36
3.2.1.12	Solid and Hazardous Wastes: U.S. Regulations for Solid and Hazardous Waste: Resource Conservation and Recovery Act (RCRA).....	36
3.2.1.13	U.S. FDA Indirect Food Additives	39
3.2.1.14	FDA Current Good Manufacturing Practice: Pharmaceutical	39
	Pharmaceutical Solvents.....	40
3.2.1.15	US ACGIH.....	43
3.2.2	Canada.....	43
3.2.2.1	Chemical Management Plan (CMP)	43
3.2.2.2	Solvent Degreasing Regulations.....	43
3.2.3	Mexico	44
3.3	Western Europe	45
3.3.1	EU	45
3.3.1.1	EU Occupational Exposure Limits (OELs).....	46
3.3.1.2	REACH.....	46
3.3.1.3	VOC Regulations	46
3.3.1.4	ODS Regulations	47
3.3.1.5	Trichloroethylene (TRI) Charter	47
3.3.1.6	Solvents & Air Quality	48
3.3.1.7	Ozone Modelling by the ESIG.....	49
3.3.1.8	Industrial Emissions Directive (IED).....	49
3.3.1.9	EU Installations and Activities Using Organic Solvents Regulations 2012	52
3.3.1.10	EU Waste Framework Directive 2008/98/EC. Waste Hierarchy.....	52
3.3.1.11	GHS and CLP Regulation on the Classification, Labelling and Packaging (CLP) of Substances and Mixtures	53
3.3.1.12	European Green Deal	54



3.3.1.13	Bio-based Solvent Standards – CEN.....	54
3.3.1.14	ATEX and explosive atmosphere.....	55
3.3.1.15	EU Circular Economy Action Plan	55
3.3.1.16	EU Directive 2004/42/CE	55
3.3.1.17	EU Directive 2014/312/EU	56
3.3.1.18	EU Framework Regulation (EC) 1935/2004	56
3.3.1.19	EU Food Contact Materials	56
3.3.1.20	EU Regenerated Cellulose Directive 2007/42/EC	57
3.3.1.21	Swiss Printing Inks Ordinance	57
3.3.1.22	EU Framework Regulation (EC) 1935/2004	57
3.3.1.23	EU Cosmetics Legislation	57
3.3.1.24	Regulation (EC) No. 1107/2009 of the European Parliament.....	58
3.3.1.25	EU F-GAS Regulation	58
3.3.1.26	EU REACH Regulations	58
3.3.2	UK	58
3.3.2.1	UK REACH.....	59
3.3.2.2	Control of Substances Hazardous to Health (COSHH)	59
3.3.2.3	Workplace exposure limits (WELs) EH40/2005.....	59
3.3.2.4	UK Health & Safety at Work Act 1974	59
3.3.2.5	The UK's Clean Air Strategy 2019	59
3.3.2.6	Disposal of Hazardous Waste.....	60
3.3.2.7	Prevent Groundwater Pollution from Solvents Guidance	60
3.3.2.8	UK DSEAR.....	60
3.3.2.9	UK General Product Safety Regulations 2005 (GPSR).....	61
3.3.2.10	UK Volatile Organic Compounds in Paints, Varnishes and Vehicle Refinishing Products Regulations 2012	61
3.3.2.11	UK HSE Health and Safety in Construction.....	61
3.3.2.12	UK Cosmetic Products Enforcement Regulations 2013	61
3.3.2.13	UK formulation and finishing of pharmaceutical products	61
3.3.2.14	UK Biocidal Products Regulations (BPR)	62
3.3.2.15	UK HSE Monitoring the Impact of Plant Protection Products (PPP).....	62
3.4	Asia Pacific	62
3.4.1	China	62
3.4.1.1	The 14th five-year plan	62
3.4.1.2	Carbon Peak before 2030	63
3.4.1.3	Comprehensive Work Plan for Energy Conservation and Emission Reduction	63
3.4.1.4	Local government policy on VOC	63
3.4.1.5	Nationwide battle to prevent and control pollution	64
3.4.1.6	China Compulsory Certificate	64
3.4.1.7	China Food Safety Law (FSL).....	64
3.4.1.8	China Adhesives Standard (draft).....	64
3.4.2	Japan.....	64
3.4.2.1	Chemical Substances Control Law (CSCL).....	66



