Appendix

Table 1s. Studies on future analysis of power generation and Renewable Energy (RE), with Methodologies of Analytic (A), Descriptive (D) and Analytic- Descriptive (AD)

Scope	Methodology //Findings
Iran	AD// Five scenarios- considering constant cost of conversion of Solar or Wind energy (Jalalimajidi et al., 2018)
Iran	A// Two scenarios -estimated that RE technologies can generate sufficient energy to fulfil all electricity demand in Iran by 2030 Aghahosseini et al, 2017)
Ireland	D// Four scenarios- show that electricity demand will increase dramatically in the future- Correspondingly, the electricity generation portfolio will continue to decarbonize, with growing levels of renewables (EirGrid, 2017)
Iran	D// Finance of the projects is still a challenge. Banks and financial institute are worried about Iranian deal and risk of sanctions imposed by USA (Weston, 2016)
Pakistan	D// proved theoretically that selected wind zone is more favorable for country consumer demand- future perspective and the major challenges during windmill implementation were also being discussed. (Baloch et al, 2016)
Iran	D// Briefing challenges and opportunities: Challenges: Finance, bank transfer, lack of experience from existing renewable energies plants, undefined standards for the grid connection. Opportunities: Excellent geographic and topographic conditions, very attractive feed-in tariffs and a high rate of return (Watson Farley and Williams, 2016)
Spain	A// proposing State space models in order to simulate wind power plant output and generate scenarios to analyze capabilities of wind power plants generation (Díaz et al, 2016)
Global	A// Presenting how main elements on Wind Power could be analyzed comprising Project costs, production, subsidies and power price, operation costs, project-end options, financing, tax and required rate of return (Deloitte, 2015)
Iran	D// Five barriers on RE in Iran: complicated procedure of applying for license, uncertainty about feed-in tariff, finance, uncertainty about on time payment by the government, instability in pertaining regulations (Sadegh Zadeh, 2015)
Iran	AD// Four scenarios- Standardization and fossil energy as most probable scenarios, Green path (10% RE) as most optimistic scenario and non-targeted subsidy as most pessimistic (Chaharsooghi et al., 2015)
Japan	A// Quantifying key factors affecting on global onshore wind energy by 2050. Five factors, including onshore wind resource potential, investment cost, balancing cost, transmission cost and climate change mitigation policy (Dai et al, 2016)
Iran	A// Two scenarios: a wind power plant and a hydro power plant foundation- results showed a decrease in the share of natural gas and an increase in the share of wind power and hydro power. (Hasankhani et al, 2015)
Iran	AD// Costs and benefits of a 100MW Wind Plant was analyzed and investment and production incentives were evaluated. (Houshmand and Hosseini, 2014)
Global	AD// Analyzing demographic, economic and social impacts affecting the market and the substantial market trends in each geographic region-the report forecasts demand for Wind power to 2030 using a series of scenarios. (Knight, et al, 2013)
India	D// Targeted 15% renewable energies by 2030 - only if wind sector could be grown without brakes and policy withdrawals (Chauhan, Agarwal, and Suman, 2013)
Iran	D// Showing the increase in energy demand between 2005-2030 in average by 2.6% (BAU), 0.4% (efficiency), 2.4% (renewable) and 0.2% (combined) annually (Panjeshahi, 2012)
Iran	AD// Three scenarios: Fossil Scenario proceeding current process, Nuclear Energy Scenario and RE Scenario, consequently consisting of 14%, 21% and 27% renewable energies (Razini, et al, 2011)

