

Contents

1 Influences of EVs on Power System by Improving the Microclimate	1
1.1 Introduction	1
1.2 The Impact of Urban Microclimate on Electric ACEC	3
1.2.1 Case and Data Selection	4
1.2.2 Electrical ACEC Data	5
1.2.3 Effect of UHIE on Perceived Temperature	7
1.2.4 Effect of THE on Perceived Temperature	8
1.2.5 Effect of CE on Perceived Temperature	9
1.3 Interaction Between Urban Microclimate and Electric ACEC	11
1.3.1 Comprehensive Effect of Urban Microclimate on Electric ACEC	11
1.3.2 The Feedback of Electric ACEC on Urban Microclimate	12
1.4 Discussion About Interaction Between Urban Microclimate and Electric ACEC	13
1.5 The Influence of EVs on Urban Microclimate	16
1.6 Case Study on Influences of EVs on Urban Microclimate	17
1.7 Reduction of ACEC	18
1.8 Conclusions	19
References	20
2 The Response of EV Charging Loads to TOU Price	25
2.1 Introduction	25
2.2 Optimized Charging Model in Response to TOU Price	26
2.3 Algorithm	28
2.4 Case Study	30
2.4.1 Settings of Simulation	30
2.4.2 The Results and Analysis of Simulation	32
2.5 Conclusions	34
References	35

3	The Response of EV Charging Load to the Grid Voltage	37
3.1	Introduction	37
3.2	The Profile of the Proposed Strategy	39
3.2.1	The Selection of Voltage Signal	39
3.2.2	UVLS with the Participation of EV Charging Load	40
3.3	Case Study	43
3.3.1	Parameters and Model of Simulation	43
3.3.2	Results of the Simulation	44
3.4	Conclusions	47
	References	48
4	The Response of Large-Scale EV Charging Loads to Frequency	49
4.1	Introduction	49
4.2	Characteristics of EV Charging Loads	49
4.3	The Current Related Research of EVs on FR	50
4.3.1	EVs' Advantages in FR	50
4.3.2	The Current Related Research of FR Based on the Coordination Among EVs, AGC, BESSs	51
4.4	Properties of FR Resources	52
4.4.1	Traditional FR Resources	52
4.4.2	Large-Scale Energy Storage Devices	52
4.4.3	EV/BESS FR Resource	53
4.5	Coordinated Control Strategy for EVs/BESSs	55
4.5.1	Coordination Principle	55
4.5.2	Implementation Method for Coordinated FR	57
4.6	Case Study and Results	62
4.6.1	Simulation Model and Parameters	62
4.6.2	Simulations of Power System FR	65
4.7	Conclusions	69
	References	69
5	The Asynchronous Response of Small-Scale Charging Facilities to Grid Frequency	73
5.1	Introduction	73
5.2	Formulation of the Proposed Control Method	74
5.3	The Demonstration of Coordination	75
5.4	The Demonstration of Equality	77
5.5	Case Study	78
5.5.1	Simulation Model and Parameters	78
5.5.2	Validation of Coordination	80
5.5.3	Validation of Equality	82
5.6	Conclusions	83
	References	84

6 Analysis on Typical Schemes of the Integration of EV Charging Facilities into the Grid 87

6.1 Introduction 87

6.2 Main Considerations on the Integration of Charging Facilities into the Grid 88

6.3 Estimate of the EVCS’s Reverse Discharge Capacity 88

6.4 Typical Schemes of the Integration of Charging Facilities into the Grid 89

6.4.1 Schemes of the Integration of EVCPs into the Grid 89

6.4.2 EVCSs Directly Integrated into or Adjacent to 110 kV Substations 90

6.4.3 EVCSs Integrated into the Tie Point of Looped Distribution Grid 91

6.4.4 Parallel Operation of EVCSs with the Special Important Load 93

6.5 Conclusions 94

References 94

7 EV Charging Facility Planning 97

7.1 Introduction 97

7.2 Stages of EV Charging Facility Planning 97

7.3 Charging Modes Selection and Demand Forecasting 98

7.3.1 Charging Modes Selection 98

7.3.2 Charging Demand Forecasting 100

7.4 Charging Facility Planning 101

7.4.1 Planning Principles and Process 101

7.4.2 Planning Model 102

7.5 Case Study 103

7.5.1 Analysis on Charging Mode Selection 103

7.5.2 Analysis on Charging Facility Planning 104

7.6 Conclusions 105

References 105