	3.4.2.2	Industrial Safety and Hygiene Law (ISHL)	67
	3.4.2.3	Japan Food Sanitation Act.....	68
3.5	South America.....		68
	3.5.1	Brazil	68
	3.5.1.1	Industrial Regulations Overview	69
	3.5.1.2	Brazilian National Agency of Petroleum, Natural Gas and Biofuels (ANP).....	69
	3.5.1.3	Brazilian Health Regulatory Agency (Anvisa)	71
	3.5.1.4	ABNT STANDARDS (BRAZILIAN ASSOCIATION OF TECHNICAL STANDARDS)	71
	3.5.1.5	Mercosur Technical Regulations/Resolutions.....	72
	3.5.2	Chile	72
	3.5.3	Columbia	72
4	End Use Market Review		73
4.1	Paints and coatings		73
	4.1.1	Market Overview	73
	4.1.2	Typical Solvents Employed and Emerging Green Solvents	75
	4.1.3	Sector Sustainability Development	76
4.2	Adhesives.....		76
	4.2.1	Market Overview	76
	4.2.2	Typical Solvents Employed and Emerging Green Solvents	79
	4.2.3	Sector Sustainability Development	79
4.3	Printing inks.....		80
	4.3.1	Market Overview	80
	4.3.2	Typical Solvents Used and Emerging Green Solvents	82
	4.3.3	Sector Sustainability Development	82
4.4	Industrial and Institutional Cleaning		83
	4.4.1	Market Overview	83
	4.4.2	Typical Solvents Employed and Emerging Green Solvents	84
	4.4.3	Sector Sustainability Development	85
4.5	Home and Personal Care Products		85
	4.5.1	Market Overview	85
	4.5.2	Typical Solvents Employed and Emerging Green Solvents	88
	4.5.3	Sector Sustainability Development	88
4.6	Pharmaceutical products.....		88
	4.6.1	Market Overview	88
	4.6.2	Typical Solvents Used and Emerging Green Solvents	89
	4.6.3	Sector Sustainability Development	89
4.7	Agrochemicals.....		90
	4.7.1	Market Overview	90
	4.7.2	Typical Solvents Used and Emerging Green Solvents	94
	4.7.3	Sector Sustainability Development	94
4.8	Electronics.....		95
	4.8.1	Demand.....	96



4.8.2	Typical Solvents Used and Emerging Green Solvents	97
4.8.3	Sector Sustainability Development	97
4.9	Others.....	97
4.9.1	Construction	97
4.9.2	Manufacturing (rubber/plastics/fibres).....	98
4.9.3	Water treatment.....	98
4.9.4	Soil remediation	98
4.9.5	Wire Winding	99
4.9.6	Cooling Agents	99
4.9.7	De-icing and windshield wash.....	99
4.9.8	Brake fluids.....	99
4.9.9	Plastics Recycling	99
5	Market Outlook	100
5.1	Global Solvent Market	100
5.1.1	Green Solvent Development.....	102
5.2	Regional Solvent Markets	104
5.2.1	North America	104
5.2.2	South America.....	107
5.2.3	Western Europe	109
5.2.4	China	110
5.2.5	Asia Pacific (excluding China).....	111
5.2.5.1	Japan	112
6	Green Solvents	114
6.1	Product Value	114
6.2	Acids.....	114
6.2.1	Acetic Acid.....	114
6.2.1.1	Market Analysis.....	114
6.2.1.2	Commercial Potential	116
6.2.1.3	Acetic Acid Cost Competitiveness	117
6.2.2	Formic Acid	117
6.2.2.1	Market Analysis.....	117
6.2.2.2	Commercial Potential	118
6.3	Alcohols.....	119
6.3.1	Ethanol	119
6.3.1.1	Market Analysis.....	119
6.3.1.2	Commercial Potential	120
6.3.1.3	Ethanol Cost Competitiveness.....	120
6.3.2	Methanol.....	121
6.3.2.1	Market Analysis.....	121
6.3.2.2	Commercial Potential	123
6.3.2.3	Methanol Cost Competitiveness	123
6.3.3	Propylene Glycol	123
6.3.3.1	Market Analysis.....	123