Table 2s. List of Critical factors and driving forces

	Descriptor	Citation		Descriptor	Citation
Investment	Investment cost	Baloch et al, 2016	Power Purchasing	Feed-in Tariff	Schleich et al., 2017
		Die et al, 2015			Weston, 2016
	Finance	Weston, 2016			Watson Farley and Williams, 2016
		Watson Farley and Williams,2016			Deloitte, 2015
		Deloitte, 2015			Sadegh Zadeh, 2015
		Sadegh Zadeh, 2015			Chauhan et al., 2013
	Rate of Return	Watson Farley and Williams,2016			
		Deloitte, 2015			Hooshmand and Hosseini, 2014
	Ex-Change Rate	Ayandeban, 2016		Payment Transaction	Weston, 2016
		Hooshmand and Hosseini, 2014			Watson Farley and Williams, 2016
		Hanafizadeh et al, 2011		Wind power price compared to thermal , hydropower, etc.	Zhao et al., 2016
	Interest Rate	Ayandeban, 2016		Proceeding with targeted subsidies	Ayandeban, 2016
		Hanafizadeh et al, 2011		Tax	Hvelplund et al., 2017
	financial Institutes collaboration with Iran	Weston, 2016			
		Farsi et al, 2016			Deloitte, 2015
	Paving the way for foreign investors	Ayandeban, 2016			Chauhan et al., 2013
	Import Duty	Chauhan et al, 2013		Guaranteed Period of Purchasing	Watson Farley and Williams, 2016
					Sadegh Zadeh, 2015
Technology	Capacity Factor		Network and Demand	Integration between electricity, heating and transportation sectors	Hvelplund et al., 2017
		Greenpeace,2008		Construction lag of grid and peak regulation power plants	Zhao et al, 2016
		EWEA, 2008		Total electricity Demand	Hasankhani et al., 2015
	Technology Improvement capability	Ayandeban, 2016			Panjeshahi, 2012
		Chauhan et al, 2013			EWEA, 2008
				Energy Efficiency	EWEA, 2008
		EWEA, 2008		Growth Rate of Wind Power Market	Watson Farley and Williams, 2016
		Thresher et al, 2008			Chauhan et al, 2013
	Turbine Capacity	Schleich et al, 2017		National grid being upgraded to cope with influx of Renewable Energy	Weston, 2016
				Electric utility quota obligation	
		Greenpeace, 2008	Operation and Maintenance	Operation Cost	Deloitte, 2015
	Turbine Size			Replacement of Old Turbines	EWEA, 2008
		Thresher et al, 2008		Local Experience to be referred	Watson Farley and Williams, 2016

	Production Cost of Turbine	Schleich et al, 2017		Consulting companies who could provide consultancy during whole life cycle of wind farm	Zhao et al., 2016
				Stability of Government	Hanafizadeh et al., 2011
		Greenpeace,2008	Politics	Continuity of JCPOA	Ayandeban, 2016
	Production Time			Next President Election in Iran and USA	Ayandeban, 2016
	Local Manufacturing capability	Chauhan et al, 2013		Offshore Wind Resource Potential	
					Thresher et al, 2008
	Binding Emission reduction	Panjeshahi, 2012		Onshore Wind Resource Potential	Wheeler and Desai, 2016
		EWEA, 2008			Brautlecht and Nicola, 2015
	Procedure of work permit	Watson Farley and Williams,2016			Die et al., 2015
		Sadegh Zadeh, 2015			Niroo Research Institute, 2016
Policies	Political ambitious	Hvelplund et al, 2017	Geography		
		Weston, 2016			Thresher et al., 2008
				Site Selection	Baloch et al., 2016
		Chauhan et al, 2013			Watson Farley and Williams,2016
		EWEA, 2008		Quality of territorial Wind Sources	Zhao et al, 2016
	Laws stability and Consistency				Baloch et al., 2016
	Domestic Infrastructure Development	Farsi et al, 2016			Khalaji and Safaei, 2003
Social, Cultural and Ecological	ownership transfer of the lands by owners to Wind farm developers	Hvelplund et al, 2017			
		Zhao et al, 2016			
	Citizens' resistance for on-shore and near-shore wind power expansion	Hvelplund et al, 2017			

Table 3s. Profile of Interviewees at Phase 1

No.	Education	Experience	Working Organization
1	Master	More than 15 years	Wind Farm Consultant
2	Master	10-15 years	Wind Farm EPC Contractor
3	Master	10-15 years	Research institute
4	Doctorate	More than 15 years	Research institute
5	Doctorate	7-8 years	Research institute
6	Doctorate	7-8 years	Research institute
7	Doctorate	7-8 years	Research institute
8	Master	7-8 years	Parts Manufacturer
9	Master	10-15 years	Parts Manufacturer
10	Master	7-8 years	Wind Farm Investor
11	Master	10-15 years	Parts Manufacturer