6.3.3.2	Commercial Potential	126
6.3.3.3	Propylene Glycol Cost Competitiveness	126
6.3.4	Isopropanol	127
6.3.4.1	Market Analysis	127
6.3.4.2	Commercial Potential	128
6.3.4.3	Cost Competitiveness	128
6.3.5	Glycerol	129
6.3.5.1	Market Analysis	129
6.3.5.2	Commercial Potential	132
6.4	Esters	132
6.4.1	Ethyl Acetate	132
6.4.1.1	Market Analysis	132
6.4.1.2	Commercial Potential	134
6.4.2	Ethyl Lactate	134
6.4.2.1	Market Analysis	134
6.4.2.2	Commercial Potential	135
6.4.2.3	Ethyl Lactate Cost Competitiveness	136
6.4.3	Dimethyl Carbonate	136
6.4.3.1	Market Analysis	136
6.4.3.2	Commercial Potential	137
6.4.4	Methyl Soyate	138
6.4.4.1	Market Analysis	138
6.4.4.2	Commercial Potential	140
6.5	Ethers	141
6.5.1	Dimethyl Ether (DME)	141
6.5.1.1	Market Analysis	141
6.5.1.2	Commercial Potential	143
6.5.2	Tetrahydrofuran (THF)	143
6.5.2.1	Market Analysis	143
6.5.2.2	Commercial Potential	145
6.5.2.3	THF Cost Competitiveness	145
6.5.3	2-Methyltetrahydrofuran (2-MeTHF)	145
6.5.3.1	Market Analysis	145
6.5.3.2	Commercial Potential	146
6.5.4	2-methoxyethanol / Ethylene Glycol Monomethyl Ethers	146
6.5.4.1	Market Analysis	146
6.5.4.2	Commercial Potential	147
6.6	Ketones	147
6.6.1	Acetone	147
6.6.1.1	Market Analysis	147
6.6.1.2	Commercial Potential	150
6.6.2	Diacetone Alcohol (DAA)	151
6.6.2.1	Market Analysis	151
6.6.2.2	Commercial Potential	151



6.6.3	Methyl Ethyl Ketone (MEK)	151
6.6.3.1	Market Analysis.....	151
6.6.3.2	Commercial Potential	152
6.6.4	Methyl Isobutyl Ketone (MIBK).....	152
6.6.4.1	Market Analysis.....	152
6.6.4.2	Commercial Potential	153
6.7	Natural Solvents	153
6.7.1	D-limonene	153
6.7.1.1	Market Analysis.....	153
6.7.1.2	Commercial Potential	154
6.8	Proprietary Solvents	155
6.8.1	Cyrene	155
6.8.1.1	Market Analysis.....	155
6.8.2	Rhodiasolv.....	155
6.8.2.1	Market Analysis.....	155
6.8.3	Biolife Range	156
6.8.3.1	Market Analysis.....	156
6.8.4	NXTLEVVEL.....	157
6.8.4.1	Market Analysis.....	157
6.9	Neoteric Solvents	157
6.9.1	Ionic Liquids	157
6.9.1.1	Market Analysis.....	157
6.9.1.2	Commercial Potential	159
6.9.2	Supercritical Fluid.....	159
6.9.2.1	Market Analysis.....	159
6.9.2.2	Commercial Potential	160
6.9.3	Natural Deep Eutectic Solvents	160
6.9.3.1	Market Analysis.....	160
6.9.3.2	Commercial Potential	161
7	Key Green Solvents Producers	162
7.1	Solvay.....	162
7.1.1	Overview	162
7.1.2	End Use Markets.....	162
7.1.3	Solvents Business	163
7.1.4	Green Solvents Highlight	163
7.2	Huntsman	164
7.2.1	Overview	164
7.2.2	End Use Markets.....	164
7.2.3	Solvents Business	165
7.2.4	Green Solvents Highlight	165
7.3	TotalEnergies	166
7.3.1	Overview	166
7.3.2	End Use Markets.....	166
7.3.3	Solvents Business	166