Table 4s. CIB Matrix

		A		B				C			D			E			F		G			H		I		J		K	
		A1	A2	B1	B2	B3	B4	C1	C2	C3	D1	D2	D3	E1	E2	E3	F1	F2	G1	G2	G3	H1	H2	I1	I2	J1	J2	K1	K2		
A	A1			-2	-2	-2	-2	0	0	0	2	0	-2	0	0	-1	0	0	0	0	0	-1	1	0	0	0	0	1	-1		
	A2			2	2	3	2	0	0	0	-1	0	2	-1	0	1	0	0	0	0	0	1	-1	0	0	0	0	-1	1		
B	B1	0	0					0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0		
	B2	-1	1					0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0		
	B3	0	0					0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
	B4	-1	1					0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0	1	-1	0	0	1	0		
C	C1	2	-2	-2	0	-2	0				1	0	-2	0	0	-1	1	-1	0	0	0	-1	1	-1	1	0	0	1	0		
	C2	0	0	2	2	2	2				0	2	0	0	1	0	-1	1	0	0	0	1	-1	1	-1	0	0	0	-1		
	C3	-1	3	2	1	2	1				-1	-1	1	0	1	0	-1	1	0	0	0	1	-1	0	0	0	0	-1	1		
D	D1	0	0	2	2	3	3	0	0	0				-1	-1	1	1	-1	0	0	0	0	0	0	0	0	0	0	-1		
	D2	0	0	1	1	1	1	0	0	0				0	1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0		
	D3	0	0	-2	-2	-2	-2	0	0	0				0	0	0	-1	1	0	0	0	0	0	0	1	0	0	0	0		
E	E1	0	0	1	1	1	1	0	0	0	-1	0	1				0	0	0	0	0	0	0	0	0	0	0	0	0		
	E2	0	0	0	1	1	1	0	0	0	0	1	0				0	0	0	0	0	0	0	0	0	0	0	0	0		
	E3	0	0	-1	-1	-1	-1	0	0	0	1	0	-1				0	0	0	0	0	0	0	0	0	0	0	0	-1		
F	F1	1	-1	-2	-2	-2	-2	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0		
	F2	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0			0	0	0	0	0	0	0	0	0	0	0		
G	G1	-1	2	2	2	2	3	-1	2	1	0	1	0	0	1	0	0	0				1	-1	1	-1	0	0	1	0		
	G2	1	-1	0	0	0	0	0	0	-1	0	0	0	0	0	0	0	0				1	0	0	0	0	0	0	0		
	G3	1	-2	-2	-2	-2	-1	2	-2	-1	0	-1	0	-1	-1	0	1	-1				-2	2	-1	1	0	0	-1	1		
H	H1	-1	1	2	2	2	2	0	0	0	2	1	0	1	1	-1	-1	1	0	0	0			1	-1	1	-1	1	-1		
	H2	0	-1	-2	-2	-2	-2	0	0	0	-2	-1	0	-1	-1	1	1	-1	0	0	0			-1	1	-1	0	-1	1		
I	I1	0	0	1	1	1	1	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0			0	0	0	0		
	I2	0	-1	-1	-1	-1	-2	0	0	0	0	-1	0	0	-1	0	0	0	0	0	0	0	0			0	0	0	0		
J	J1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	-1			0	0		
	J2	0	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	1			0	0		
K	K1	-1	1	1	1	1	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				
	K2	0	0	-1	-1	-1	-1	0	0	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0				