	7.3.4	Green Solvents Highlight	166
7.4		ZEON Corporation.....	166
	7.4.1	Overview	166
	7.4.2	End Use Markets.....	167
	7.4.3	Solvents Business	167
	7.4.4	Green Solvents Highlight	167
7.5		Braskem	167
	7.5.1	Overview	167
	7.5.2	End Use Markets.....	168
	7.5.3	Solvents Business	168
	7.5.4	Green Solvents Highlight	168
7.6		Mitsubishi Chemical	169
	7.6.1	Overview	169
	7.6.2	End Use Markets.....	169
	7.6.3	Solvents Business	169
	7.6.4	Green Solvents Highlights.....	169
7.7		Merck.....	170
	7.7.1	Overview	170
	7.7.2	End Use Markets.....	170
	7.7.3	Solvent Business.....	170
	7.7.4	Green Solvents Highlight	170
7.8		Shell	171
	7.8.1	Overview	171
	7.8.2	End Use Markets.....	171
	7.8.3	Solvents Business	172
	7.8.4	Green Solvents Highlight	173
7.9		Eastman Chemical Company.....	173
	7.9.1	Overview	173
	7.9.2	End Use Markets.....	174
	7.9.3	Solvents Business	174
	7.9.4	Green Solvents Highlight	174
7.10		BASF	175
	7.10.1	Overview	175
	7.10.2	End Use Markets.....	175
	7.10.3	Solvents Business	175
	7.10.4	Green Solvents Highlight	176
7.11		ExxonMobil Chemical.....	176
	7.11.1	Overview	176
	7.11.2	Solvent End Use Markets.....	176
	7.11.3	Solvents Business ⁰	177
	7.11.4	Green Solvents Highlight	178
7.12		INEOS	179
	7.12.1	Overview	179
	7.12.2	End Use Markets.....	179



7.12.3	Solvents Business	179
7.12.4	Green Solvents Highlight	180
7.13	Archer Daniels Midland	180
7.13.1	Overview	180
7.13.2	End Use Markets.....	180
7.13.3	Solvents Business	180
7.13.4	Green Solvents Highlight	181
7.14	Cargill	181
7.14.1	Overview	181
7.14.2	End Use Markets.....	181
7.14.3	Solvents Business	181
7.14.4	Green Solvents Highlight	182
7.15	Evonik.....	182
7.15.1	Overview:	182
7.15.2	End Use Markets:.....	183
7.15.3	Solvent Business:.....	183
7.15.4	Green Solvents Highlights ⁰	183
7.16	Neste	184
7.16.1	Overview	184
7.16.2	End Use Markets.....	184
7.16.3	Solvents Business	184
7.16.4	Green Solvents Highlight	185
7.17	PennAKem	186
7.17.1	Overview	186
7.17.2	End Use Markets.....	186
7.17.3	Solvents Business	187
7.17.4	Green Solvents Highlight	187
7.18	Stepan Company.....	188
7.18.1	Overview	188
7.18.2	End Use Markets.....	188
7.18.3	Solvents Business	188
7.18.4	Green Solvents Highlight	188
7.19	Sasol	189
7.19.1	Overview	189
7.19.2	End Use Markets.....	189
7.19.3	Solvents Business	189
7.19.4	Green Solvents Highlight	189
7.20	UBE Industries	190
7.20.1	Overview	190
7.20.2	End Use Markets.....	190
7.20.3	Green Solvents Highlight	190
7.21	Dow	191
7.21.1	Overview	191
7.21.2	End Use Markets.....	191



7.21.3	Solvents Business	191
7.21.4	Green Solvents Highlight	193
7.22	Feiyang Frontsea Novelchem	193
7.22.1	Overview	193
7.22.2	End Use Market for Green Solvents	193
7.22.3	Solvents Business	193
7.22.4	Green Solvents Highlight	193
7.23	Yuanli Chemical	194
7.23.1	Overview	194
7.23.2	End Use Markets.....	194
7.23.3	Solvents Business	194
7.23.4	Green Solvents Highlight	194
7.24	Other Green Solvent Producers.....	194
7.24.1	Gevo.....	194
7.24.1.1	Overview	194
7.24.1.2	Green Solvent Activity.....	194
7.24.2	Clariant.....	195
7.24.2.1	Overview	195
7.24.2.2	Green Solvent Activity.....	195
7.24.3	Croda.....	195
7.24.3.1	Overview	195
7.24.3.2	Green Solvent Activity.....	195
7.24.4	Elevance.....	195
7.24.4.1	Overview	195
7.24.4.2	Green Solvent Activity.....	196
7.24.5	Romil Pure Chemistry	196
7.24.5.1	Overview	196
7.24.5.2	Green Solvent Activity.....	196
7.24.6	Honeywell.....	196
7.24.6.1	Overview	196
7.24.6.2	Green Solvent Activity.....	196
7.24.7	Celanese	197
7.24.7.1	Overview	197
7.24.7.2	Green Solvent Activity.....	197
7.24.8	Chemrec.....	198
7.24.8.1	Overview	198
7.24.8.2	Green Solvent Activity.....	198
7.24.9	India Glycols.....	198
7.24.9.1	Overview	198
7.24.9.2	Green Solvent Activity.....	198
8	NexantECA Solvent Market Attractiveness Index (NESMAI)	199
Appendices		
A	References	205