Table 5s. Analysis Structure

Descriptor	Variant	Descriptor	Variant
A. Investment Cost	A1. Increase	F. Delay in payment and how to compensate it	F1. Delayed Payments
	A2. Decrease		F2. On time payments
B. Finance	B1. Joint Investment by local investors and Iranian Banks (bank loans)	G. Continuity of Joint Comprehensive Plan of Action	G1. Continuity of Joint Comprehensive Plan of Action with further evolvement in International collaboration with Iran
	B2. Joint Investment by local and foreign Investors		G2. Continuity of Joint Comprehensive Plan of Action with current limitations in International collaboration with Iran
	B3. 100% finance by local Investor		G3. Termination of Joint Comprehensive Plan of Action
	B4. 100% finance by foreign Investor	H. Political ambitious	H1. Willingness and support by government to develop Wind Farm
C.Ex-change Rate	C1. Increase		H2. Unwillingness to support Wind Farm development
	C2. Stability	I. Laws stability	I1. Stability
	C3. Decrease		I2. Non-stability
Feed-in Tariff	D1. Increase	J. Consistency	J1. consistency between laws and authorizations related to the project implementation
	D2. Stability		
	D3. Decrease		J2. inconsistency between laws and authorizations related to the project implementation
E. Guaranteed Period of Purchasing	E1. Increase to more than 20 years		
	E2. Stability at 20 years	K. Capital subsidy and grant or rebate	K1. Allocated
	E3. Decrease from 20 years		K2. Not allocated

Table 6s. State of Scenarios

Scenario No.	A	B	C	D	E	F	G	H	I	J	K	Impact Score	Optimistic (O)	Moderate (M)	Pessimistic (P)
1	A2	B4	C2	D2	E2	F2	G1	H1	I1	J1	K1	51	8	3	0
	O	O	M	M	M	O	O	O	O	O	O				
2	A2	B4	C1	D2	E2	F2	G2	H1	I1	J1	K1	26	7	3	1
	O	O	P	M	M	O	M	O	O	O	O				
3	A2	B3	C2	D2	E2	F2	G2	H1	I1	J1	K1	34	7	4	0
	O	O	M	M	M	O	M	O	O	O	O				
4	A2	B4	C2	D2	E2	F2	G2	H1	I1	J1	K1	38	7	4	0
	O	O	M	M	M	O	M	O	O	O	O				
5	A1	B4	C1	D2	E2	F1	G2	H2	I1	J1	K1	12	4	3	4
	P	O	P	M	M	P	M	P	O	O	O				
6	A1	B4	C1	D1	E3	F1	G2	H2	I1	J1	K1	13	5	1	5
	P	O	P	O	P	P	M	P	O	O	O				
7	A1	B4	C1	D1	E3	F1	G2	H2	I2	J1	K1	10	4	1	6
	P	O	P	O	P	P	M	P	P	O	O				
8	A1	B4	C1	D1	E3	F1	G3	H2	I2	J1	K1	16	4	0	7
	P	O	P	O	P	P	P	P	P	O	O				
9	A1	B4	C1	D1	E3	F1	G2	H2	I2	J2	K1	10	3	0	8
	P	O	P	O	P	P	P	P	P	P	O				
10	A1	B4	C1	D1	E3	F1	G3	H2	I2	J2	K1	16	3	0	8
	P	O	P	O	P	P	P	P	P	P	O				

Table 7s. The spectrum of Scenarios from Most Optimistic to the Most Pessimistic

Most Optimistic←				Moderate					→Most Pessimistic
1	4	3	2	6	5	8	7	9	10

Table 8s. Total Impact and Influence of Critical Factors and Driving Forces

Descriptor	Variant	Impact	Influence	Descriptor	Variant	Impact	Influence
A. Investment Cost	A1. Increase	19	13	E. Delay in payment and how to compensate it	F1. Delayed Payments	10	8
	A2. Decrease	17	18		F2. On time payments	4	7
B. Finance	B1. Joint Investment by local investors and Iranian Banks (bank loans)	3	34	G. Continuity of JCPOA	G1. Continuity of JCPOA with further evolvement in International collaboration with Iran	23	0
	B2. Joint Investment by local and foreign Investors	4	32		G2. Continuity of JCPOA with current limitations in International collaboration with Iran	4	0
	B3. 100% finance by local Investor	0	36		G3. Termination of JCPOA	28	0
	B4. 100% finance by foreign Investor	8	34	H Political ambitious	H1. Willingness and support by government to develop Wind Farm	24	10
C. Ex-change Rate	C1. Increase	19	3		H2. Unwillingness to support Wind Farm development	22	8
	C2. Stability	18	4	I. Laws stability	I1. Stability	6	10
	C3. Decrease	20	3		I2. Non-stability	8	10
D. Feed-in Tariff	D1. Increase	16	13	J. Consistency	J1. consistency between laws and authorizations related to the project implementation	6	2
	D2. Stability	5	13				
	D3. Decrease	11	10		J2. inconsistency between laws and authorizations related to the project implementation	7	1
G. Guaranteed Period of Purchasing	E1. Increase to more than 20 years	6	5				
	E2. Stability at 20 years	3	11	K. Capital subsidy and grant or rebate	K1. Allocated	8	10
	E3. Decrease from 20 years	7	8		K2. Not allocated	5	9

Table 9s. Complying references with proposed guidelines

Guideline No.	Description	References
Boom 1	Establishment of the wind power industry with advanced standards and technologies	(International Energy Agency and Energy Research Institute, 2011)
Boom 2	Developing local capabilities for production of Wind Power components and equipment	(Zhao et al., 2016)
Boom 3	Improving the capacity of power grid for wind power with enlarging total capacity of power grid system, planning wind farm construction, connection system and determine grid-connected load of wind power, increasing the installed capacity of peak load units such as natural gas-fired power plants, pumped storage hydropower or Photovoltaics to raise the peak-shaving capacity of the grid and enhance the grid frequency by regulating and scheduling ability	(Hvelplund et al., 2017) (Zhao et al., 2016) (Laois County Council, 2011), (International Energy Agency and Energy Research Institute, 2011),
Boom 4, Realistic 2	Improving the performance of wind system component**s**	(International Energy Agency and Energy Research Institute, 2011)
Boom 5	Older small wind turbines to be retired, transformed or reconstructed	(International Energy Agency and Energy Research Institute, 2011)
Boom 6	Developing Transport infrastructure to meet the needs of developers	(Hvelplund et al., 2017) (IEA, 2014)
Boom 7	Improving advanced large-capacity turbine system RandD capabilities	(Zhao et al., 2016) (International Energy Agency and Energy Research Institute, 2011)
Boom 8, Realistic 11	Educating local population on benefits of wind power	(Landeta-Manzano et al, 2018) (Zhao et al., 2016) (IEA, 2014)
Boom 9	Development of transmission network for possible trade of power throughout the country and neighbor countries	(Hvelplund et al., 2017), (Dai et al., 2016) (IEA, 2014), (International Energy Agency and Energy Research Institute, 2011)
Boom 10	Offshore Wind Power to be started	(Hvelplund et al., 2017), (International Energy Agency and Energy Research Institute, 2011)
Boom 11	Improving more flexible high-voltage DC (HVDC), superconductive and low frequency transmission technologies for large-scale wind farms and long distances	(International Energy Agency and Energy Research Institute, 2011)
Boom 12	Applying smart dispatching techniques for optimal allocation of power resources	(Hvelplund et al., 2017), (IEA, 2014) (International Energy Agency and Energy Research Institute, 2011)
Boom 13	Preferential dispatch paired with economic incentives, including the establishment of market-based power pricing and regulations for grid integration and accommodation of large-scale wind power.	(Hvelplund et al., 2017), (International Energy Agency and Energy Research Institute, 2011)
Boom 14, Realistic 12	Plan for and encourage wide geographic distribution of Wind Power Plants	(IEA, 2014)

Realistic 1	depending on the distance between power transmission lines and wind farms, subsidies to be awarded to help connect wind farms to the power grid	(International Energy Agency and Energy Research Institute, 2011)
Realistic 3	Securing reliable supply of key materials or develop alternatives	(International Energy Agency and Energy Research Institute, 2011)
Realistic 4	Considering capacity payment subsidy to compensate for lost revenue with payments to plants offering flexible capacity for controlled Curtailment	(Hvelplund et al., 2017) (IEA, 2014)
Realistic 5	Removing trade barriers (e.g. removing or reducing import duties and taxes)	(IEA, 2014)
Realistic 6	Encouraging technology exchange with mature wind energy markets	(IEA, 2014)
Realistic 8	Increasing the deployment of renewable energy across three key sectors: electricity, heat and transport	(Hvelplund et al., 2017) (Laois County Council, 2011)
Realistic 9	Enhancement of wind resource assessment technical standards and technical capability	(International Energy Agency and Energy Research Institute, 2011)
Realistic 10	Enhancement of overall planning and co-ordination of wind power and other power plants and construction of power grids	(Zhao et al., 2016) (International Energy Agency and Energy Research Institute, 2011)
Realistic 13	Considering market reform to reward flexibility from different sources in order to encourage fast power plants, demand-side management and response, interconnection and storage	(Hvelplund et al., 2017) (IEA, 2014)