Figures

Figure 1	Global Solvents Market by Solvent Types, 2022-e	1
Figure 2	Global Solvent Market Size by Region, 2015-2035	2
Figure 3	Green Solvents Market Penetration by Region	3
Figure 4	Global Solvent Market Size by End Use Sector, 2015-2035.....	4
Figure 5	Green Solvents Market Penetration by Industries	4
Figure 6	NESMAI Parameters	5
Figure 7	NESMAI Output - US.....	6
Figure 8	NESMAI Output – Western Europe	7
Figure 9	NESMAI Output - China	8
Figure 10	Global Solvents Market by Solvent Types, 2022-e	10
Figure 11	Most Used Solvent End-of-Life Practices (USA)	15
Figure 12	U.S. Solvent Regulatory Framework	22
Figure 13	OSHA State Approved Plans.....	26
Figure 14	Resource Conservation and Recovery Act	37
Figure 15	Solid Waste Rules	38
Figure 16	Summary of EU Regulations Impacting Solvents	45
Figure 17	EU Air Pollution Regulations	48
Figure 18	Japan’s Chemical Substances Control Law	67
Figure 19	Ordinance on Prevention of Organic Solvent Poisoning	68
Figure 20	Summary of Brazil Regulations Impacting Solvents	69
Figure 21	Global Paints and Coatings Demand by End Use, 2022-e	74
Figure 22	Regional Paints and Coatings Solvent Demand, 2022-e	75
Figure 23	Global Adhesives Demand by End Market, 2022-e	78
Figure 24	Regional Adhesives Solvent Demand, 2022-e.....	79
Figure 25	Global Printing Inks Demand by End Market, 2022-e	81
Figure 26	Regional Paints and Coatings Solvent Demand, 2022-e	81
Figure 27	Global Industrial and Institutional Cleaning Demand by End Market, 2022-e.....	84
Figure 28	Regional Industrial and Institutional Cleaning Solvent Demand, 2022-e	84
Figure 29	Global Home and Personal Care Demand by End Market, 2022-e	87
Figure 30	Regional Home and Personal Care Solvent Demand, 2022-e.....	87
Figure 31	Regional Pharmaceutical Products Solvent Demand, 2022-e	89
Figure 32	Global Pesticides Demand by End Market, 2022-e	93
Figure 33	Regional Agrochemicals Solvent Demand, 2022-e.....	94
Figure 34	Regional Electronics Markets Demand, 2022-e	96
Figure 35	Solvents Applications Estimate by Volume, 2022-e	100
Figure 36	Global Solvents Demand by Region, 2022-e	101
Figure 37	Global Solvent Market Size by Region, 2015-2035	103
Figure 38	Green Solvents Market Penetration by Region	103
Figure 39	Global Solvent Market Size by End Use Sector, 2015-2035.....	104
Figure 40	Green Solvents Market Penetration by Industries.....	104
Figure 41	North America Solvents by Industry, 2015-2035.....	105
Figure 42	North America Solvent by Industry, 2022-e.....	105



Figure 43	South America Solvents by Industry, 2015-2035	108
Figure 44	South America Solvent by Industry, 2022-e	108
Figure 45	Western Europe Solvents by Industry, 2015-2035	110
Figure 46	Western Europe Solvent by Industry, 2022-e	110
Figure 47	China Solvents by Industry, 2015-2035	111
Figure 48	China Solvent by Industry, 2022-e	111
Figure 49	Asia Pacific (excluding China) Solvents by Industry, 2015-2035	112
Figure 50	Asia Pacific (excluding China) Solvent by Industry, 2022-e	112
Figure 51	Global Acetic Acid Capacity Share by Marketer	115
Figure 52	Global Acetic Acid Demand	116
Figure 53	Production Cost Comparison of Acetic Acid	117
Figure 54	Global Formic Acid Demand by End-Use	118
Figure 55	Ethanol Cost Competitiveness	121
Figure 56	Global Methanol Demand	121
Figure 57	Primary Routes to bio-Methanol and e-Methanol	122
Figure 58	Methanol Cost Competitiveness	123
Figure 59	Reaction chemistry for propylene glycol from glycerol	124
Figure 60	Global Propylene Glycol Biobased vs Synthetic Capacity	125
Figure 61	Global Propylene Glycol Demand by End-Use	125
Figure 62	Propylene Glycol Cost Competitiveness	127
Figure 63	Global Isopropanol Demand by End-Use	128
Figure 64	Isopropanol Cost Competitiveness	129
Figure 65	FAME Biodiesel Production Capacity by Region	130
Figure 66	Synthetic Glycerol Demand by End-Use	131
Figure 67	Routes to Ethyl Acetate	133
Figure 68	Ethyl Acetate Demand by End-Use	134
Figure 69	Ethyl Lactate Cost Competitiveness	136
Figure 70	Global Dimethyl Carbonate Demand by End-Use	137
Figure 71	Global Natural Oils Production	138
Figure 72	Methyl Soyate Solvent Replacement Potential	141
Figure 73	Overview of Production Steps of Methanol and DME	141
Figure 74	Global THF Capacity by Marketer	143
Figure 75	Global THF End Use	144
Figure 76	THF Cost Competitiveness	145
Figure 77	Global Acetone Capacity by Marketer	148
Figure 78	Global Acetone Consumption by End-Use	150
Figure 79	d-Limonene Production Process	154
Figure 80	Applications of Ionic Liquids	158
Figure 81	Solvay Revenues by Region, 2021	162
Figure 82	Solvay End Use Markets (Revenues) 2021	163
Figure 83	Huntsman Revenues by Region, 2021	164
Figure 84	Neste Renewable Products Range	185
Figure 85	NESMAI Parameters	199
Figure 86	NESMAI Results - US	202



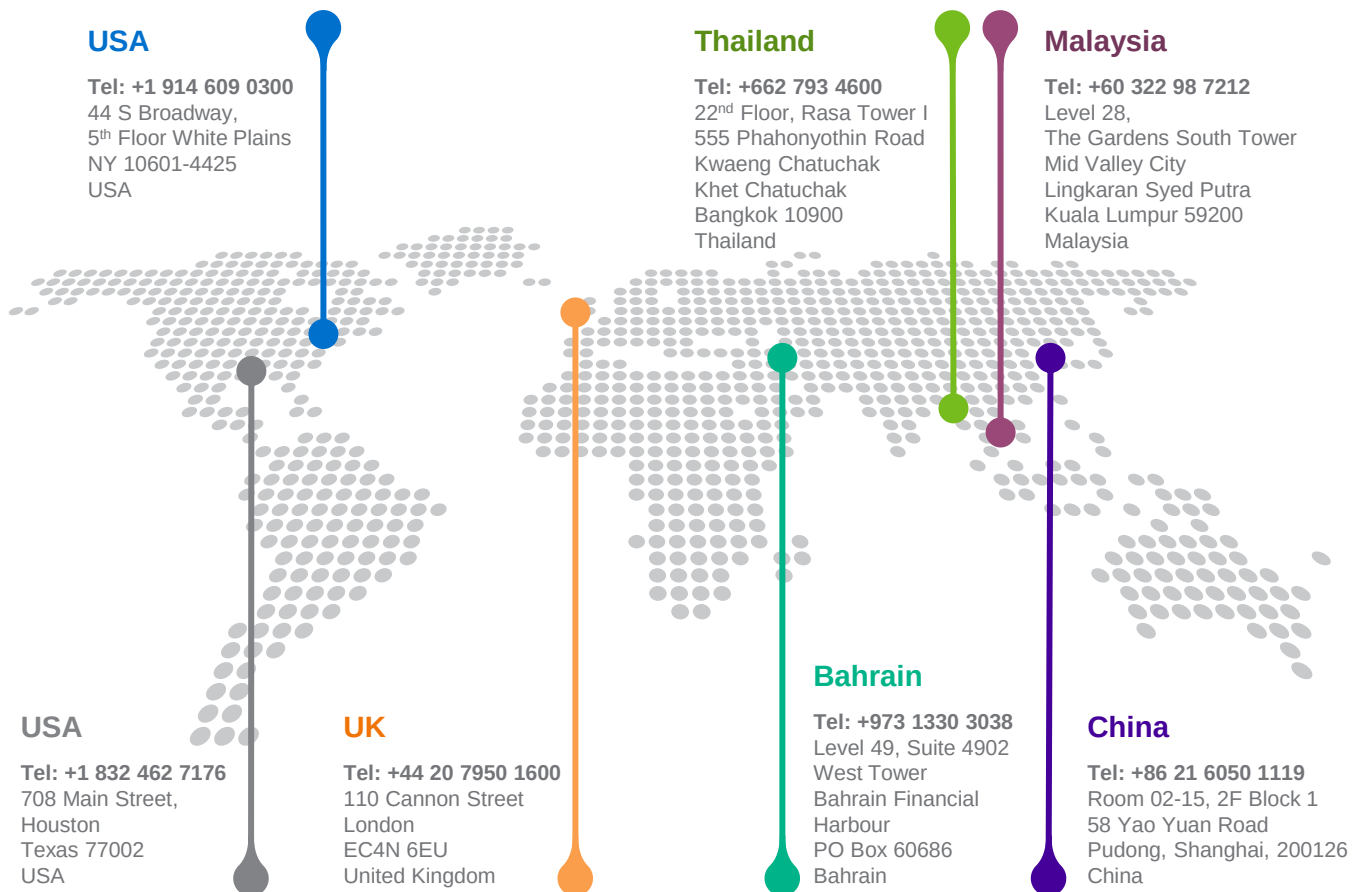
Figure 87	NESMAI Results – Western Europe.....	203
Figure 88	NESMAI Results - China	204