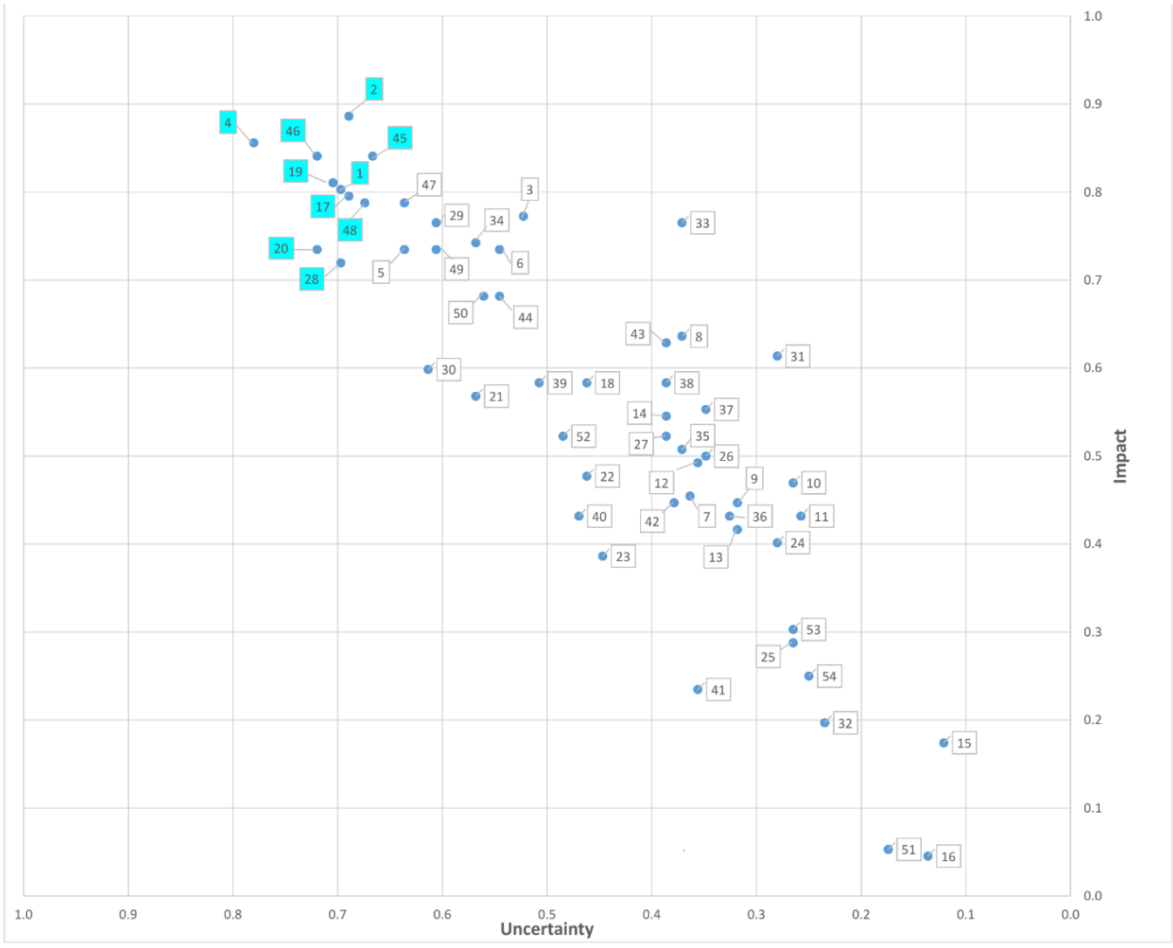

Figure 1s. Uncertainty-Impact Matrix (High-Uncertainty items are shown in blue)