Tables

Table 1	Classification of Residual Solvents by Risk Assessment.....	18
Table 2	Solvents Under Risk Evaluation by EPA	24
Table 3	OSHA Regulatory Standards.....	27
Table 4	SNAP Applications	29
Table 5	Existing Standards for Hazardous Air Pollutants ⁰	32
Table 6	Application of RACT/BACT/LAER and MACT for VOC and HAP Emissions.....	35
Table 7	Class 1 Solvents in Pharmaceutical Products.....	40
Table 8	Class 2 Solvents in Pharmaceutical Products.....	41
Table 9	Class 3 Solvents Which Should Be Limited by GMP or Other Quality-Based Requirements	42
Table 10	Solvents for Which No Adequate Toxicological Data Were Found	42
Table 11	Compliance with SED 99/13/EC	47
Table 12	IED Implementation Requirements	51
Table 13	Adhesives Categories.....	77
Table 14	Global Solvent Demand by End Use 2015-2035	101
Table 15	Global Solvent Demand by Region 2015-2035.....	101
Table 16	Major Global Methanol Producer, 2022.....	122
Table 17	DMC Replacement Potential	138
Table 18	Methyl Soyate Solvent Application	140
Table 19	Identified Global Bio-Acetone Capacity	149
Table 20	Identified Global MIBK Producer Capacities	153
Table 21	Rhodiasolv IRIS Applications and Benefits	156
Table 22	Identified major Producers of Ionic Liquids	158
Table 23	NESMAI Parameters	200



NexantECA partners with clients to help them navigate the big global energy, chemicals and materials issues of tomorrow. We provide independent advice through our consulting, subscriptions and reports, and training businesses using expertise developed in markets, economics and technology through our fifty years of operation. We are entirely dedicated to supporting sustainable development of the industry and provide expert advice with efficiency, speed, and agility.



Disclaimer

This Report was prepared by NexantECA, the Energy and Chemicals Advisory company. Except where specifically stated otherwise in this Report, the information contained here is prepared on the basis of information that is publicly available, and contains no confidential third-party technical information to the best knowledge of NexantECA. Aforesaid information has not been independently verified or otherwise examined to determine its accuracy, completeness or financial feasibility. Neither NexantECA, Client nor any person acting on behalf of either assumes any liabilities with respect to the use of or for damages resulting from the use of any information contained in this Report. NexantECA does not represent or warrant that any assumed conditions will come to pass.

Copyright © by NexantECA (BVI) Ltd. 2022. All rights reserved.