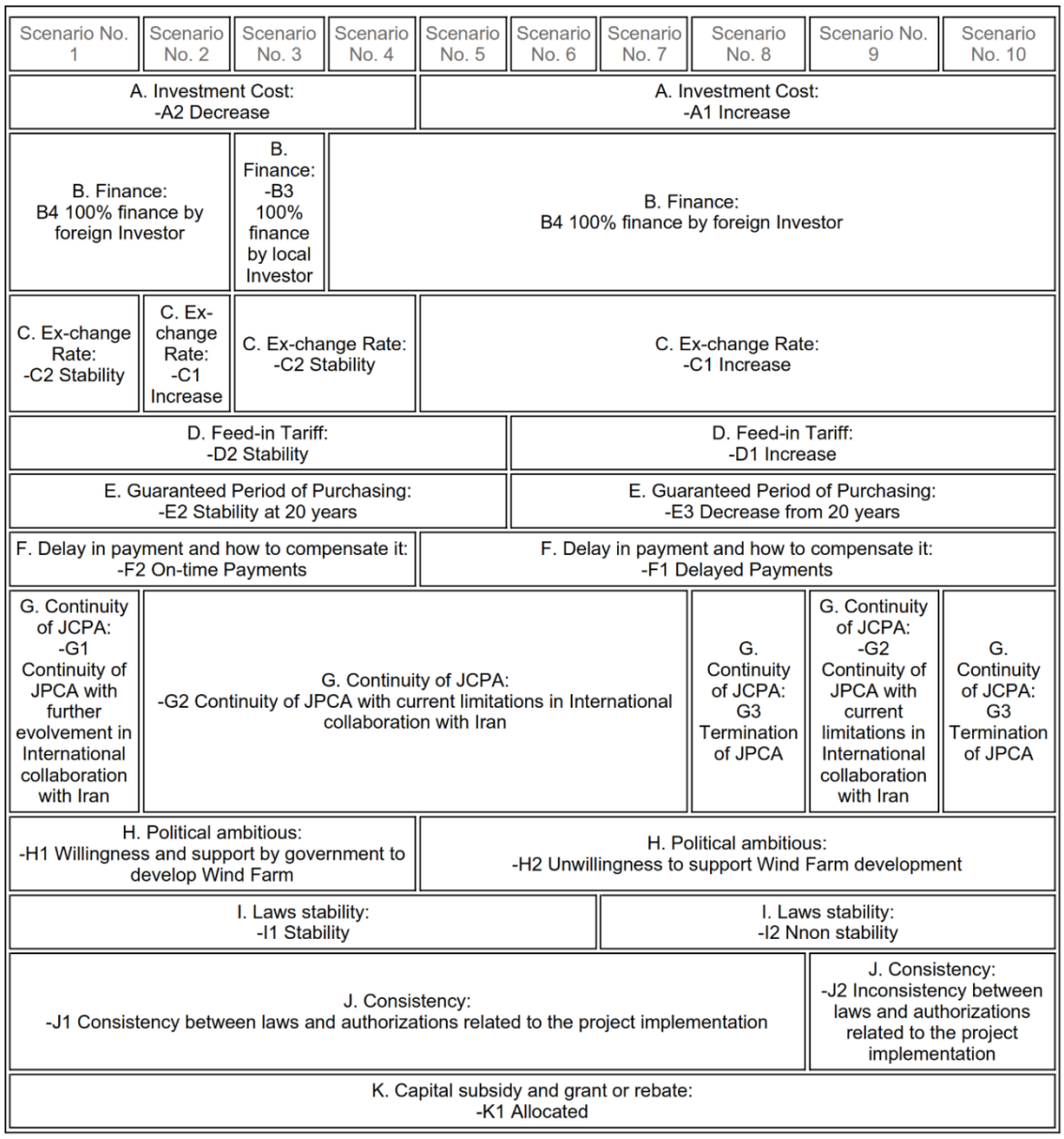

Figure 2s. Tableau of Scenarios